If growers are having difficulty controlling weeds with pre-emergence atrazine applications, and resistant weed biotypes are not present, the field may be exhibiting enhanced atrazine degradation. Growers should consider the following recommendations to improve weed control.

- Be familiar with other s-triazine herbicides that are frequently applied in corn and cotton production systems that **cross-adapted bacteria can biodegrade**. In corn be aware of simazine, e.g., Prinose®, and ametryn, e.g., Evik 80W®, in cotton be conscious of prometryn, e.g., Caparol®.

- Avoid production systems with two or more consecutive years of soil applied s-triazine use.

- Use atrazine in conjunction with alternative residual herbicides, and if needed, follow with an appropriate post-emergence herbicide application.

- Research has demonstrated that post-emergence atrazine applications can be effectively used for two or more consecutive years in adapted soils; however, expect limited residual weed control with the herbicide.

- State Corn and Extension Weed Science Specialists should be consulted regarding viable alternative residual herbicides and application restrictions on specific corn varieties.

**References**


**Disclaimer:** Mention of trade or commercial names is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

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Enhanced atrazine degradation has been confirmed in agricultural soils throughout North America and Europe. Adapted soils have been identified in various U.S. states where atrazine and (or) other s-triazine herbicides have been used extensively: California, Colorado, Hawaii, Illinois, Louisiana, Mississippi, Tennessee, and Texas.¹-³ To date, reduced residual weed control with atrazine has only been confirmed under greenhouse conditions in Mississippi (Figure 2) and under field conditions in Colorado (Figure 3) and Mississippi.⁴-⁶

The agronomic significance of enhanced atrazine degradation is decreased herbicide persistence which may result in reduced residual weed control. For example, the average half-life for atrazine in non-adapted soil is 60 days. Conversely, the average atrazine half-life in adapted soil is 6 days.¹ This 10-fold difference in atrazine persistence between adapted and non-adapted soil can adversely affect residual weed control.

The effectiveness of a residual herbicide is primarily a function of two parameters: 1) the herbicide concentration required to control a weed species, and 2) the herbicide’s persistence in soil. For example, if an atrazine concentration of 0.4 mg/kg soil is required to control a given weed, then we can expect 80 days of residual weed control in a non-adapted soil as compared to 8 days in an adapted soil (Figure 1).

Enhanced degradation can develop following one atrazine application.⁷ However, the probability of encountering reduced residual weed control with atrazine increases if the herbicide is applied annually for three or more consecutive years (Figure 3).⁵

Figure 1. Residual weed control with atrazine in adapted and non-adapted soils.

Figure 2. Greenhouse response of pitted morningglory to atrazine applied pre-emergent at 0.0, 1.6, and 1.6 lbs ai/acre in non-treated, adapted and non-adapted Mississippi soils, respectively. Photograph taken 21 days after application.

Figure 3. Weed control in Colorado no-tillage corn fields as a function of consecutive years of atrazine use.

Is there evidence for cross-adaptation among s-triazine herbicides?

Yes. Genetic analysis of bacteria isolated from Mississippi and Colorado adapted soils indicate the potential for widespread cross-adaptation among various s-triazine herbicides.¹ Specifically, laboratory experiments have confirmed that soils exhibiting enhanced atrazine degradation are cross-adapted with the s-triazine herbicide simazine, and Mississippi field studies have confirmed decreased persistence and reduced residual weed control with simazine in atrazine adapted soils.⁶

Can atrazine’s effectiveness as a residual herbicide be restored in soils where reduced residual weed control has been observed?

Probably. We are currently conducting research in Mississippi to address this question. Our research group should have a more definitive answer by 2010.