PREDICTED IMPACT OF TRANSGENIC CROPS ON WATER QUALITY AND RELATED ECOSYSTEMS IN VULNERABLE WATERSHEDS OF THE UNITED STATES

David I Gustafson

Monsanto Company, 800 N. Lindbergh Blvd., St. Louis, MO 63167 USA

Biographical Sketch

Dr. Gustafson is a Monsanto Science Fellow, who first joined the company in 1985. His academic training was at Stanford and the University of Washington in Seattle, where he received B.S. and Ph.D. degrees, respectively, both in chemical engineering. A major focus of his work has been the development of new computer models for predicting the environmental behavior of crop chemicals, especially as it relates to drinking water quality. Among the many models he has developed for this purpose is the GUS-Index, which is now used by regulatory agencies worldwide to determine the potential of pesticides to contaminate ground water supplies

Abstract

The US agricultural industry faces a challenge to reduce the off-site impacts of crop protection chemicals that result from pesticide movement into ground and surface waters. While most water resources are not impacted significantly, monitoring data show that the water quality of vulnerable watersheds can be affected when certain pesticides of high mobility and/or environmental persistence are widely used. Transgenic cropping systems are intended to optimize the types and quantities of pesticides necessary for production of food, feed, and fiber. Because of this shift in chemical pesticide use, such cropping systems may be anticipated to result in reduced impacts on water quality and possibly related ecosystems.

This poster uses computer modeling to predict the water quality impacts of three new transgenic cropping systems: (1) corn modified to withstand nonselective herbicides; (2) cotton modified to combat certain lepidopteron pests through the insertion of genetic material from *Bacillus thuringiensis (Bt)*; and (3) corn similarly modified to prevent damage from European Corn Borer and other pests. All three transgenic cropping systems are predicted to result in significantly lower pesticide concentrations in ground and surface waters, thereby reducing whatever impacts these products have on drinking water quality and related ecosystems. Research to document reduced impacts on aquatic biodiversity with the *Bt*-crops is now underway.

In the case of transgenic, herbicide-tolerant corn, the assessment shows that glyphosate and glufosinate loads in runoff would be generally 1/5 to 1/10 those of atrazine and alachlor. These model results indicate that the replacement of pre-emergent corn herbicides with the post-emergent herbicides allowed by genetic modification of corn dramatically reduces herbicide concentrations in vulnerable watersheds. Given the significantly lower chronic mammalian toxicity of these compounds, and their susceptibility to breakdown in the drinking water treatment process, risks to human populations through drinking water would also be reduced.