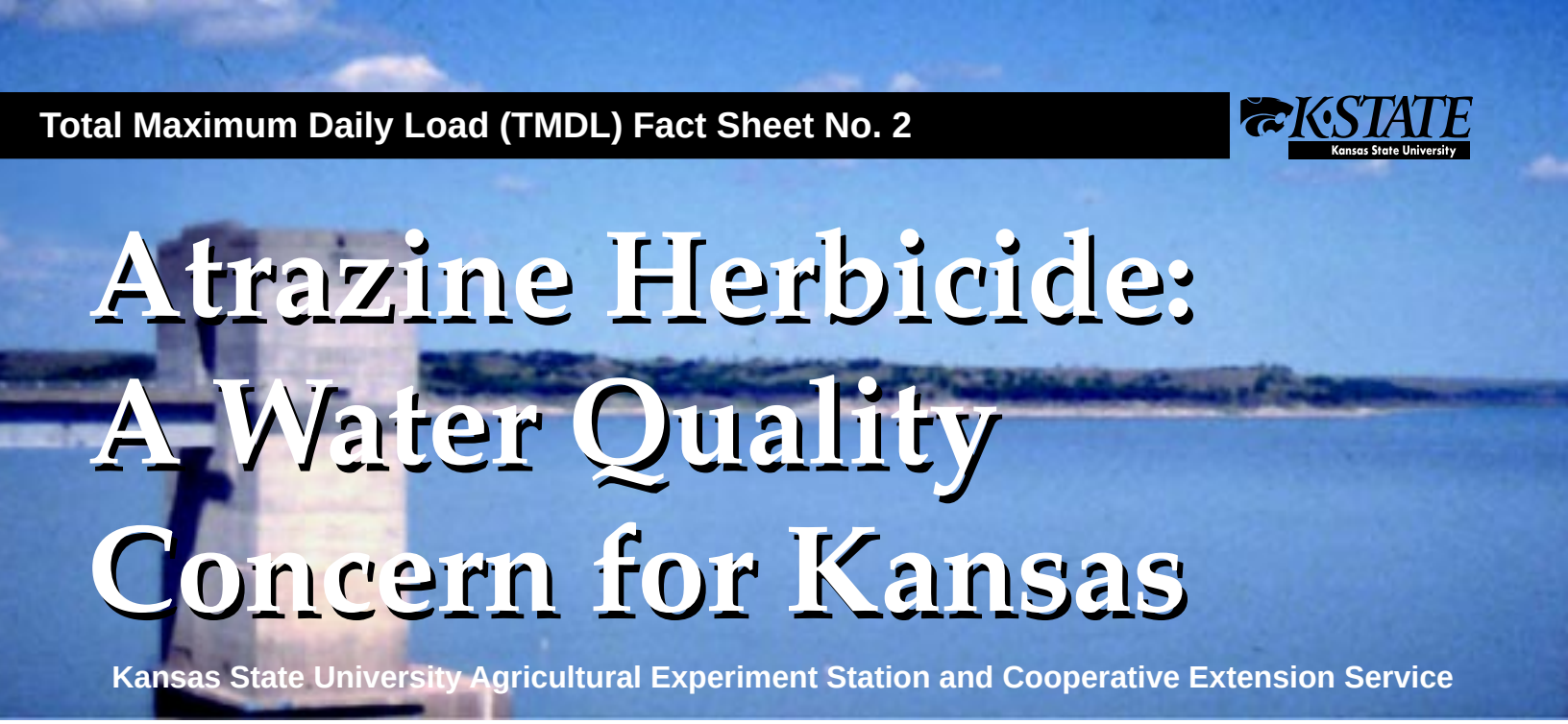

Atrazine Herbicide: A Water Quality Concern for Kansas

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Atrazine herbicide is widely used in Kansas for selective weed control in corn and grain sorghum. It has wide application flexibility and is one of the lowest-cost herbicides on a per-acre basis. In addition, atrazine has been shown to be one of the most effective soil-applied herbicides for weed control in corn and grain sorghum. Atrazine is often used by itself, but also is included in many postemergence herbicide tank-mix programs. However, there are environmental concerns regarding the use of atrazine.

Water Quality Concerns

In recent years, there have been concerns about the level of atrazine herbicide runoff entering surface waters.

This particularly became a concern when the Environmental Protection Agency (EPA) announced that a maximum contaminant level (MCL) for atrazine had been set at an annual average of 3 parts per billion (ppb). This is an enforceable level for public drinking water systems and, according to EPA, is a concentration that is safe to drink over a 70-year lifetime with no adverse effects. Municipal water treatment plants do not typically remove atrazine during the treatment process.

In addition, an aquatic life standard for atrazine concentrations in Kansas surface water has been set at 3 ppb. A number of rivers, streams, and lakes in eastern Kansas routinely exceed the 3 ppb standard for brief periods, following herbicide application in the spring.

