



ADVISORY COMMITTEE ON RELEASES TO THE ENVIRONMENT

Advice on a paper by Chilcutt and Tabashnik (2004) on gene flow from Bt maize crops to refuge plants

Advice of the Advisory Committee on Releases to the Environment (ACRE) under S.124 of the Environmental Protection Act 1990 (Part VI) to the Secretary of State for Environment, Food and Rural Affairs, Scottish Ministers, Ministers of the Welsh Assembly Government and the Department of Environment (Northern Ireland).

Background:

The paper by Chilcutt and Tabashnik (2004)¹ reports on experiments that measured gene flow between varieties of Bt maize and non-Bt maize and discusses whether this gene flow could accelerate pest resistance to Bt endotoxins by compromising the effectiveness of high dose/ refugia. High dose/ refugia are employed to delay the development of resistance in pest populations by growing areas of non-Bt plants near Bt crops. The prediction is that rare individuals in a Bt crop that are resistant to the endotoxin will mate with relatively abundant susceptible individuals in refuges and that their offspring will be killed by a high dose of endotoxin from the Bt plants. If this works in practice, modelling suggests that the development of resistance in a population will be significantly delayed.

The authors of this paper suggest that there are two mechanisms by which pest resistance could be accelerated by gene flow from Bt to non-Bt maize: firstly, by diminishing the size of refuges and thereby the population of susceptible pests that feed primarily or partially on maize kernels and secondly, by generating maize plants with intermediate rather than high levels of Bt toxins. The latter might then allow a proportion of pests that would otherwise be killed to survive and consequently increase the selection pressure on genes conferring resistance.

The use of refugia to delay the development of resistance to Bt endotoxins is not directly pertinent to the UK since we do not have a problem with the pests that Bt crops are targeted against. However, the Welsh Assembly Government have requested ACRE's advice on the implications that gene flow between Bt and non-Bt crops might have on maize production in the EU.

¹ Charles F. Chilcutt and Bruce E. Tabashnik (2004). Contamination of refuges by *bacillus thuringiensis* toxin genes from transgenic maize. Proceedings of the National Academy of Sciences, USA. **101**(20): 7516 –7529.

Advice:

ACRE considers that this paper by Chilcutt and Tabashnik does not contain new information, although it does support existing data on the frequency of gene flow between spatially separated maize plants. The authors discuss the possible implications for the development of pest resistance to Bt endotoxins in this paper but do not support these ideas with new data or modelling experiments. To the contrary, all the available evidence from Bt crop cultivation indicates that the refuge strategy being employed has been effective. High dose/ refugia have been used in a number of countries over a number of years (including Spain, Argentina and the USA) and this has been accompanied by detailed monitoring for the development of pest resistance – none has been found. ACRE therefore concludes that whilst the paper puts forward an interesting theory, it does not provide supporting evidence for this and all the monitoring of refugia to date indicates that the strategy is not being compromised by gene flow between Bt maize and non-Bt maize.