



**RICE CRC**

**FINAL RESEARCH REPORT**

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<b>Title of Project :</b>	<b>Improved protocols for isolated microspore culture of rice. Application of molecular approaches to rice improvement</b>
<b>Project Reference number :</b>	<b>3301</b>
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## SUMMARY

*A summary of this work is provided. The remainder of the original report has been withheld from publication as the information contained therein should be regarded as “commercial in confidence”.*

The main objectives of this project were (a) to develop a microspore culture based rapid breeding system (b) to understand the genetic basis of cold tolerance and (c) achieve genetic improvements in the cold tolerance of Australian rice germplasm.

Thanks to the establishment of a special linkage with researchers in the Peoples Republic of China, some excellent cold tolerant germplasm was introduced into Australia. The cold tolerance of this germplasm has been confirmed by cold treatments under glasshouse conditions. This germplasm was then provided to several breeding, genetic, and physiological research groups within the CRC. Crossing has also been carried out between this germplasm and elite Australian cultivars in order to deliver doubled haploid plants for cold tolerance breeding and genetic research.

Doubled haploid (DH) plant production is a way of rapidly fixing genetic segregation in the early generations of a crossing program, thereby reducing the number of years required for the establishment of pure breeding lines. Typically, DH plants of rice are normally produced by anther culture. As a result of this procedure, we have released over one hundred DH plants from a cross between the cold tolerant American cultivar M103 and the cold sensitive Australian cultivar Doongara. However, anther culture is a low efficiency system in that it is difficult to produce large numbers of DH plants. Microspore culture, on the other hand, is a highly efficient system which isolates young pollen from anthers, and gives rise to large numbers of DH plants in crops such as canola and barley. Microspore culture has also been reported in rice; however its efficiency of production has left much to be desired, especially with respect to cultivar response.

In our work, which commenced in 1997, significant improvements have been made to the procedure for rice microspore culture; in fact most of the Australian cultivars have been successfully cultured. An efficient and reliable microspore culture protocol for the production of double haploid plants is close to completion. In the year 2005, doubled haploid plants production has shifted completely from anther culture to isolated microspore culture. Production of doubled haploid plants from crosses made between elite Australian cultivars with Chinese cold tolerant germplasm is underway using this new and improved technology.

Another achievement has been the successful culture of young rice panicle for controlled experiments on cold tolerance. A procedure has been developed which allows researchers to culture very young panicles and/or florets. This culture system has been used in both molecular and physiological studies of cold tolerance in rice.

Identification of genes for cold tolerance using molecular approaches was carried out in collaboration with colleagues at Plant Industry, CSIRO, Canberra. Several chromosomes have been identified by molecular mapping to carry important genetic factors for cold tolerance. Investigation of cold tolerance by microarrays has also revealed the genes involved in cold tolerance. These findings, in turn, will lead to the development of specific molecular markers for cold tolerance in breeding programs.

### Acknowledgements

Master students: Ms. Xiaobo Lu (rice anther culture) and Mr. Rajneesh Verma (microsatellite mapping of cold tolerance)