

Transgenic potatoes capable of resisting freezing injury

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Plants, being sessile, are not able to prevent environmental stresses, such as extreme temperatures and drought from affecting them, hence their only option is to face these stress factors through the evolution of coping mechanisms at the molecular and cellular level. However, high intensities of these factors reduce and limit plant growth. Potato (*Solanum tuberosum*) is highly frost-susceptible since it has been observed that frost causes 40% loss in yield along with the low-quality output of the surviving potatoes. Therefore, scientists have been researching methods to tackle this problem. One such method is to prevent the recrystallisation of ice crystals inside the potato through the ice-recrystallisation inhibition (IRI) protein that was derived from *Lolium perenne* (IRI3 transgene). The IRI3 transgene was introduced into the potato through *Agrobacterium*-based transformation which resulted in the creation of three successful transgenic potato lines. They were confirmed for transgene insertion by polymerase chain reaction (PCR) and Southern blot. The transgenic varieties exhibited remarkable recovery post-frost injury and retained 14-22% of the essential ions proved by the ion-leakage assay. Furthermore, the biochemical analysis showed increased antioxidant enzyme activity (for superoxide dismutase and catalase) which enabled efficient management of cellular homeostasis after freezing. This research could be extremely beneficial to the countries found in relatively colder parts of the world like Siberia, Russia, Canada and Greenland as they would be able to cultivate potatoes even in harsh weather and not lose 40% of their agricultural yield. Apart from the benefits of this method, many issues are yet to be addressed in terms of environmental ethics and edibility. If these issues can be resolved, it could prove to be a groundbreaking method to improve frost tolerance and stabilise potato cultivation in colder regions of the world.

Keywords: Transgenic potato, Genetic engineering, Ice recrystallisation protein, Frost tolerance, Potato cultivation

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