

IRAC International Statement: Considerations for the resistance management value of using insecticidal chemistry on transgenic crops expressing insecticidal proteins.

Chemical insecticides can be applied to conventional and transgenic crops expressing insecticidal proteins. Insecticidal chemistry may be applied to transgenic crops for a number of reasons, particularly to broaden the range of pests controlled or increase the level of target pest control. In certain circumstances, the application of chemical insecticides to transgenic crops also may be considered for insecticide resistance management (IRM) purposes.

All currently commercialized synthetic insecticidal chemistries offer an alternative mode of action to the insecticidal proteins expressed in transgenic plants and there is little evidence for cross-resistance between these chemistries and the insecticidal proteins*. Therefore the combined use of synthetic insecticidal chemicals and proteins which target the same insect pest offers the potential for an IRM tactic that could be beneficial for preserving the susceptibility of the target insects to both components. However, negative IRM impacts may arise if chemical insecticides are applied to a non-transgenic refuge as this reduces the population of insects that are susceptible to the plant expressed protein. Therefore when selecting refuge size and structure, it is important to take into account chemical insecticide application programs.

When considering a pest management program, it is important to take into account IRM considerations for both the transgenic trait (i.e. refuge adoption) and the chemistries being employed (both foliar applied and seed treatments). The following should be considered when assessing the IRM value of applying chemical insecticides to transgenic crops expressing insecticidal proteins:

- 1) An IRM benefit of the combined use of insecticide chemistry and transgenic crops expressing insecticidal proteins will only occur while the target insect population is exposed simultaneously to lethal doses of both the insecticide chemistry and the insecticidal protein(s).
- 2) For there to be an IRM benefit, the insecticide should be applied to the transgenic crop but not the refuge. In cases where both the transgenic crop and the refuge are treated with the insecticide, the IRM benefits will be neutralized. In circumstances where only the refuge is sprayed, this will have a negative effect on IRM for the transgenic crop. Despite the neutral or negative effects on IRM, insecticide sprays applied to the refuge may offer other benefits such as improved pest control.
- 3) In most cases, a refuge-in-a-bag (RIB) strategy does not allow for the selective application of chemical insecticides only to the transgenic plants, and therefore the impact of chemical applications to both the transgenic plants and the embedded refuge is unlikely to provide an IRM benefit.
- 4) The application of insecticides to a field that contains, or is suspected to contain, a significant proportion of target pests that are resistant to the transgenic crop can provide local suppression of the pest population and slow the geographic spread of the resistant insects. This use of insecticides can therefore provide area-wide IRM benefits.
- 5) The combined effects of the chemical insecticide and the expressed insecticidal proteins will be less effective and potentially detrimental if resistance has or is already developing to either the chemical or the protein(s).

*Not including foliar applied sprays which are based on *Bacillus thuringiensis* proteins.