Colloquia Papers and Authors

Presiding: Jude W. Grosser

Genetic Stability of Transgenes Under Field Conditions: Introduction to the Colloquium

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The genetic engineering of horticultural crops to improve disease/insect resistance, cultivar quality, or other parameters has become a primary area of focus for many research programs. The technique is attractive because a single beneficial trait can be added to an already successful cultivar without otherwise altering cultivar integrity. However, little information has been available regarding performance of such transgenic plants in the field, particularly regarding woody perennial crops. The purpose of this colloquium was to provide the latest information available regarding the performance of transgenic plants in the field, covering a wide range of crops, including fruit, nut, and forest trees, as well as vegetables. Focus was on the long-term expression of transgenes and promoter efficiency. The information presented should be particularly useful to researchers who are currently designing or performing experiments to improve horticultural crops by genetic engineering.

In the first manuscript, "Field Performance of Transgenic Potato, with Resistance to Colorado Potato Beetle and Viruses," Duncan et al. describe a true success story resulting in the commercialization of three new transgenic potato (*Solanum tuberosum* L.) cultivars. Excellent performance and transgene stability were demonstrated in the field for three consecutive years. Transgenic "New Leaf " potato contains the cry3A Bt gene that confers resistance to the Colorado potato beetle. "New Leaf Plus" contains the cry3A Bt gene along with a virus-derived gene conferring resistance to potato leaf roll virus (PLRV). "New Leaf Y" contains the cry3A gene and a virus-derived gene conferring resistance to potato virus Y. Regulatory issues and a long-term management plan for use of these cultivars are also discussed in this paper. This work clearly demonstrates adequate transgene stability for an annual crop, and also that transgenes can be stacked to add multiple traits to an already established cultivar.

The second paper, "Stability of Herbicide Resistance and *GUS* Expression in Transgenic Hybrid Poplars (*Populus* sp.)" by Meilan et al., shifts the discussion to a long-term perennial forest tree crop. Commercially useful and consistent transgene stability was demonstrated in 38 out of 40 transgenic hybrid poplars containing two genes that impart tolerance to glyphosate (GOX and CP4), after 4 years in the field and vegetative propagation. This encouraging work provides strong evidence that gene silencing will not be a problem in transgenic woody crops, as long as an adequate number of properly constructed transgenic lines are produced and evaluated in multi-year trials in a variety of environments.

The third and final paper, "Different Genes for Different Folks in Tree Crops: What Works and What Does Not" by Dandekar et al., presents a woody plant transformation research program that is truly breathtaking in scope, promoting the idea "any gene from any source." In addition to disease, pest, and herbicide resistance, this extensive lab and field program also addresses modifying traits such as improving fruit/nut quality, nutritional content, and productivity. Examples described include apple (*Malus* ×*domestica* Borkh.) and walnut (*Juglans* sp.) transformed with Bt genes conferring enhanced resistance to the coddling moth; transgenic Bt persimmon for enhanced Lepidopteran insect resistance; transgenic apples with altered sugar/sugar alcohol (sorbitol) and ethylene metabolism to improve eating quality and shelf life; altered oil/fat composition in transgenic walnut to improve nutritional quality; transformation of citrus with genes that alter growth architecture for tree size control; and a study of self-incompatibility in transgenic almond [*Prunus dulcis* (Mill.) D.A. Webb] to increase productivity.

In conclusion, adequate transgene stability has been demonstrated in the field for both annual and perennial crops. Plant transformation is clearly a viable strategy for introducing one or more traits into established cultivars, as long as a cloned gene(s) controlling the trait is available, and the recipient crop is amenable to established transformation techniques. Given this, commercialization of transgenic woody fruit, nut, and forest crops could occur in the not-too-distant future.

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