Synapse
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Atrazine:
Consider the Alternatives

Executive Summary

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1. Executive Summary

Every year, atrazine is applied to tens of millions of acres of corn grown in the United States, making it one of the world's most widely used agricultural chemicals. Atrazine is a potent weed killer—and is also the subject of persistent controversy about its health and environmental effects. It is known to be an endocrine disrupter even at extraordinarily low concentrations, with extensively studied, harmful impacts on many species of wildlife. It weakens immune systems in wildlife; there is some evidence from laboratory studies that it may be a carcinogen (although debate continues on this point); and exposure during pregnancy may increase risks of birth defects and low birth weight in humans. Produced by Syngenta, a European company, atrazine is subject to strict regulations that effectively prevent its use in the European Union—but it remains a staple of American agriculture.

The Atrazine Benefits Team

While the health impacts of atrazine use have been the subject of extensive research, much less has been written about the economic impacts. In a 2007 article, Frank Ackerman (one of the authors of this report) found that most studies showed only limited benefits from atrazine, and that a Syngenta-sponsored economic analysis contained serious errors that cast doubt on the validity of its conclusions. More recently, Syngenta assembled an "Atrazine Benefits Team" of researchers who released five studies in 2011, claiming to show huge benefits from atrazine use and alleging that Ackerman's conclusions were now outdated.

This report examines the Atrazine Benefits Team papers, and identifies three major flaws in their analysis:

1) They exaggerate the effectiveness of atrazine and offer an incomplete analysis of both chemical and non-chemical alternatives. Some important alternative herbicides receive little or no attention, and the option of non-chemical or low-chemical integrated weed management techniques is not discussed.
2) Much of their analysis relies on the unrealistic assumption that crop prices are unaffected by changes in crop yields—producing misleading and unfounded estimates of large economic benefits from atrazine use.
3) In the one Atrazine Benefits Team analysis that considers changes in crop prices as well as yields, the withdrawal of atrazine would lead to a 4.4 percent decrease in corn production and an 8.0 percent increase in corn prices. The result is that under Syngenta's own assumptions, corn growers' revenues would actually *increase* by 3.2 percent if atrazine became unavailable. The author of the paper fails to mention this benefit. While an 8.0 percent price increase would affect the largest buyers of corn—primarily ethanol producers and animal feedlots—the resulting impact on consumer prices for gasoline and beef would only amount to pennies per gallon or pound, respectively, in exchange for significant health and environmental benefits.

In the following sections we summarize key findings related to each of these major flaws.

Incomplete analysis of alternatives

Chemical alternatives

Most of the weed pressure on corn is caused by ten common weeds; atrazine resistance has been detected in six of these weeds. Common waterhemp, the third-most noxious corn weed in the United States, displayed atrazine resistance in more than half of a large sample of Iowa weed populations studied by one of the Atrazine Benefits Team authors. Meanwhile, several other herbicides appear to be equivalent or superior to atrazine in effectiveness, especially when used in appropriate combinations. The Atrazine Benefits Team analysis, however, is built upon a comparison between atrazine and other single-herbicide alternatives—and appears to omit or inadequately assess several highly effective herbicides.

Alternative weed management methods

U.S. agriculture has shifted toward simplified, highly chemical-dependent systems, such as reliance on "Roundup Ready" corn and other herbicide-tolerant crops. This has created a situation in which weeds resistant to common herbicides—such as glyphosate (Roundup) and atrazine—are more likely to succeed and proliferate than non-resistant weeds, thereby increasing the herbicide-resistant weed population over time. In response, many producers have turned to integrated weed management (IWM), analogous to the better-known methods of integrated pest management. IWM employs multiple non-chemical techniques, including crop rotation, intercropping, enhanced crop competitiveness, cover crops, conservation tillage methods, and banded fertilizer placement. A study of IWM found that these techniques have synergistic effects, with much greater weed reduction when multiple techniques are combined. The Atrazine Benefits Team did not discuss these approaches as alternatives to atrazine.

