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United States Department of Agriculture

USDA-NRCS Perspective on Runoff Mitigation from Agriculture

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USDA-NRCS

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Natural Resources Conservation Service

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Overview

- Organizations at the USDA
- Agency History of Pesticide Mitigation Ranking
- Current Approach to Pesticide Mitigation Ranking (Agronomy Technical Note 5)
- Conservation Practice Standard (Code 595) Pest Management Conservation System
- Agency Tool for Pesticide Loss Assessment (WIN-PST)

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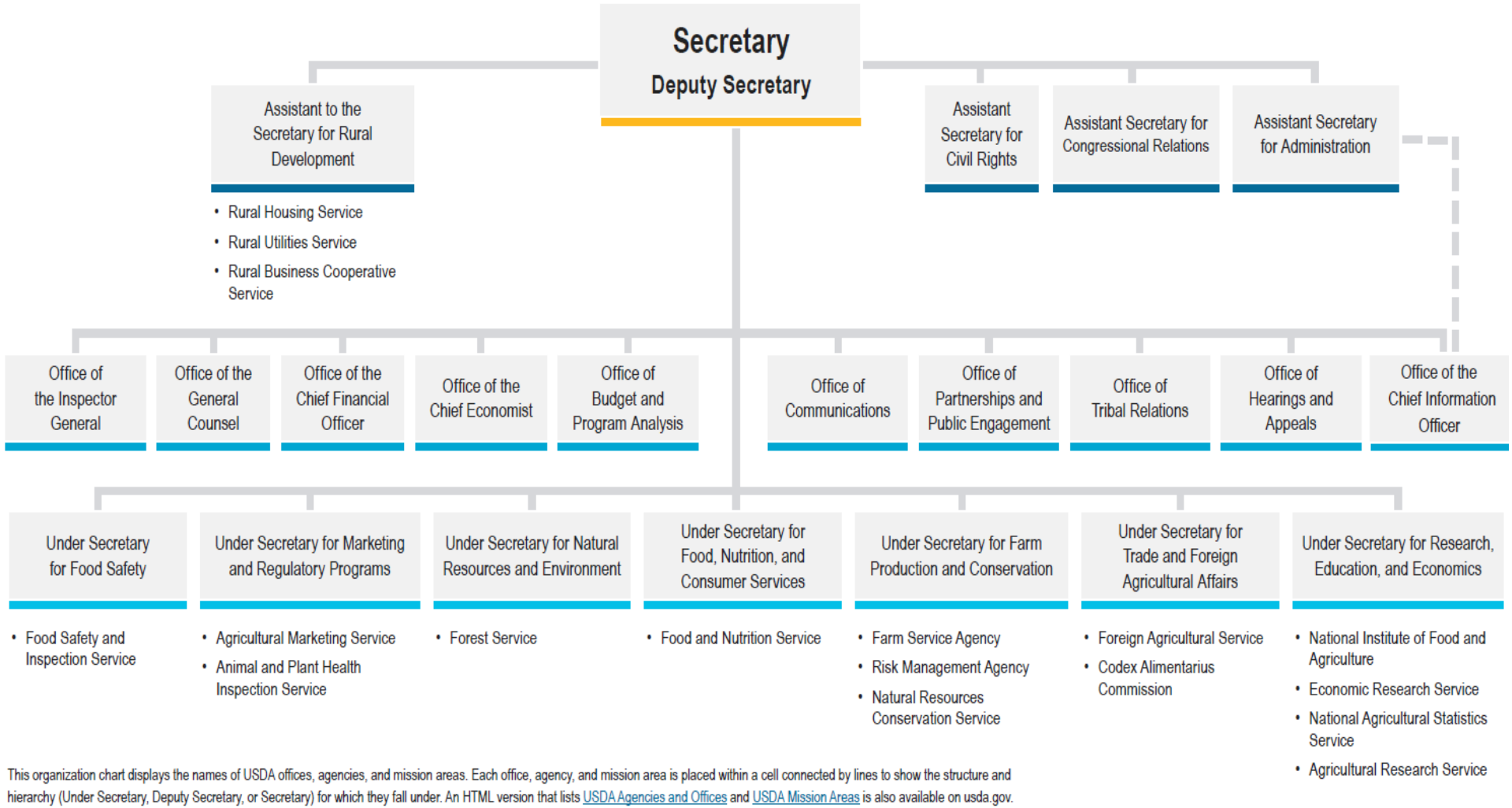
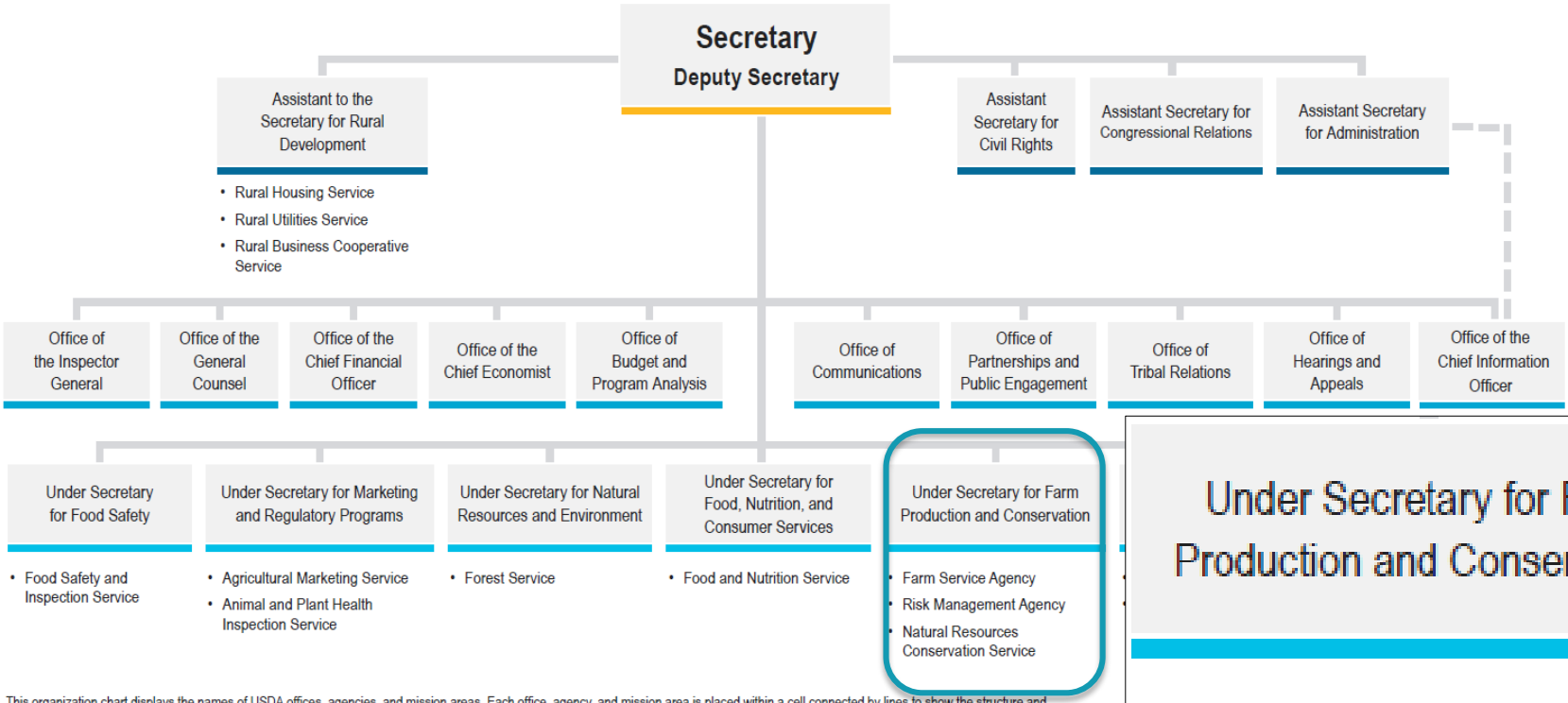
USDA Organization Chart



