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G97-1323 Best Management Practices to Reduce Atrazine Runoff from Corn Fields in Nebraska

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Best Management Practices to Reduce Atrazine Runoff from Corn Fields in Nebraska

This NebGuide presents best management practices (BMPs) which can be used to reduce atrazine runoff from dryland and irrigationd corn fields in Nebraska.

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Atrazine is one of the most widely used herbicides in Nebraska. It is used alone or combination with other herbicides for weed control in both dryland and irrigationd corn. Atrazine is popular because of its effectiveness and economy. However, environmental concerns are an increasingly important part of producer decisions regarding weed control, fertility and irrigation management practices. A public concern is reducing atrazine runoff to surface waters.

Best management practices (BMPs) reduce the amount of atrazine at the soil surface, reduce water runoff from a field and reduce losses from the first runoff after atrazine application. For example, practices such as banding and incorporation reduce the amount of atrazine at the soil surface. No-till planting reduces water runoff by leaving crop residue at the soil surface. Additional description of the impact of these and other practices designed to reduce atrazine runoff can be found in *Agricultural Management Practices to Reduce Atrazine in Surface Water* (Nebraska Cooperative Extension, G96-1299). In general, practices reducing atrazine runoff will also reduce the losses of herbicides often used in combination with atrazine, such as alachlor (Lasso), acetochlor (Harness) and metolachlor (Dual). See

pesticides and Water Quality in Nebraska (Nebraska Cooperative Extension EC96-143) for additional information on reducing herbicide runoff.

Residue Management

Implementing BMPs begins with crop residue management. Conservation tillage and planting systems that leave 30 percent or more crop residue on the soil surface reduce water runoff and the amount of atrazine leaving the field. Conservation tillage includes **mulch-till**, **ridge-till** and **no-till**. **Mulch-till** systems limit soil and residue disturbance to maintain crop residue cover at or above thirty percent. Increased infiltration with high residue cover can reduce water runoff. **Ridge-till** on the contour holds water on the land and improves infiltration. **No-till** can increase water infiltration into the soil but will not be effective at reducing losses on tight, poorly drained soils or soils with a restrictive soil layer limiting water infiltration. Overall, residue management that increases water infiltration will reduce atrazine runoff.

Best Management Practices

Recommended BMPs for reducing atrazine runoff from corn fields are described below. Adopting some of these practices can reduce potential atrazine runoff by one-half or more compared to preemergence broadcast applications at full label rates. Other practices can cut potential losses significantly, even if application rates remain the same. With each description scenarios are described for various tillage practices. This information, along with factors influencing adoption, is summarized in *Table I.*

Table I. Best management practices for reducing atrazine runoff from dryland and irrigationd corn production.

Best Management Practice	*Potential Percent Reduction*[1]	*BMP Recommended For:*			*Factors Influencing Adoption*	
		Mulch-till	*Ridge-till*	*No-till*	*PRO*	*CON*
Alternative Herbicides	100%	yes	yes	yes	• Longer application period for some alternatives	• Alternatives generally cost more or are less effective
Crop Rotation	50-66%	yes	yes	yes	• Breaks weed and pest cycles • May reduce costs, increase yields • Reduces total atrazine use	• Different management requirements if rotations are not already used
Herbicide Rotation	50-66%	yes	yes	yes	• Reduces atrazine use • Reduces risk of weed resistance to atrazine	• Cost may increase if alternatives cost more
Band Application	50-66%	yes	yes	no	• Effective with mulch-till and ridge-till with cultivation • Reduces herbicide cost	• Needs cultivation, may increase soil moisture loss and erosion • Wet spring could prevent timely cultivation

Soil Incorporation	35-66%	yes	no	no	• Improves weed control if rain does not activate atrazine within seven days of application	• Additional operation needed if not done with regular tillage • Can't be used with no-till • May increase erosion
Post Application	50%	yes	yes	no	• Can base herbicide selection on specific weeds • Lower rates used	• Wet or windy spring could prevent timely post application
Early Preplant	50%	yes	yes	yes	• Effective for no-till and ridge-till • Lower herbicide cost	• Additional treatment may be needed if weeds persist
Split Application OR Split Application with post alternatives	33-50%	yes	yes	yes	• May apply less if initial application is effective • Flexibility can improve overall weed control	• Requires two applications and may increase cost • Wet spring or windy conditions could prevent post application
Reduced Rates and Combination Products	33-50%	yes	yes	yes	• Easy to adopt • Broadens weed control spectrum	• Cost may increase • Lower atrazine rate may not be effective on some broadleaf weeds

[1]Percent reduction is based on potential reduction of atrazine runoff compared to 100% surface spray applied each crop year.

Alternative Herbicides

Herbicides without atrazine may be used with any tillage system. Alternative products can be equally effective, but most are more expensive. However, other practices, such as split application or spot treatments to high infestation areas, can reduce herbicide use and cost. Even if alternatives are not used on all acres, areas of high runoff potential may justify using an atrazine alternative.

