

**Establishment of a transformation system for pearl millet (*Pennisetum glaucum*)
and
genetic enhancement against fungal diseases**

Pearl millet is the sixth most important cereal world-wide. It is a high-yielding summer forage, tolerant to drought, to very acidic soils and can be grown in low rainfall areas where maize and sorghum are not profitable.

The permanent increase of the world population and the expansion of deserts endanger human nutrition. Due to its good adaptation to drought and heat, pearl millet is an important crop to help attain food security where other cereals fail.

Although resistant against many diseases, pearl millet is susceptible to several fungal pathogens like downy mildew (*Sclerospora graminicola*) and rust (*Puccinia substriata*) which are causing high yield losses every year. Therefore, it is of great interest to develop high yielding and pathogen resistant cultivars.

In addition to classical breeding methods, genetic engineering is a promising strategy to introduce valuable traits into pearl millet. Many approaches can be applied to improve fungal resistance of crop plants, like the expression of chitinases, glucanases and phytoalexins. As well, genes that are not of plant origin can also be used to increase fungal resistance.

One of the major prerequisites for the implementation of this purpose is the establishment of efficient transformation systems.

In this work a transformation system for pearl millet has been developed based on an earlier improved regeneration system from immature zygotic embryos.

Additionally, a new suspension culture and a high-capacity regeneration system have been established. A regeneration rate of 60 pearl millet plants per callus was achieved.

Using the *in vitro* transformation system developed here, the antifungal gene *afp* from the mold *Aspergillus giganteus* has been stably introduced into three pearl millet genotypes. The insertion and expression of the gene were analyzed over two generations using molecular methods.

An increase in resistance of up to 90% against infection with *P. substriata* in comparison to wildtype plants has been shown in an *in vitro* infection assay of detached leaves of T₁ and T₂ progeny of plants expressing the *afp*-gene.