This organization chart displays the names of USDA offices, agencies, and mission areas. Each office, agency, and mission area is placed within a cell connected by lines to show the structure and hierarchy (Under Secretary, Deputy Secretary, or Secretary) for which they fall under. An HTML version that lists USDA Agencies and Offices and USDA Mission Areas is also available on usda.gov.

USDA Organization Chart



This organization chart displays the names of USDA offices, agencies, and mission areas. Each office, agency, and mission area is placed within a cell connected by lines to show the structure and hierarchy (Under Secretary, Deputy Secretary, or Secretary) for which they fall under. An HTML version that lists USDA Agencies and Offices and USDA Mission Areas is also available on usda.gov.

Under Secretary for Farm Production and Conservation

- Farm Service Agency
- Risk Management Agency
- Natural Resources Conservation Service

Development of Mitigation Ranking

- **Where it all began**
  - A matrix was developed by the EPA-sanctioned Aquatic Dialogue Group and published by SETAC in:
    - *Aquatic Dialogue Group: Pesticide Risk Assessment and Mitigation*, Baker JL, Barefoot AC, Beasley LE, Burns LA, Caulkins PP, Clark JE, Feulner RL, Giesy JP, Graney RL, Griggs RH, Jacoby HM, Laskowski DA, Maciorowski AF, Mihaich EM, Nelson Jr HP, Parrish PR, Siefert RE, Solomon KR, van der Schalie WH, editors. 1994. Society of Environmental Toxicology and Chemistry, Pensacola, FL., pages 99-111 and Table 4-2.
  - They provided ranges of effectiveness for various mitigation techniques.

Development of Mitigation Ranking

TABLE 4-2. MITIGATION PRACTICES SUMMARY GUIDE* FOR PESTICIDE RUNOFF LOSSES TO SURFACE WATERS

Practice	Potential Reduction of Surface Runoff Transport**		Comments
	strongly adsorbed***	weakly to moderately adsorbed	
Field Loss Reduction:			
lower application rate	0-50%	0-50%	loss reduction should be ≥ rate reduction; *e.g.*, at 3/4 rate, loss should be reduced at least 25%
partial substitution	0-80%	0-80%	environmental concerns may also exist for pesticide(s) used as substitute(s); upper range would go to 100% with total elimination of use
partial treatment	0-75%	0-75%	*e.g.*, herbicide banding; loss or reduction in pest control and/or alternative treatments must be considered
formulation	0-25%	0-50%	potential effects need to be documented in field, laboratory, and/or modeling studies
soil erodibility/special restrictions	0-50%	0-25%	restrictions should be targeted to more strongly adsorbed pesticides used on highly erodible land
soil incorporation	25-50%	35-70%	mechanical incorporation reduces the amount in surface mixing zone; more important for solution losses
application timing	0-50%	0-50%	loss decreases with time between application and storm-runoff; probabilistic weather information could be used
no-till	50-90%	0-40%	erosion control by 90% feasible; runoff volume reduction much less; herbicide wash off from residue may increase concentrations in runoff
conservation-tillage	40-75%	0-50%	erosion control less than for no-till; runoff reduction for first storm after application more reliable than for no-till
subsurface drainage	0-20%	0-50%	subsurface drainage can reduce antecedent moisture and therefore runoff and erosion; infiltration can reduce surface concentrations for less strongly adsorbed pesticides
avoid sealing/compaction	0-20%	0-50%	very similar to the effects of infiltration differences caused by subsurface drainage
irrigation	0-25%	0-50%	improved management practices reduce runoff and erosion; greater infiltration could reduce concentrations for less strongly adsorbed pesticides
strip cropping	0-75%	0-60%	possible combination of reduced use (untreated strips) plus buffer effect (sediment deposition on contour)
crop rotation	0-90%	0-90%	pesticide needed could be much reduced in some rotations
Field-to-Stream Transport Reduction:			
terrace/detention ponds	20-90%	5-20%	sediment transport reduction; infiltration in basins could reduce runoff volumes and therefore losses
constructed wetlands	20-90%	0-50%	a practice for which little quantitative information exists
buffer strips	10-40%	10-25%	relative area untreated to total area important; assumed to be ≤ 10%
set-backs	0-50%	0-25%	protection from spills (point-source) during mixing/loading/handling
vegetative filter strip	20-60%	10-40%	to be effective, runoff must pass through at nearly uniform depth; removal more efficient for lower contributing area-filter strip area ratio
grassed waterways	10-40%	2-10%	similar to filter strip, but likely with higher contributing area-filter strip ratio; concentrated flow reduces effectiveness

* The rough estimates of the likely range of effects for each practice are based on limited research and/or professional judgment.
** It should be possible to predict a more narrow range for potential reduction using mathematical modeling for a specific pesticide and a specific set of soil and environmental conditions.
*** Partition coefficient, or K, typically > 100

IPM Techniques

Conservation Practices

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Development of Mitigation Ranking

Vegetative filter strip—A vegetative filter strip is a buffer strip planted to grass or some other close-grown plants, normally of a forage type (but might include shrubs or even trees). As with the buffer strip, the purpose of the vegetated filter strip is to remove pesticides in solution or associated with sediment from runoff by filtration, deposition, infiltration, adsorption, decomposition, and/or volatilization. By both slowing runoff velocity and providing more biological surface area (living and dead) for interaction, the vegetative filter strip is expected to be somewhat more efficient in reducing the field-to-stream transport of pesticides, likely in the range of 10 to 60%.