In 1998, the Kansas Department of Health and Environment submitted its list of impaired waters (303(d) list) to EPA in which several lakes were identified as impaired by runoff of atrazine. For the atrazine-impaired watersheds, a Total Maximum Daily Load (TMDL) will be set and an implementation plan developed to reduce atrazine levels.

It is hoped that the reductions called for in the TMDL plan will be reached voluntarily by farmers using atrazine best management practices (BMPs). However, if voluntary adoption does not bring the atrazine concentrations into compliance with water quality standards, regulatory actions may need to be implemented.

How Atrazine Can Move Into Water

Kansas State University researchers have found annual atrazine runoff losses often range from 1 to 3 percent of the total applied. The amount of atrazine lost from crop fields is determined by the chemical characteristics of atrazine; soil and site characteristics; tillage practices; and rainfall duration, intensity, and timing.

Atrazine is lost from the top inch of the soil surface. In general, the greater the slope and the lower the infiltration rate of the surface soil, the greater the atrazine runoff potential. Reducing tillage intensity may or may not reduce atrazine runoff. The surface soil moisture at time of herbicide application, length of time from herbicide application until the first runoff event, and the intensity and duration of the first runoff event greatly influence the amount of atrazine lost in surface runoff. The drier the soil surface at atrazine application time, the more water and atrazine that will infiltrate into the soil and the less atrazine will be available to run off.

Up to two-thirds of the total atrazine runoff from a field may occur with the first major runoff event following atrazine application. The longer the time period between atrazine application and the first major runoff event, the less atrazine runoff that will occur. The most atrazine runoff often occurs during the peak atrazine application period of May, June, and July, which is also the period with the highest amount and intensity of rainfall.

Controlling Atrazine Runoff

The most effective way to minimize atrazine runoff into surface water is to implement a series of research-proven BMPs. K-State researchers have determined those BMPs that, when adopted by farmers, will minimize atrazine runoff. These atrazine BMPs are designed to:

- reduce the amount of atrazine on the soil surface at any one time, especially during high-rainfall periods in late spring and early summer;
- reduce the rate of atrazine used in a field;
- reduce the impact of the first runoff event on atrazine loss; and
- provide a mechanism for deposition of the atrazine before it leaves the field.

12 Best Management Practices for Atrazine

1. *Incorporate atrazine into the top 2 inches of soil*. Apply preplant atrazine alone or as part of a tankmix and incorporate into the top 2 inches of soil with a field cultivator, tandem disk, or other appropriate tillage implement. This can reduce atrazine runoff by **60 to 75 percent** compared to a surface application without incorporation.
2. *Use fall or early spring applications*. Atrazine runoff can be reduced by **50 percent** by applying atrazine the previous fall or prior to April 15 of the current cropping year. Rainfall intensity, duration, and amount is lower during these time periods.
3. *Use postemergence atrazine premix products*. Many postemergence herbicide premix products are available that, when used at recommended rates, result in less atrazine being applied than with typical soil-applied atrazine applications. Using these products can result in **50 to 67 percent** less atrazine runoff.
4. *Reduce soil-applied atrazine application rates*. The lower the atrazine rate applied, the less potential for atrazine runoff. This can reduce the amount of atrazine applied by as much as **33 percent**.
5. *Use split applications of atrazine*. Using split applications reduces the amount of atrazine available for runoff at any given time. This has the potential to reduce atrazine runoff by **25 percent** compared to applying all the atrazine at planting.
6. *Use reduced soil-applied atrazine rates followed by a postemergence herbicide application*. Applying atrazine at a reduced soil-applied rate of approximately 1 pound per acre at planting, followed by a postemergence application of a premix product that contains low rates of atrazine, results in **25 percent** less atrazine runoff compared to surface applying all atrazine at planting time.
7. *Use non-atrazine herbicides*. New herbicides that do not contain atrazine are available for use in corn and grain sorghum. These alternative herbicides may require greater management or be more expensive. This can reduce the amount of atrazine applied by as much as **100 percent**.
8. *Use integrated pest management strategies*. Integrated weed management strategies combine prevention, suppression, monitoring, and pesticides to control weeds while minimizing the amount of herbicide needed. These strategies have the potential to reduce atrazine runoff by **0 to 100 percent**.
9. *Band herbicides at planting or cultivation*. Applying atrazine over the row in a 10- to 15-inch band reduces the total amount of atrazine applied to a field by **50 to 67 percent** resulting in a corresponding reduction in atrazine runoff compared to a broadcast surface application without incorporation.
10. *Establish vegetative and riparian buffer areas*. These buffers are effective at slowing down runoff and settling out soil particles from erosion. The buffers also may reduce the amount of water runoff by increasing infiltration of runoff water within the buffer. To the extent that water infiltrates into the buffer strip soils, atrazine loss will also be reduced.
11. *Use proper atrazine rates, mixing, loading, and disposal practices*. Read and follow all label directions. Develop and implement a spill prevention and response plan.
12. *Utilize conservation practices and structures*. Conservation practices and structures that slow or reduce water runoff and soil erosion reduce atrazine runoff.

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