

# Assessment of the effects of GE crops on biological diversity: the process and the data

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Commercial use of genetically engineered (GE, also known as “genetically modified”) organisms have tended to generate controversy wherever they are proposed around the world. One part of this has been the potential ecological effects of these organisms. There are three kinds of potential ecological effects that require investigation: 1) gene flow and its consequences, 2) effects on species, ecological communities and ecosystems, and 3) evolutionary effects. In this talk, I will focus on the second of these.

Based on experiences with GE crops, seven main kinds of potential adverse effects on species, ecological communities and/or ecosystems have been identified. For GE crops, these are: a) adverse effects on crop production, b) reduced soil health or quality, c) reduced value of non-crop economic activities, d) reduced cultural value, e) increased conservation concern, f) reduced environmental quality, and g) increased human disease via environmental change. Analysis of each of these has been uneven across regulatory regimes. Here I present a detailed analysis of 80 laboratory studies of the effects of Cry toxins and proteinase inhibitors (PIs) on natural enemies that were published in the peer-reviewed literature. Natural enemies have been studied because of concerns that GE crops could disrupt naturally occurring biological control, thereby giving rise to secondary pest outbreaks. They are tested first in the laboratory because under some regulatory regimes, these are the required tier 1 tests. These tier 1 tests play a key role in regulatory decision-making. If a natural enemy is significantly affected in these tier 1 tests, then tier 2 tests must be initiated. If it is not affected in the tier 1 test, then the toxin is considered ecologically safe, and no other tests are needed. Thus, proper determination of the outcome of these laboratory tests is essential for the risk assessment process to proceed with confidence.

Using a simple meta-analysis, we examined the 1648 responses in the papers. Only Cry1Ab, Cry1Ac, and GNA have received sufficient study that general conclusions might be drawn. Most of the responses have been reported from Europe and east- and austral-Asia, which are not the geographic locations where most of the GE crops are used. Five species account for nearly 1/3 of the reported responses. There has been an overemphasis on these five species when some taxa have been rarely examined. We found widespread evidence that both Cry toxins and PIs have effects on natural enemies, both directly and indirectly. These effects are both positive and negative, and occur across many different kinds of responses. Our work has been publicly criticized, and we have responded to all of these criticisms. I summarize these exchanges, and conclude that there are effects on natural enemies that were not identified by the tier 1 tests. These tier 1 tests do not reliably indicate the presence/ absence of an effect and should not be relied on to lend confidence to a risk assessment.

## 演者紹介

Andow 教授は、日系アメリカ人で Brown 大学卒業後、Cornell 大学で学位を取り、現在ミネソタ大学昆虫学研究室の教授です。昆虫と植物、昆虫と天敵の種間関係、侵入生物の生態学、遺伝子組換え作物の環境リスク評価など多岐にわたる研究に携わられています。現在は今回の演題である遺伝子組換え作物の環境リスク評価の世界的な権威です（昆虫生態制御学研究室・矢野栄二）。