Other advantages and concerns are similar to those for buffer strips. Specifically, to be effective, runoff must not concentrate or channelize, but ideally must pass through the vegetation in nearly uniform sheet flow. The vegetation must be erosion- and pesticide-resistant. The lower the ratio of contributing watershed to filter strip area, the longer the contact time and the greater removal efficiency.

Removal efficiency depends on pesticide properties, with less soluble, more strongly adsorbed pesticides likely to be more affected. In addition, as with buffer strips, climate, hydrologic, and soil factors resulting in more erosion could make this practice more effective.

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First Iteration into a National NRCS Document

- **The ratings were relative index values as opposed to absolute values, much like the Conservation Practice Physical Effects (CPPE) matrix.**
- **They were intended to help planners choose the best combination of techniques for their identified resource concerns.**
- **The ratings were based on the relative potential for a technique to provide mitigation.**
- **The technique must be specifically designed, implemented and maintained for the mitigation potential to be realized.**
- **Early ratings had pluses and minuses**
  - "no effect" (blank)
  - "slight effect" (+/-)
  - "moderate effect" (++/--)
  - "significant effect" (+++/---)
- **Effectiveness guidance:**
  - +'s generally have the potential to reduces losses by 10 -15%
  - ++'s have the potential to reduces losses by about 25%
  - +++'s have the potential to reduce losses by about 50%.

First Iteration into National NRCS Documents

Pest Management Mitigation Techniques	Pesticide Loss Pathways			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
Management Techniques [1/]				
Application Timing	+++	+++	+++	Reduces exposure potential - delaying application when significant rainfall events are forecast can reduce pesticide transport to ground and surface water, application when conditions are optimal can reduce the amount of pesticide applied, also delaying application when wind speed is not in accordance with label requirements can reduce pesticide drift to surface water
Formulations/Adjuvants	++	++	+	Reduces exposure potential – formulations and/or adjuvants that increase efficacy allow lower application rates
Lower Application Rates	+++	++	+++	Reduces exposure potential - use lowest effective rate
Partial Treatment	+++	++	+++	Reduces exposure potential - spot treatment, banding

Mitigation Technique	Pesticide Loss Pathways			Function
	Leaching	Solution Runoff	Adsorbed Runoff	
Anionic Polyacrylamide (PAM) Erosion Control (450)	-	+	+++	Increases infiltration and deep percolation, reduces soil erosion
Bedding (310)	+	+	+	Increases surface infiltration and aerobic pesticide degradation in the rootzone
Brush Management (314)	+++	+++	+++	Using non-chemical brush control often reduces the need for pesticides, pesticide use requires environmental risk analysis and appropriate mitigation - see Pest Management (595)
Conservation Cover (327)	+++	+++	+++	Retiring land from annual crop production often reduces the need for pesticides, builds soil organic matter

Table from a 2005 version of Conservation Practice Standard Code 595

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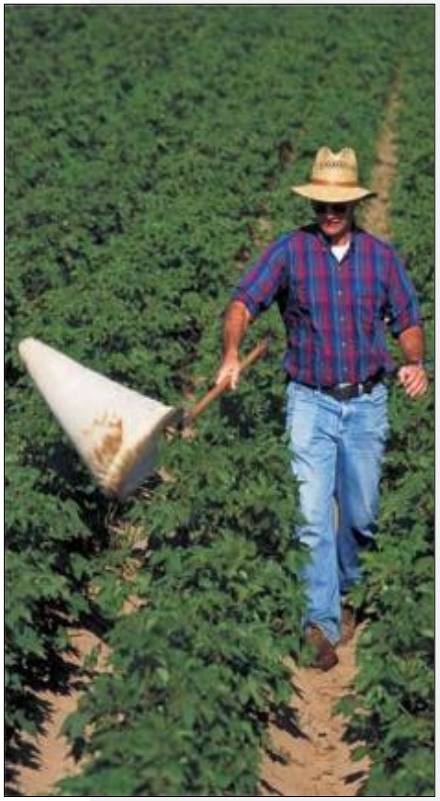
Conservation Practice Standard (CPS) 595: Pest Management Conservation System

- **The 2005 version of CPS 595 required a different level of mitigation depending on the resulting WIN-PST soil/pesticide interaction hazard.**

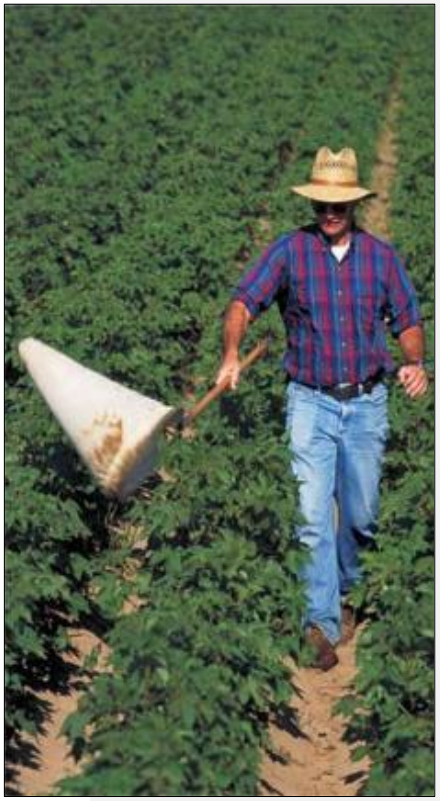
WIN–PST identified final hazard rating	Minimum mitigation needed
Low or very low	None
Intermediate	One or two practices or technique
High	Three or more practices or techniques
Extra High	Mitigation may not work



Conservation Practice Standard (CPS) 595: Pest Management Conservation System

- **Both the previous (2010) and current (2020) versions of CPS 595 requires a different level of mitigation depending on the resulting WIN-PST soil/pesticide interaction hazard.**

WIN–PST identified final hazard rating	Minimum mitigation index score level needed
Low or very low	None
Intermediate	20
High	40
Extra High	60



Current Iteration into National NRCS Documents

- **Main change is from a plus/minus system to a numerical system.**
- **A general rule of thumb for IPM techniques or NRCS conservation practices having an index value of:**
  - 5 is that they generally have the potential to reduce losses by 5% to 10%.
  - 10 generally have the potential to reduce losses by about 25%.
  - 15 generally have the potential to reduce losses by 50% or more

Old Effectiveness guidance:

- +'s generally have the potential to reduces losses by 10 -15%
- ++'s have the potential to reduces losses by about 25%
- +++'s have the potential to reduce losses by about 50%.

