Long term preservation of plant cell lines

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Plant cell cultures have been used for isolation of production of secondary metabolites but they also provide an interesting model system for plant research. Nevertheless they often consist of a heterogeneous population of cells with sometimes different physiological properties. This phenomenon has first been observed concerning the production of secondary metabolites, but affects also other physiological potentials of a cell cultures like salt tolerance. In the 80s many studies showed that cryopreservation was able to preserve the biosynthetic capacity of dedifferentiated cell cultures and provide a higher degree of stability over time than continuous sub-culturing more recently we demonstrated this also for physiological traits.

Since the beginning of plant cell cryopreservation different technical approaches have been developed: Controlled rate freezing, Vitrification, Encapsulation/Dehydration and Ultra-rapid freeing. More recently combinations of these basic techniques have been applied. All these techniques have been applied to many different plant tissues for the aim of germplasm conservation. The basic problem for the cryopreservation of all plant cells is the high water content of plant cells and the sub-cellular presence of water in the vacuoles. Nevertheless the situation is different for different tissue types. Mersitematic cells show relatively low water contents and techniques like ultra-rapid freezing or vitrification can be applied. Embyrogenic cell lines usually exhibit mechanisms of drought tolerance facilitating cryopreservation. Undifferentiated plant cell lines consist very often of an elongated cell type with many and large vacuoles and a high water content. For these cell cultures the classical controlled rate freezing approach is still the most successful technology. So far simple techniques like ultra-rapid freezing were not successful for undifferentiated plant cell lines. Only one technical approach, the application of ultra-rapid cooling in combination with encapsulation and vitrification yielded some success.

For routine work in a collection also practical considerations are of importance. The classical controlled rate freezing approach is still the most practical for collections, since it allows producing large batches of samples conserved under identical conditions.