ADVISORY COMMITTEE ON RELEASES TO THE ENVIRONMENT

Advice on the implications of findings in a Defra-funded desk study: 'Agronomic and environmental implications of the establishment of GM herbicide tolerant problem weeds'

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Background

This study was commissioned by Defra to examine the agronomic and environmental consequences of geneflow from genetically modified herbicide tolerant (GMHT) crops. This follows the publication of a number of studies showing that gene transfer to wild relatives of certain crop plants is possible. Previous studies have demonstrated that GM herbicide tolerance does not confer a selective advantage to plants growing in semi-natural habitats where the associated herbicide is not used (e.g. Crawley et al., 1993[1], Crawley et al., 2001[2]). However, in agricultural environments where herbicide use is common, herbicide tolerant weeds may have a selective advantage and crop management practices may need to be changed.

The report's authors reviewed the information on the frequency of hybridisation between oilseed rape and sexually compatible weed species and concluded that such events are relatively uncommon such that changes in management to control any resulting weeds were unlikely, with the possible exception of *B.rapa* hybrids in certain areas. However, the authors noted that GMHT oilseed rape volunteers could persist in fields at levels that may require alteration of crop rotations and herbicide regimes. In GM sugar beet crops the authors concluded that good crop management should prevent the formation of HT weed beet but that failure to manage bolters would result in HT weed beet.

The authors also concluded that management changes would not be required in fields that have previously contained sexually compatible crops growing adjacent to GMHT crop fields because any HT volunteers would be present at very low levels in these areas.

The second part of the study investigated the agronomic changes that would be required to manage HT weeds in cropped fields. The authors used lifecycle models for each of the crops to investigate the build up of volunteers within different crop rotations and their associated management regimes

[1] Crawley, M.J., et al., 1993. Ecology of transgenic oilseed rape in natural habitats. Nature. 363:620-623.
[2] Crawley, M.J., et al. 2001. Transgenic crops in natural habitats. Nature. 409:682-683.

(including herbicide use and methods of soil tillage). The authors concluded that rotations would need to be altered for some HT weeds to be controlled but that this depended on the type of herbicide tolerance conferred to the weed. Predictions were based on 3 types of herbicide tolerance in oilseed rape (glyphosate, glufosinate ammonium and imidazolinone) and two types of HT tolerance in sugar beet (glyphosate, glufosinate ammonium).

The environmental consequences of controlling HT weeds were also investigated. The authors used a risk assessment tool which calculates site specific values for each herbicide product in terms of eco-ratings and ecotox scores (which combine all the toxicological data on the effects of the rates of products used on plants, invertebrates and vertebrates). In addition, the authors used their own expertise in combination with data from the published literature to assess the impact of the management changes to tillage and timing of cultivations. The authors concluded that changes to herbicide regimes were within the bounds of good agricultural practice in terms of their eco-ratings and ecotox scores. However since control of GMHT volunteers is easier in winter wheat than in spring crops farmers may prefer to grow these in order to avoid the build up of HT weed problems. In some circumstances, this would result in the loss of over wintered stubbles which have been associated with the decline in populations of plants, invertebrates and birds over the past few decades.

The authors recommended that fields where HT crops were cultivated, their surrounding margins and adjacent crops should be monitored for the presence of HT weeds. In particular the consortium noted that detailed records of crop management after the HT crop should be kept since this may be helpful in explaining any adverse effects on the environment that might subsequently arise.

Advice:

This research adds to our understanding of possible long-term adverse environmental effects that could be associated with the post-cultivation management following the release of certain GMHT crops. However this study was a desk exercise and the scenarios examined may not be representative of the field situation. ACRE recommends that monitoring for changes in cropping practices and crop management after certain HT crops are grown would be appropriate to address the issues raised by this research.

This research clearly demonstrates that the agronomic regimes associated with the post-harvest management of different crops and different herbicide tolerance traits have different effects on the environment. ACRE therefore advises that it will continue to deal with applications to cultivate GM crops, including GMHT crops on a case-by-case basis.

Comment

There are currently no applications for the commercial cultivation of herbicide tolerant GMHT oilseed rape or sugar beet crops in the EU but this desk study investigates scenarios that may be of some value if future applications are forthcoming.

The report shows that some of the altered management practices required in subsequent crops and post-harvest, such as minimum tillage rather than ploughing may provide environmental benefits. However the report also highlights that certain practices to enhance the control of HT weeds such as a change from spring sown crops to winter wheat could lead to adverse effects on some farmland habitats. This adverse effect is possible in regions with very light soils because over wintered stubbles are retained in these areas if a spring crop is subsequently sown. As the report's authors recognise, over wintered stubbles are valuable foraging grounds for some farmland bird species. The Committee also notes that a change from glyphosate to paraquat in subsequent crops in the rotation could lead to adverse effects on mammals such as hares, particularly if recommended risk mitigation measures were not adopted, even though the use of both chemicals falls within the definition of "low environmental impact" used by the authors of this report.

ACRE notes that most of the alterations to crop management anticipated by this research are necessary because of the requirement to segregate GM (labelled) produce and non-GM (unlabelled) produce (keeping within the EU GM presence labelling threshold of 0.9%). Some of the changes to management practices suggested in this report would also be appropriate to conventionally produced crops for which there is a need for segregation for specialist markets e.g. oilseed rape producing higher levels of linolenic acid or erucic acid. However, although some changes (such as leaving a long period between sowing conventional oilseed rape and the specialist variety and using minimum tillage rather than ploughing) would be necessary for these crops, other changes (such as changes to the herbicide regime used in other crops and the selection of winter wheat rather than spring sown crops) are specific to HT crops. How widespread the requirement to make these changes would be remains a matter of speculation.

The report highlights that some GMHT crops, such as those conferring tolerance to glufosinate ammonium should not alter the herbicide regimes used in subsequent crop management whereas others (glyphosate or imidazolinone tolerant crops) would require alterations to these practices.

The report provides useful information about the financial implications of agronomic changes that could affect farmers choosing to grow GMHT crops. However, ACRE does not take considerations of this nature into account when evaluating environmental risk assessments of GM crops.

The report recommends that monitoring of weeds (to determine whether any are HT) in subsequent crops, in adjacent fields and in crop margins should be conducted and that detailed records of crop management after the HT crop should be kept since this may be helpful in explaining any adverse effects on the environment that might subsequently arise. ACRE agrees that this is a sensible and proportionate approach to the possible risks identified in the report.