Crop Rotation

Crop rotation is practiced with most dryland corn and changes in farm bill requirements make crop rotation easier to implement in irrigationd corn. Depending on the rotation, crop rotation in which atrazine is not used on one or more crops will reduce long-term atrazine runoff from one-half to two-thirds. Crop rotation breaks pest cycles, reduces pesticide costs, increases yields, lowers the cost of fertilizer and irrigation and reduces the overall cost of production.

Herbicide Rotation

Herbicide rotation substituting nonatrazine alternatives in some years will reduce long-term atrazine loss by one-half to two-thirds, depending on whether atrazine is used one out of two or one out of three years. Alternating herbicides also reduces the risk of developing herbicide resistant weeds. Alternative herbicides may increase cost. However other practices, such as split application or spot treatments to high infestation areas, can reduce overall herbicide use and cost.

Band Application

Band application places atrazine in a narrow band over the crop row, leaving between-row areas for cultivation. Depending on the width of the band, this can reduce atrazine runoff from one-half to two-thirds compared to broadcast applications. However, cultivation with banding may increase soil erosion and soil moisture loss. If these are important factors in dryland production, consider other BMPs. Guidance systems on cultivators have also allowed reduction in band widths. Banding can reduce herbicide cost for **mulch-till** and **ridge-till** systems already using cultivation for between-row weed control. Timely cultivation is necessary for weed control between rows and may be delayed by wet or windy spring weather. Banded application is not recommended for **no-till** without treatment to control between-row weeds.

Soil Incorporation

Incorporating atrazine into the top two inches of soil with tillage places it below the surface where it has less potential for surface runoff. Incorporation can reduce atrazine runoff by as much as two-thirds compared to surface applications. Incorporation can improve weed control with **mulch-till** systems, especially if rain does not activate atrazine within seven days of application. With **ridge-till** systems, tine and rotary spikes have been used to obtain some incorporation. In dryland production incorporate atrazine with normal tillage operations to avoid extra soil disturbance that increases soil moisture loss and erosion potential. Incorporation is not possible with **no-till** without some soil disturbance. Mulching cultivators, which retain and/or return residue to the soil surface, may be used for incorporation when crop residue cover is needed for erosion control. Center pivot irrigation systems may also be used to incorporate and activate atrazine under dry soil conditions. Do not irrigation if soil is wet or rain is imminent.

Postemergence Application

Postemergence herbicides usually contain low rates of atrazine (0.5 lb/acre) and can reduce atrazine runoff by one-half or more when compared to preemergent applications. Post-application often occurs during periods of lower rainfall and runoff potential. Post-application in **mulch-till** can provide excellent broadleaf control. However, timely post-application is required for effective weed control and a wet spring or windy conditions may reduce the time available for application. Post application in **no-till** is recommended only if early treatments failed.

Early Preplant

Early preplant application using less than a label rate can reduce potential atrazine runoff by up to one-half. Early April preplant applications with **no-till** and **ridge-till** can provide effective control and atrazine will be less vulnerable to spring and early summer runoff. If additional control is needed with a preemerge or postemerge product, an atrazine alternative, band application or spot treatment should be used.

Split Application with Low Rates

Split application, with the one-half to two-thirds applied early preplant and one-half to one-third applied at planting, can reduce atrazine runoff up to one-third. Alternately, split application with a nonatrazine alternative at planting or postemergent can reduce runoff up to one-half. In all tillage systems atrazine can be split between early preplant and planting treatments. Also in mulch-till and ridge-till, application can be preemergence at planting followed by a postemergence application if needed. If good weed

control is achieved with the preemergence application, the post application may not be needed.

Reduced Rates and Combination Products

Use reduced atrazine rates with any tillage system. The lower the rate, the lower the potential atrazine runoff. Today, most atrazine is applied at 1.0 to 1.5 lb/acre in combination products or mixes. This reduces potential atrazine runoff proportionately compared to label rates (2.0 to 2.5 lb/acre). Combination products are easy to adopt. Very low application rates may not be effective for high weed infestations or very wet springs. Local spot spraying can control outbreaks while reducing total atrazine application and cost. If low rates do not provide effective weed control, consider increased rates along with BMPs or use nonatrazine alternatives.

Related Extension Publications

- *Agricultural Management Practices to Reduce Atrazine in Surface Water.* Nebraska Cooperative Extension, G96-1299.
- *pesticide Runoff and Water Quality in Nebraska.* Nebraska Cooperative Extension, EC96-143.
- *Herbicide Use in Nebraska.* Nebraska Cooperative Extension, EC96-130.
- *Best Management Practices for Agricultural pesticides to Protect Water Resources.* Nebraska Cooperative Extension, G93-1182.

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