Current Iteration into National NRCS Documents

Table 1: IPM techniques for reducing pesticide environmental risk

IPM techniques [1]	Mitigation index value [4] (by pesticide loss pathway)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Application timing—ambient temperature				5	• Reduces exposure—spraying during cooler temperatures (e.g., early morning, evening or at night) can help reduce drift losses • Avoid spraying in temperatures above 90 °F or label specific level
Application timing—rain	15	15	15		• Reduces exposure—delaying application when significant rainfall events are forecast that could produce substantial leaching or runoff can reduce pesticide transport to ground and surface water
Application timing relative humidity				5	• Reduces exposure—spraying when there is higher relative humidity reduces evaporation of water from spray droplets thus reducing drift losses
Application timing—wind				10	• Reduces exposure—delaying application when wind speed is not optimal can reduce pesticide drift • Optimal spray conditions for reducing drift occur when the air is slightly unstable with a very mild, steady wind between 2 and 9 miles per hour or [illegible] label specific range

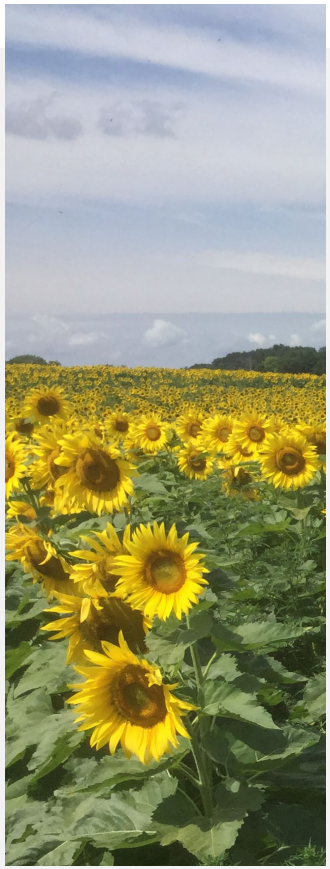
Table 2: Conservation practices for re[illegible]cing pest[illegible]de envi[illegible]mental [illegible]k

Pesticide mitigation conservation practices [1,2]	Mi[illegible]tion inde[illegible]alue [4] (by[illegible]esticide lo[illegible] pa[illegible]ay)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Alley Cropping (Code 311)	5	5	10	10	• Increases infiltration and uptake of subsurface water; reduces soil erosion; can provide habitat for beneficial insects, which can reduce the need for pesticides; also, can reduce pesticide drift to surface water
Anionic Polyacrylamide (PAM) Erosion Control (Code 450)		5	15		• Increases infiltration and deep percolation; reduces soil erosion
Bedding (Code 310)	5	5	5		• Increases surface infiltration and aerobic pesticide degradation in the root zone
Conservation Cover (Code 327)[5]	10	10	10		• Increases infiltration; reduces soil erosion; and builds soil organic matter in perennial cropping systems such as orchards, vineyards, berries, and nursery stock. Consider unintended impact of enhancing populations of soil pests.

