

My background is 20 years in academic plant genetic research, and 20-odd years in commercial plant breeding, mostly self-employed. I now have no vested interests in any aspect of science or agriculture. I have two points to make and from them I comment on the desirability of using transgenics ('GM') to breed organic crops.

Firstly, genetic knowledge and applications are developing so fast that the certainties based on established 'big facts' may be misplaced: here are two examples. Within the last two decades assumptions that gene expression was understood conflicted with embarrassing anomalies in the expression of transgenes. This led to the recognition that natural mechanisms existed to silence genes, and this is itself now approaching commercial application. And more recently, the mantra that acquired characteristics cannot be inherited now conflicts with research into apparent heritable, environmentally-induced epigenetic effects, and if the latter is true then crop breeding may change profoundly. Any commercial breeding programme - be it non-GM or GM - takes perhaps 10 years, with the genetic potential and the technologies more or less fixed from the outset. So, cultivars introduced to agriculture derive from knowledge and technologies which are already 10 years out of date. (This fuels the GM conflict because the 'pros' can describe the potential of current research, and the 'antis' can point at the (inevitable) failures and uncertainties of some GM products and the technology which went into them.)

Secondly, breeders - ranging from commercial breeders aiming at international markets to subsistence farmers - produce saleable or useable products from which they intend to gain some advantage. Breeders working within charities or the public sector on academic and 'public-good' programmes may have different constraints, but it is unlikely that they will be able to ignore these objectives in their work. Although some breeders use particular technologies in which they have vested interests, the over-riding incentives are to produce cultivars which can be sold or grown for profit and much of that profit will depend on a new cultivar not being pirated by competitors or simply multiplied by customers. That is, the development of cultivars is partly driven by the breeder's wish to protect his investment: and this will determine which technology is appropriate.

So, should we breed 'GM organic crops'? A few single transgene resistances to insects and viruses are in use; more complex and sophisticated inducible resistances may be possible; and perhaps 'generalised' disease resistance could be introduced via manipulation of, say, the jasmonic acid pathway. But we are looking a long way into an uncertain future.

It is possible that breeders may commit themselves to breeding organic crops if they were confident that they could protect their investment via GM-based F1 hybrid cultivars, or by using the various 'traitor'/terminator technologies. But such cultivars would have to possess prodigious advantages for consumers to accept them - way beyond, say, trite claims for 'neutraceutical' crops, or the ability to grow under organic production systems.

I have, however, one major technical problem with the use of transgenes. Breeders have for decades used 'natural' single gene resistances to herbivores and pathogens. It is well known that pests usually eventually overcome such resistance, necessitating the use of new resistance genes. Transgenic resistances may follow the same course. There is also evidence - albeit more tenuous - that when single gene resistance is lost, or when, say, a pesticide stops being used, that the exposed crop is more susceptible than it was when the resistance or the pesticide was first introduced several decades earlier. That is, a high level of protection has allowed lower levels of resistance/tolerance to drift away, for reasons which are unclear. Perhaps the same will happen under the effects of transgenes. I suggest that research into organic breeding should be aimed at understanding and exploiting 'background' adaptability to environments, rather than introducing major transgenic effects.

Peter Crisp, 7 October 2008