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Potato Transformation

Lee Rooke and Keith Lindsey

1. Introduction

Potato is the world's fourth most important food crop, being surpassed in total production only by wheat, corn, and rice. Improved resistance to disease and pests during growth and storage is therefore of significant economic importance.

Cultivated varieties of *Solanum tuberosum* L. are tetraploid and exhibit a high level of genetic heterozygosity, which imparts vigor and high tuber yield to the cultivar. Improvement by conventional breeding is complicated because of segregation of the important characteristics and traits among the progeny. Genetic engineering offers the opportunity to introduce genes of interest and value into a cultivar without altering the commercially desirable phenotype. Our own interest in potato transformation is in using T-DNA-mediated promoter trapping to identify tissue-specific genes in this species ***(1)***.

Potato is one of the few crop species readily susceptible to infection by the soil-borne bacterium *Agrobacterium tumefaciens*, the causative agent of Crown Gall disease. This infection represents a natural gene vector system in which genetic information is transferred from the bacterium and integrated into the plant nuclear genome, where the transgenes can be expressed. The system has been exploited to genetically engineer plants by eliminating the oncogenic genes from the transferred DNA (T-DNA). Specific genes introduced between the T-DNA border repeats can then be transferred into plant cells without being accompanied by tumor formation (**ref. *2***; *see* Chapter 35). Transformed plant cells are directly selected for in tissue culture by the inclusion within the transferred DNA of a marker gene that confers resistance to an antibiotic or herbicidal compound ***(3)***. Efficient transformation must be subsequently followed by reproducible regeneration of whole plants: Manipulation of hormone com-

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