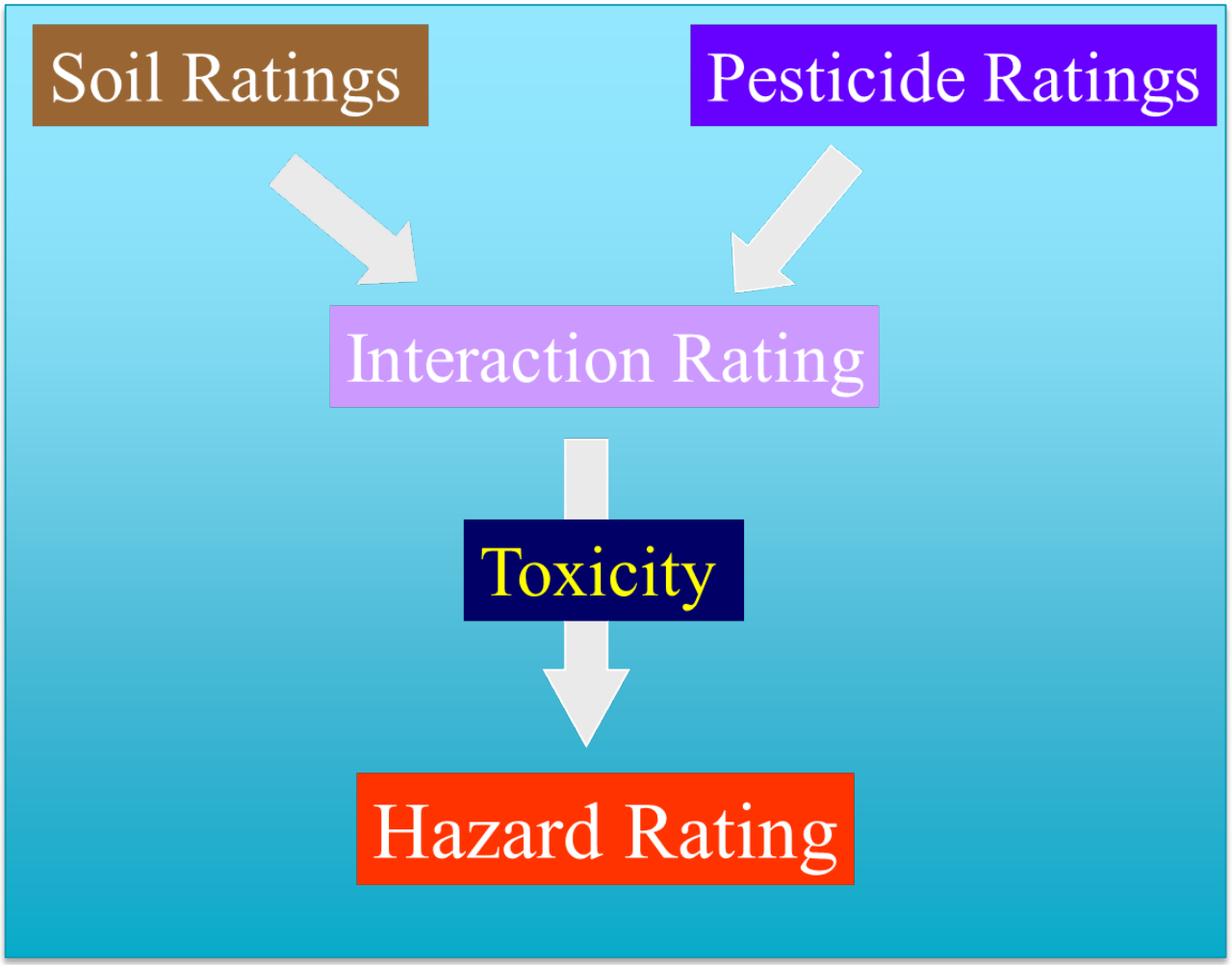
Tables from Agronomy Technical Note 5

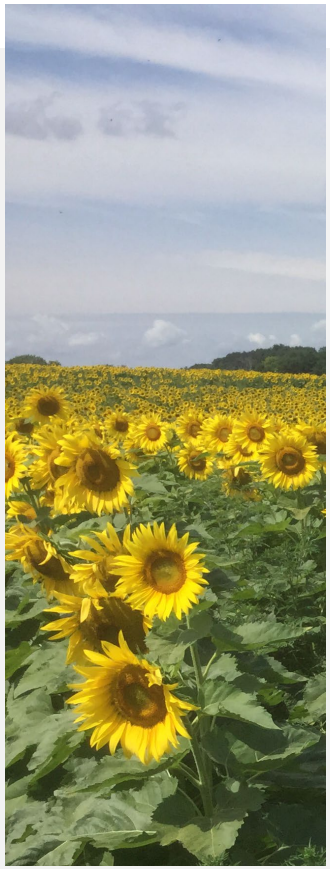
Windows-based Pesticide Screening Tool (WIN-PST)

- Conservation planners can use WIN–PST for water quality pesticide hazard analysis.
- The hazard analysis done with WIN–PST for drinking water and aquatic habitat is not as comprehensive as the risk assessment that supports the EPA's pesticide registration process.
- WIN–PST is sufficient to guide site-specific application of additional mitigation measures to address natural resource concerns identified in the conservation planning process.
- Conservation planners use WIN–PST to identify soil/pesticide combinations that may warrant additional mitigation to help protect site-specific natural resources.



Windows-based Pesticide Screening Tool (WIN-PST)





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Windows-based Pesticide Screening Tool (WIN-PST)

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Soil / Pesticide Interaction Loss Potential and Hazard Rating Report

3402 Longford	4673 Irwin	3900 Ortello
85% SIL Hydro: C	90% SICL Hydro: D	100% FSL Hydro: A
Saline County, Kansas: KS169	Saline County, Kansas: KS169	Saline County, Kansas: KS169
OM% 3 H1 Depth: 8	OM% 3 H1 Depth: 11	OM% 1.5 H1 Depth: 7

ATRAZINE 4L HERBICIDE
Reg No: 100-497
42.6% Atrazine

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (b<dry>)	L	V
Solution:	I (bi<dry>)	H	I
Adsorbed:	L (bi<dry>)		L

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (b<dry>)	L	V
Solution:	I (bi<dry>)	H	I
Adsorbed:	L (bi<dry>)		L

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	I (b<dry>)	H	I
Solution:	L (bi<dry>)	I	L
Adsorbed:	L (bi<dry>)		L

DITHANE DF RAINSHIELD
Reg No: 62719-402
75% Mancozeb

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (f<dry>)	L	L
Solution:	I (f<dry>)	H	H
Adsorbed:	I (f<dry>)		L

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (f<dry>)	L	L
Solution:	I (f<dry>)	H	H
Adsorbed:	I (f<dry>)		L

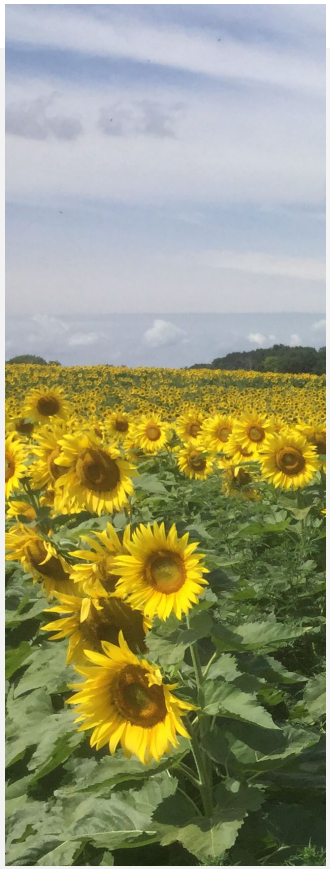
	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (f<dry>)	L	L
Solution:	L (f<dry>)	I	I
Adsorbed:	L (f<dry>)		L

ROUNDUP HERBICIDE
Reg No: 524-445
41% Glyphosate, isopropylamine salt

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (f<dry>)	V	V
Solution:	I (f<dry>)	V	L
Adsorbed:	I (f<dry>)		V

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (f<dry>)	V	V
Solution:	I (f<dry>)	V	L
Adsorbed:	I (f<dry>)		V

	Loss Potential	Human Hazard	Fish Hazard
Leaching:	V (f<dry>)	V	V
Solution:	L (f<dry>)	V	L
Adsorbed:	L (f<dry>)		V



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Questions?

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CPS 595 Implementation Requirement

CPS 595 Implementation Requirement - Mitigation

Conservation Practice Standard 595 — Version 3.4 — December, 2016

Client:	Ty Meyer	Tract:	20401	Field #:	2
Planner:	Emily Fugate	Date:	8/22/19	Acres:	236.00
Consultant:	Wilbur Ellis	Crop:	Wheat		

Purpose(s): Mitigate off-site pesticide risks to water quality from leaching, solution runoff and adsorbed runoff losses.

Crop Rotation: Wheat/Fallow
Landuse: Crop
Soil types to which this mitigation applies: Palouse, Konert, Latah
Description of waters of concern (river, irrigation ditch, stream, pond, etc.): Union Flat Creek (fish bearing)

When these pesticides are applied to this field in this manner... | ...the pesticides are expected to pose the following potential Hazards... | ... and even with the existing level of mitigation (listed in the Cons. Planning Worksheet) require the following additional level of | ...to achieve the below mitigation index scores and for full implemention of the practice standard.

Pesticide Information					WIN-PST Hazard Ratings							Planned IPM Mitigation Techniques	Clarifications & Comments	Mitigation Index Score				
Product Name	Active Ingredient (a.i.)	Ap. Area	Ap. Method	Ap. Rate	Leaching (ILP)		Solution Runoff (ISRP)		Adsorbed Runoff (IARP)					Leaching	Solution Runoff	Adsorbed Runoff	Drift and Volatilization	Pollinator - Direct Contact
TILT FUNGICIDE	Propiconazole	Broadcast	Foliar	Low	Human	I	Human	H				Setback (30')	Avoid spraying within 30' of field where there are water bodies to reduce solution run-off.	30	40		34	EI
					Fish	L	Fish	L	Fish	V				30	40	50	30	

Practices that must be maintained in or around the field for this mitigation analysis to be valid:

Conservation Practices	Description
Residue and Tillage Management, No-Till (329)	Managing the amount, orientation and distribution of crop and other plant residue on the soil surface year round while limiting soil-disturbing activities to only those necessary to place nutrientse and plant crops. These systems typically reduce runoff loss more effectively than 346 or "conventional tillage" systems. Assumes at least 60% ground cover at the time of application.
Field Border (386)	The field border is acting as a buffer for runoff and sediment. The field border is installed in accordance to the proper additional criteria that addresses runoff and sediment. Assumes 20 foot minimum width. See 386 Jobsheet for more information.

