Developing herbicide tolerant transgenic plants for sustainable weed management

ABSTRACT

The use of herbicide is important in the modern integrated weed management system. However, herbicide also can kill valuable crops and cause significant losses in agricultural activity. One of the solutions to this problem is by developing herbicide resistant plant for instance using dehD gene from Rhizobial system. In this study, we developed transgenic tobacco plants that were resistant to monochloroacetic acid (MCA) herbicide. A gene from Rhizobium sp. coding for a dehalogenase D (dehD) capable of degrading monochloroacetic acid (MCA) has been previously isolated, characterised, cloned and sequenced. The coding sequence was fused with a cauliflower mosaic virus 35S promoter and introduced into tobacco plants by Agrobacterium-mediated gene transfer. In plant transformation experiments, the gene was shown to confer tolerance to MCA at a tissue culture level where MCA could be used to select for transformants. Integration and expression of the dehD gene in regenerated plants was confirmed by PCR analyses and Reverse Transcriptase PCR, respectively. The Chi Square analyses of five transgenic plants (T1), suggested that the dehD gene was segregated according to Mendelian 3:1 ratio. These findings showed that transgenic N. benthamiana plant resistant to MCA herbicide was successfully produced. The mode of action of dehD enzyme is not known but they probably affect many enzyme pathways. dehD gene has several advantages as a marker in plant breeding and genetic studies. In our knowledge, this is the first experimental data of transgenic N. benthamiana engineered with dehD gene originated Rhizobium sp.

Keyword: Dehalogenase D gene; Herbicide resistant; Monochloroacetic acid; Nicotiana benthamiana; Transgenic plant