A Vindication of Plant Transgenics

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Responding to criticisms of biotechnology, its applications and implications, can be a frustrating experience. All too often, the complaints are either wrongly targeted (as when supposed ethical concerns are really matters of safety and risk) or so hypothetical as to be beyond meaningful discussion. Whatever the complaintant feels afterward, the person replying to the attack is likely to conclude that little or nothing has been achieved.

One defender of biotechnology who should not be feeling frustrated at the moment, however, is Alan McHughen of the Crop Development Center at the University of Saskatchewan (Saskatoon, Canada). He and his colleagues have just provided one of the most impressive rebuttals of biotechnological criticism that I have ever encountered. It is concrete and comprehensive, and leaves many of the opponents of plant gene manipulation without a leg to stand on.

McHughen and his team have long been interested in the need to develop crops resistant to sulfonylurea. Cereal farmers throughout the world use this herbicide because of its efficacy in small doses and its low toxicity. However, some sulfonylurea products persist in the soil for many years, severely limiting the options for rotating crops. A farmer in Saskatchewan, for example, with soil of neutral pH, has to wait 34 months after applying metsulfuron methyl before seeding flax. The only options are to grow a cereal continuously or to leave the land fallow over the summer.

Farmers could avoid both of these undesirable practices if they were able to include in their rotation one crop that was capable of growing in soil containing residual herbicide. In addition, they might well be able to reduce their overall use of chemicals to combat weeds.

A few years ago, the Saskatoon group used *Agrobacterium* to transfer into flax a modified gene coding for acetolactate synthase (the natural target of sulfonylurea herbicides) from *Arabidopsis*. They subsequently reported promising results from preliminary field tests with several lines produced in this way. Now—the sledgehammer blow for critics—they have come up with some highly impressive data from three years of extensive, randomized, replicated, multidose trials with two of their transgenic cultivars.

The researchers derived both lines of flax from the popular commercial cultivar Norlin, which they planted as a control. The trials took place at the Kernen Crop Research Farm east of Saskatoon, where the soil pH is such that the residual activity of sulfonylurea is as severe as it is anywhere in western Canada. McHughen and his colleagues believe that the selection pressure there is as great as would be likely to be encountered in commercial practice. Using plots 2 × 4 meters, they sprayed various sulfonylurea herbicides onto the soil in the autumn before seeding the flax, as in conventional farming, but they did this as late as possible to restrict natural degradation.

The outcome of the three-year project amounts to a vindication of plant transgenics and an item-by-item rebuttal of their criticism on environmental and other grounds. The results, which appear in the current *Transgenic Research* (**4**:3-11), confirm that at least one of the lines of flax under trial in Saskatoon is fully resistant to conventional doses of the sulfonylureas when cultivated under field conditions. The new cultivar carries no agronomic penalties, regardless of the presence or absence of herbicides. Its use will require less chemical use than the parent strain, and will lead to more sustainable agronomic practices when used in commercial farming.

Especially notable was the transgenic's agronomic performance. Many transgenic plants developed over the past decade have expressed their new trait perfectly well, but have had the disadvantage of producing a low yield. This throws up the question of just how much loss of yield is tolerable if the new trait *per se* is of particular value. In the case of McHughen's flax, however, there was no change in either yield or quality characteristics as compared with the parent line.

There have been comparatively few published studies following replicated, randomized, multiyear field trials of transgenic crops—despite the considerable increase in the number of much more limited studies that have been conducted in recent years. This absence of extensive evidence has helped to sustain both the environmentalists' objections to such plants and the skepticism of some plant breeders about the advantages of recombinant work over classical techniques.

Generalizations are risky. But this really does look like a major landmark in both the development and acceptance of transgenic crops. ///