Mitigation Index Legend

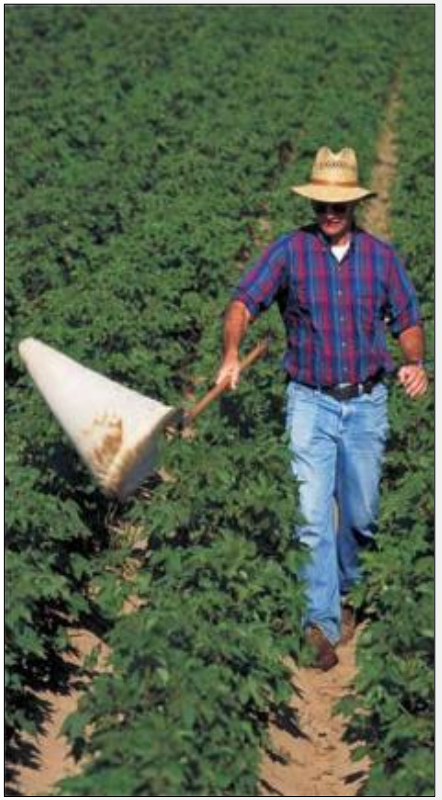
Meaning	Shading
Not an identified resource concern/pesticide loss pathway combination.	
Resource concern/pesticide loss pathway combination exists and minimum mitigation criteria HAS been satisfied.	
Resource concern/pesticide loss pathway combination exists and minimum mitigation criteria has NOT been satisfied.	

EXISTING IPM Techniques that must be maintained in or around the field for this mitigation analysis to be valid:

EXISTING IPM Techniques	Description	Applies to these Pesticides
CLIENT NO LONGER USES THIS PRODUCT	IPM Decision to no longer use this pesticide. Pesticide is no longer being applied and therefore any potential hazards posed by this pesticide are no longer present in this field. Client has either switched to an alternitive product or an alternative IPM technique or set of techniques that addresses the pest. See notes section for details.	LORSBAN ADVANCED
Monitoring & Economic Pest Thresholds.	Reduce the total amount of pesticide applied because applications are based on monitoring that determines when a pest population exceeds a previously determined economic threshold.	TILT FUNGICIDE, PUMA 1EC HERBICIDE
Formulations and Adjuvants	Specific pesticide formulations and/or adjuvants are used to increase efficacy and allow lower application rates or drift retardant adjuvants are used to reduce pesticide spray drift. Required records: a written description of how the formulation and/or adjuvants reduced pesticide usage or drift.	PUMA 1EC HERBICIDE,

NEW IPM Techniques that must be installed/implemented and maintained in or around the field for this mitigation analysis to be valid:

NEW IPM Techniques	Description	Applies to these Pesticides
Setback (30')	A 30' setback from the edge of the field will be used. No application of chemicals within 30' of the downslope or downwind edge(s) of the field. Required records: plan map showing location of setback and the slope on the field.	PUMA 1EC HERBICIDE TILT FUNGICIDE



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Agronomy Technical Note 5 Tables

Table 1 IPM techniques for reducing pesticide environmental risk

IPM techniques [1]	Mitigation index value [4] (by pesticide loss pathway)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Application timing—ambient temperature				5	• Reduces exposure—spraying during cooler temperatures (e.g., early morning, evening or at night) can help reduce drift losses • Avoid spraying in temperatures above 90 °F
Application timing—rain	15	15	15		• Reduces exposure—delaying application when significant rainfall events are forecast that could produce substantial leaching or runoff can reduce pesticide transport to ground and surface water
Application timing—relative humidity				5	• Reduces exposure—spraying when there is higher relative humidity reduces evaporation of water from spray droplets thus reducing drift losses
Application timing—wind				10	• Reduces exposure—delaying application when wind speed is not optimal can reduce pesticide drift • Optimal spray conditions for reducing drift occur when the air is slightly unstable with a very mild, steady wind between 2 and 9 miles per hour
Formulations and adjuvants [2, 3]	5	5	5	5	• Reduces exposure—specific pesticide formulations and/or adjuvants can increase efficacy and allow lower application rates; drift retardant adjuvants can reduce pesticide spray drift
Monitoring + economic pest thresholds	15	15	15	15	• Reduces exposure—reduces the amount of pesticide applied with preventative treatments because applications are based on monitoring that determines when a pest population exceeds a previously determined economic threshold
Partial treatment	15	15	15	10	• Reduces exposure—spot treatment, banding and directed spraying reduces amount of pesticide applied • Assumes less than 50 percent of the area is treated
Precision application using smart sprayers	10	10	10	10	• Reduces exposure—using smart sprayer technology (i.e., green sensors, sonar-based sensors, GPS-based variable rate application, computer controlled spray nozzles, etc.) can substantially reduce the amount of pesticide applied
Setbacks	5	5	5	10	• Reduces exposure—reduces overall amount of pesticide applied; reduces offsite pesticide drift • Assumes that the setbacks with no application are at least 30 feet wide
Soil incorporation [2, 3]		15	15		• Reduces exposure—reduces solution and adsorbed runoff losses, but potentially increases leaching losses, especially for low K_{OC} pesticides • Applicable to shallow mechanical or irrigation incorporation • Not applicable if pesticide leaching to groundwater is an identified natural resource concern • Not applicable if soil erosion is not adequately managed


Photo by B. James

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Agronomy Technical Note 5 Tables

