



ADVISORY COMMITTEE ON RELEASES TO THE ENVIRONMENT

Advice on the status of the products of protoplast fusion under Directive 2001/18/EC

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).

Date: 22nd February 2005

Background:

It is not explicit in Directive 2001/18/EC whether protoplast fusion is considered a GM technique or not. The Directive (Articles 2, 3(1) and Annexes IA (Part I) and IB) implies that this depends on whether the outcome of protoplast fusion could have occurred 'naturally'. If this approach were applied more generally to plant breeding methods, a number of techniques might be categorised as GM (if they have not been used in a number of applications and have a long safety record – recital 17 of Directive 2001/18/EC). This is because traditional plant breeding includes a range of techniques that compromise the physical and genetic barriers that would otherwise limit (but not necessarily totally inhibit) sexual hybridisation. ACRE considers that the details of the technique used should define whether a crop variety should be categorised as GM without reference to whether the outcome could have occurred naturally, and that GM should be considered as being based around the use of recombinant DNA (cloning) technology.

The aim of plant breeding is to utilise genetic variation by selecting for novel gene combinations from which useful traits can be derived. As the genetic distance between plants increases (and the potential to generate genetic variation in their progeny increases), the probability of generating viable progeny through sexual hybridisation is reduced. Protoplast fusion is one technique that is used to facilitate the generation of novel genotypes that might otherwise not occur or might do so at low frequencies via sexual hybridisation. The generation of novel plant varieties through protoplast fusion involves removing the walls of plant cells (to produce protoplasts), fusing protoplasts together and regenerating plants from them that may include DNA from both parents. This technique has been used in the development of commercial potato and oilseed rape varieties.

Breeding techniques that facilitate the mixing of DNA from plants that would otherwise not interbreed or that would do so at low frequencies, are more likely to result in a departure from strict Mendelian inheritance patterns and cause genetic reassortment and instability. Protoplast fusion, for example, can result in fragments of DNA derived from one parent being dispersed throughout intact chromosomes

inherited from the other parent¹. However, even in this case, there must be a certain degree of genetic compatibility between the parental lines for the generation of progeny containing DNA from both parents to be successful. For example, fusing protoplasts derived from an animal and a plant will not generate organisms containing DNA from both. In addition, protoplast fusion techniques may be used to create novel nuclear/cytoplasm combinations. This may be valuable as a means of creating or modifying cytoplasmic male sterility, which again can be an important tool in the generation of hybrid crops.

ACRE does not consider that protoplast fusion is necessarily a GM technique. Rather, it is one of a number of plant breeding techniques that relies on a degree of genetic relatedness between parents for success. These techniques are significantly less directed than GM, which involves the addition or removal of specific characterised fragments of DNA. Plant breeding relies on random genetic change followed by selection, and marker technology can be used to detect whether desired genetic changes have occurred.

Advice: ACRE does not consider that the use of protoplast fusion in the generation of new crop varieties necessarily means that those crops should be classified as GM. Characterising crop varieties as GM or non GM depending on whether their genetic make-up could have occurred naturally is not helpful. As it is, traditional plant breeding encompasses a broad range of techniques that compromise genetic and physical reproductive barriers to a greater or lesser extent. ACRE considers that the methodology used should define whether GM technology has been used in the development of a new crop variety and this should not rely upon judgements as to whether the event could have occurred naturally.

¹ Szarka B, Gonter I, Molnar-Lang M, Morocz S, Dudits D. (2002). Mixing of maize and wheat genomic DNA by somatic hybridization in regenerated sterile maize plants. *Theor Appl Genet.* 2002 **105(1)**:1-7.