

Transfer of a resistance gene into hops

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Resistance breeding

Hops – i.e. mainly the female cones - produce resins and essential oils which are used for bittering and flavoring of beer.

Some fungal pathogens cause severe damage in hop production. Thus, breeding for resistance is of great importance.

Classical breeding efforts are very time consuming and the gene-pool resources in hops - especially regarding resistance traits - are very limited. Furthermore, crossbreeding leads not only to an improvement of resistance traits, but often also to unwanted changes in brewing quality.

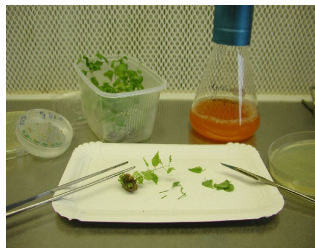
Gene transfer may help to overcome such limitations and guarantee addition of few resistance traits to aroma hops.



Indirect gene transfer

A gene transfer method via Agrobacterial infection has been optimized and applied successfully.

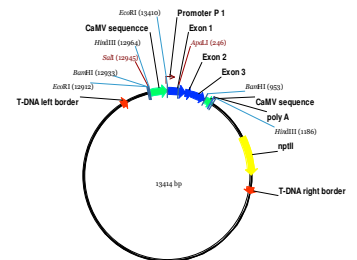
Well adjusted regeneration protocols are essential to obtain completely transgenic plants deriving from just one cell.



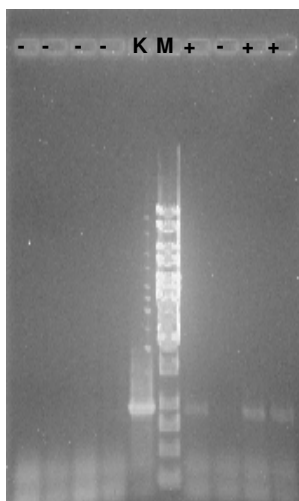
Construction of a chitinase gene vector

A chitinase gene was prepared by RT-PCR and cloned into a binary vector.

This construct was transferred into *in vitro* grown hop internodes.



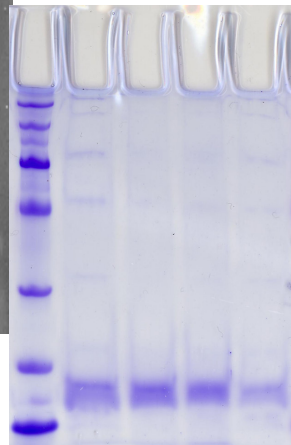
Detection of transgenes bearing and expressing the chitinase gene



After regeneration of plants, transgenes have to be distinguished from non-transgenic plants and examined regarding their genotype (DNA) and phenotype (protein, trait).

The presented methods allow a detection of the transferred chitinase gene.

The expressed resistance towards powdery mildew is tested *in vitro* by standardized artificial inoculation with spores of well characterized powdery mildew isolates.



Resistance tests by artificial inoculation with well characterized powdery mildew isolates