Table 1 IPM techniques for reducing pesticide environmental risk—Continued

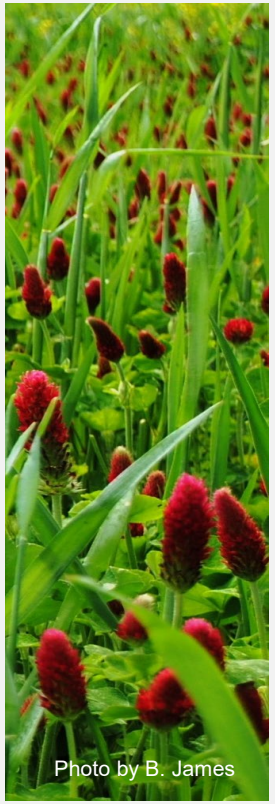
IPM techniques [1]	Mitigation index value [4] (by pesticide loss pathway)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Spray nozzle selection, maintenance, and operation				10	• Reduces exposure—selecting appropriate nozzle and pressure for the application, with an emphasis on higher volume spray nozzles run at lower pressures, will produce larger droplets and a narrower droplet size distribution, which reduces spray drift • Proper nozzle spacing, boom height, and boom suspension, along with frequent calibration and replacement of worn nozzles and leaking tubing, can increase efficacy and reduce drift potential
Substitution—cultural, mechanical, or biological controls	15	15	15	15	• Reduces risk—partial substitution of alternative cultural, mechanical, or biological pest suppression techniques reduces the application of a pesticide that poses a hazard to an identified natural resource concern • Not applicable if hazards from alternative suppression techniques are not adequately managed
Substitution—lower risk pesticides [2,3]	15	15	15	15	• Reduces risk—partial substitution of an alternative lower risk pesticide reduces the application of a pesticide that poses a hazard to an identified natural resource concern • Not applicable if the alternative pesticide is not explicitly recommended by Extension or an appropriately certified crop consultant because the NRCS cannot make pesticide recommendations
Substitution—semiochemicals	15	15	15	15	• Reduces risk—using semiochemicals (e.g., mating disruption pheromones) to decrease reproductive success or control population density/location reduces the application of a pesticide that poses a hazard to an identified natural resource concern

1/ Additional information on pest management mitigation techniques can be obtained from Extension pest management publications including IPM Guidelines and Crop Profiles, pest management consultants, and pesticide labels.

2/ The pesticide label is the law—all pesticide label specifications must be carefully followed, including required mitigation. Additional mitigation may be needed to meet NRCS pest management requirements for identified resource concerns.

3/ Teh NRCS does not make pesticide recommendations. All pesticide application techniques must be recommended by Extension or an appropriately certified crop consultant and selected by the producer.

4/ Numbers in these columns represent index values that indicate relative effectiveness of IPM mitigation techniques to reduce hazardous pesticide losses through the identified pathways.



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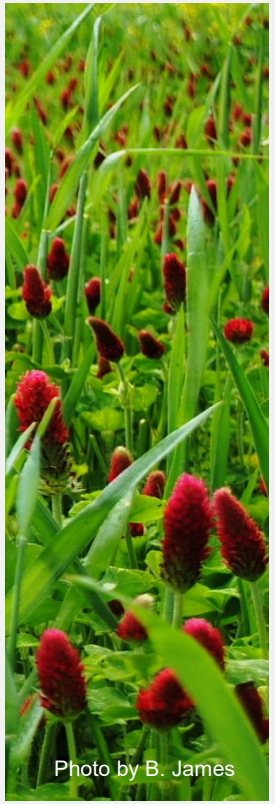
Agronomy Technical Note 5 Tables

Table 2 Conservation practices for reducing pesticide environmental risk

Pesticide mitigation conservation practices [1, 2]	Mitigation index value [4] (by pesticide loss pathway)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Alley Cropping (Code 311)	5	5	10	10	• Increases infiltration and uptake of subsurface water; reduces soil erosion; can provide habitat for beneficial insects, which can reduce the need for pesticides; also can reduce pesticide drift to surface water
Anionic Polyacrylamide (PAM) Erosion Control (Code 450)		5	15		• Increases infiltration and deep percolation; reduces soil erosion
Bedding (Code 310)	5	5	5		• Increases surface infiltration and aerobic pesticide degradation in the root zone
Conservation Cover (Code 327)	10	10	10		• Increases infiltration; reduces soil erosion; and builds soil organic matter in perennial cropping systems such as orchards, vineyards, berries, and nursery stock
Conservation Crop Rotation (Code 328)	10	10	10		• Reduces the need for pesticides by breaking pest life cycles • Rotation shall consist of at least two crops in the rotation and no crop grown more than once before growing a different crop
Constructed Wetland (Code 656)	5	5	10		• Captures pesticide residues and facilitates their degradation
Contour Buffer Strips (Code 332)		10	10		• Increases infiltration; reduces soil erosion
Contour Farming (Code 330)		5	5		• Increases infiltration and deep percolation; reduces soil erosion
Contour Orchard and Other Fruit Area (Code 331)		5	5		• Increases infiltration and deep percolation; reduces soil erosion
Cover Crop (Code 340) that is incorporated into the soil	5	5	5		• Increases infiltration; reduces soil erosion; builds soil organic matter • Assumes at least 4,000 pounds per acre of live biomass at the time of tillage
Cover Crop (Code 340) for weed suppression that is mulch tilled or no-tilled into for the next crop	10	10	10	10	• Increases infiltration; reduces soil erosion; builds soil organic matter • Requires at least 4,000 pounds per acre of live biomass at the time of tillage and at least 30 percent ground cover at the time of the pesticide application
Cross Wind Ridges (Code 588)			5 [3/]		• Reduces wind erosion and adsorbed pesticide deposition in surface water • Assumes the pesticide is applied while the field is in the ridged state
Cross Wind Trap Strips (Code 589C)			10 [3/]		• Reduces wind erosion and adsorbed pesticide deposition in surface water; traps adsorbed pesticides
Deep Tillage (Code 324)		5	5		• Increases infiltration and deep percolation • Not applicable if pesticide leaching to groundwater is an identified natural resource concern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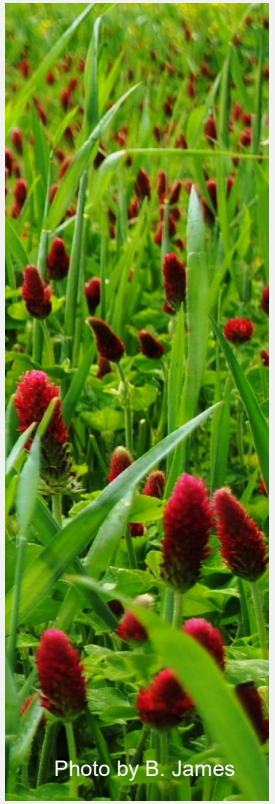
Agronomy Technical Note 5 Tables

Table 2 Conservation practices for reducing pesticide environmental risk—Continued