Assuming crop yields do not affect crop prices

Because the most effective chemical and non-chemical alternatives were not considered in the Atrazine Benefit Team's analyses, it seems likely that they overstated the effect on crop yields that would result from eliminating atrazine. Even if their estimate of yield effects were accurate, however, there are serious flaws in their economic analysis of the market for corn.

The United States produces more than 11 billion bushels of corn annually. Most of it is used either for ethanol production (40 percent in 2012) or for animal feed (37 percent). Like other agricultural products, its price frequently moves up or down in response to changes in supply and demand. The surge in demand for ethanol, following the adoption of the federal ethanol mandate in 2005-2007, was accompanied by a doubling of the price of corn, from less than $3 per bushel in 2006 and earlier, up to $6 per bushel in 2011 and 2012. Yet despite such price volatility, two of the three Atrazine Benefits Team papers that estimate economic impacts assume that corn and other crop prices remain constant, even when crop yields and production change significantly. Under this unrealistic assumption, any assumed yield loss from the withdrawal of atrazine would automatically translate into a comparable loss of farm revenues; these assumed revenue losses are emphasized by the Atrazine Benefits Team.

Disregarding key implications of their own analysis

In the one case where the Atrazine Benefits Team used a more sophisticated model, allowing crop prices to change, they obtained a result opposite from the two papers discussed above: withdrawal of atrazine reduces corn yields, but increases corn prices by a greater percentage, resulting in an *increase* in farm revenues. Under a key scenario (assuming moderate tillage and constant glyphosate use), they estimate that corn production drops by 4.4 percent without atrazine, but the price of corn increases by 8.0 percent. Corn growers' revenue therefore increases by 3.2 percent, or $1.7 billion, if atrazine is withdrawn from the market. This benefit to farmers is never mentioned by the Atrazine Benefits Team, but is clearly implied by their results.

Other research on the "price elasticity" of corn—that is, the relationship between price changes and quantity changes—points in the same direction. Corn, like most agricultural products, is said to have "inelastic" demand, meaning that small quantity changes are associated with larger price changes. For any product with inelastic demand, a small percentage drop in output is associated with a larger percentage increase in price, raising the total sales revenues received by producers.

Corn without atrazine: who wins and who loses?

Suppose, consistent with the Atrazine Benefits Team scenario described above, that the withdrawal of atrazine would cause 4.4 percent less corn production and an 8.0 percent increase in the price of corn. Using these numbers, who wins and who loses from the withdrawal of atrazine?

Corn growers, as we have seen, would be winners, enjoying a 3.2 percent increase in sales revenue. Other winners would include people and animals that would no longer suffer the health and environmental impacts of atrazine. The biggest losers are the industries that buy corn, such as ethanol and livestock producers; they would have to pay 8 percent more for a key input to their industries. The Atrazine Benefits Team focuses on these losses, described as a decrease in "consumer surplus"—a technical term used by economists to refer to the impact of price increases on the buyers of a product.

What would an 8 percent increase in the price of corn mean for consumers? In the case of ethanol, it would cause a price increase, although probably less than 8 percent, since other costs of ethanol production would not be affected. Ethanol is blended into gasoline; percentages vary by region of the country, but it generally represents 10 percent or less of the total volume of gasoline. So even if ethanol increased in price by the full 8 percent, gasoline prices would increase less than 1 percent. At today's prices, the increased price at the gas pump would amount to about $0.03 per gallon.

For beef, two very different analyses both suggest that a 1 percent increase in the price of corn is associated with a 0.17 percent increase in the price of beef. That is, the beef price impact is one-sixth as large as the change in the price of corn. So an 8 percent increase in the price of corn would translate into a 1.4 percent price increase for beef: $0.05 per pound for ground beef or $0.10 per pound for sirloin steak. The cost of a hamburger would rise by about a penny; the cost of an 8-ounce steak would rise by a nickel.

In terms of narrow economic self-interest, ethanol producers and animal feedlots may have good reasons to favor atrazine, but corn growers have equally good reasons to explore the alternatives. Consumers, meanwhile, have only pennies per person at stake—in a question with profound impacts on health and the environment.