Pesticide mitigation conservation practices [1,2]	Mitigation index value [4] (by pesticide loss pathway)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Dike (Code 356)		10	10		• Reduces exposure potential—excludes outside water or captures pesticide residues and facilitates their degradation • Not applicable if pesticide leaching to groundwater is an identified natural resource concern
Drainage Water Management (Code 554)		10	10		• Drainage during the growing season increases infiltration and aerobic pesticide degradation in the root zone and reduces storm water runoff • Managed drainage mode when the field is not being cropped reduces discharge of pesticide residues from the previous growing season • Seasonal saturation may reduce the need for pesticides • Not applicable if pesticide leaching to groundwater is an identified natural resource concern
Field Border (Code 386)		5	10	5	• Increases infiltration and traps adsorbed pesticides; often reduces application area resulting in less pesticide applied; can provide habitat for beneficial insects, which reduces the need for pesticides; can provide habitat to congregate pests, which can result in reduced pesticide application; also can reduce inadvertent pesticide application and drift to surface water • Assumes 20-foot minimum width
Filter Strip (Code 393)		10	15	10	• Increases infiltration and traps adsorbed pesticides; often reduces application area resulting in less pesticide applied; can provide habitat for beneficial insects,,which reduces the need for pesticides; can provide habitat to congregate pests, which can result in reduced pesticide application; also can reduce inadvertent pesticide application and drift to surface water • Assumes 30-foot minimum width
Forage Harvest Management (Code 511)	10	10	10	10	• Reduces exposure potential—timely harvesting reduces the need for pesticides
Hedgerow Planting (Code 442)			10 [3/]	10	• Reduces adsorbed pesticide deposition in surface water; also can reduce inadvertent pesticide application and drift to surface water
Herbaceous Wind Barriers (Code 603)			5 [3/]	5	• Reduces wind erosion; traps adsorbed pesticides; can provide habitat for beneficial insects, which reduces the need for pesticides; can provide habitat to congregate pests, which can result in reduced pesticide application; and can reduce pesticide drift to surface water
Irrigation System, Microirrigation (Code 441)	10	15	15		• Reduces exposure potential—efficient and uniform irrigation reduces pesticide transport to ground and surface water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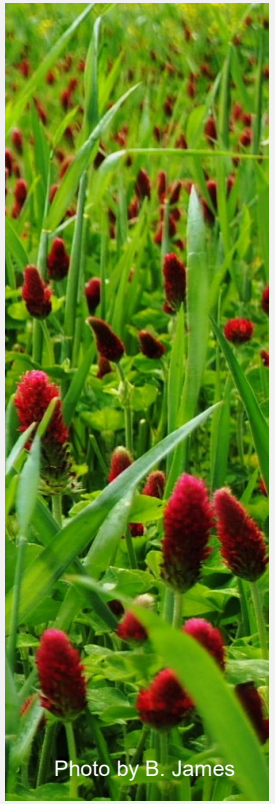
Agronomy Technical Note 5 Tables

Table 2 Conservation practices for reducing pesticide environmental risk—Continued

Pesticide mitigation conservation practices [1, 2]	Mitigation index value [4] (by pesticide loss pathway)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Irrigation System, Sprinkler (Code 442)	10	10	10		• Reduces exposure potential—efficient and uniform irrigation reduces pesticide transport to ground and surface water
Irrigation System, Surface and Subsurface (Code 443)	5	5	5		• Reduces exposure potential—efficient and uniform irrigation reduces pesticide transport to ground and surface water
Irrigation System, Tail Water Recovery (Code 447)		15	15		• Captures pesticide residues and facilitates their degradation
Irrigation Water Management (Code 449)	15	15	15		• Reduces exposure potential—water is applied at rates that minimize pesticide transport to ground and surface water, promotes healthy plants which can better tolerate pests
Mulching (Code 484) with natural materials	10	10	10		• Increases infiltration, reduces soil erosion, reduces the need for pesticides
Mulching (Code 484) with plastic	10	5	5		• Reduces the need for pesticides. Not applicable if erosion and pesticide runoff from nonmulched areas is not adequately managed
Residue and Tillage Management, No-till/ Strip-Till/Direct Seed (Code 329)	5	10	15		• Increases infiltration, reduces soil erosion, builds soil organic matter • Assumes at least 60 percent ground cover at the time of application
Residue and Tillage Management, Mulch-Till (Code 345)	5	5	10		• Increases infiltration, reduces soil erosion, builds soil organic matter • Assumes at least 30 percent ground cover at the time of application
Residue and Tillage Management, Ridge Till (Code 346)	5	5	10		• Increases infiltration, reduces soil erosion, builds soil organic matter
Riparian Forest Buffer (Code 391)	5	15	15	10	• Increases infiltration and uptake of subsurface water, traps sediment, builds soil organic matter, and reduces pesticide drift • This assumes 30-foot minimum width
Riparian Herbaceous Cover (Code 390)	5	10	10	5	• Increases infiltration, traps sediment, builds soil organic matter, and reduces pesticide drift. Assumes 30-foot minimum width
Sediment Basin (Code 350)			10		• Captures pesticide residues and facilitates their degradation • Not applicable if less than 50 percent of the treatment area drains into the sediment basin
Stripcropping (Code 585)		15	15	5	• Increases infiltration; reduces soil erosion and generally will only be treating half the area of concern
Subsurface Drainage (Code 606)	5	10	10		• Increases infiltration and aerobic pesticide degradation in the root zone • *Note: avoid direct outlets to surface water
Surface Roughening (Code 609)			5 [3]		• Reduces wind erosion and adsorbed pesticide deposition in surface water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Agronomy Technical Note 5 Tables

Table 2 Conservation practices for reducing pesticide environmental risk—Continued

Pesticide mitigation conservation practices [1, 2]	Mitigation index value [4] (by pesticide loss pathway)				Function and performance criteria
	Leaching	Solution runoff	Adsorbed runoff	Drift	
Terrace (Code 600)		10	15		• Increases infiltration and deep percolation; reduces soil erosion • Not applicable if pesticide leaching to groundwater is an identified natural resource concern
Vegetative Barriers (Code 601)			10		• Reduces soil erosion; traps sediment; increases infiltration
Water and Sediment Control Basin (Code 638)		10	15		• Captures pesticide residues and facilitates their degradation; increases infiltration and deep percolation • Not applicable if pesticide leaching to groundwater is an identified natural resource concern
Windbreak/Shelterbelt Establishment (Code 380)			10 [3/]	10	• Reduces wind erosion; reduces adsorbed pesticide deposition in surface water; traps adsorbed pesticides; reduces pesticide drift

1/ Additional information on pest management mitigation techniques can be obtained from Extension pest management publications including IPM Guidelines and Crop Profiles, pest management consultants, and pesticide labels.
2/ The pesticide label is the law. All pesticide label specifications must be carefully followed, including required mitigation. Additional mitigation may be needed to meet NRCS pest management requirements for identified resource concerns.
3/ Mitigation applies to adsorbed pesticide losses being carried to surface water by wind.
4/ Numbers in these columns represent index values that indicate relative effectiveness of pesticide mitigation techniques to reduce hazardous pesticide losses through the identified pathways.


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