ICRISAT
Science with a human face

SATrends
ICRISAT's monthly e-newsletter

SATrends Issue 62 **January 2006**

DREB1A holds water, helps overcome drought

The semi-arid tropics (SAT) are prone to hot summers and erratic rainfall. In such regions, abiotic stresses such as drought, low temperature and high salinity, are environmental factors that dramatically limit plant growth and crop productivity. Drought is the chief factor for yield loss in the SAT

The DREB1A gene added additional drought resistance to the groundnut plants in the right.

Improving the realizable yields of crops under water deficit conditions is perhaps the only option. The genetic improvement of drought tolerance is probably the most rewarding approach. However, progress in developing genotypes with enhanced tolerance to abiotic stresses, particularly drought, has been very slow.

Plant adaptation to stress is a phenomenon linked to multiple genes. Several genes belonging to both structural/functional and regulatory gene categories have been identified and are effective in providing a stress-tolerant response using the transgenic approach.

At ICRISAT, efficient transformation protocols have been developed for important legumes such as groundnut, chickpea and pigeonpea. Drought responsive element of *Arabidopsis thaliana* encoded by DREB1A cDNA was used to develop transgenic groundnut. This activity is a collaborative effort between ICRISAT and Japan International Research Center for Agricultural Sciences (JIRCAS), Japan.

By using *Agrobacterium*-mediated genetic transformation, a large number of independently transformed events of transgenic groundnut variety JL 24 were produced. Five transgenic events have been selected for the response of transpiration to progressive soil drying. This protocol is now being used by other CGIAR centers to evaluate the effect of DREB1A gene in other crops such as rice, wheat, and chickpea.

Results obtained from the five selected events are very promising for several reasons:

1. Most transgenic events reduce their transpiration upon drought imposition in dryer soils than JL 24.
2. Transpiration efficiency (TE) of most transgenic events is higher than JL 24 under well-watered conditions and it seems to correlate with a different stomatal behavior.
3. TE of one of the events was circa 50% higher than JL 24 under water stress.
4. Unlike previous studies on TE, no significant correlation was observed between TE and carbon discrimination ratio. This lack of correlation could reveal a unique type of stomatal behavior in the DREB1A groundnut, which might help in improving water use. For the first time, the DREB1A transgenics enable us to test hypotheses related to the physiology of TE by using material that can be considered as isogenic to the groundnut variety JL 24.

The DREB1A transgenic groundnuts, therefore, provide new opportunities for exploring the physiological basis of intermittent drought tolerance by plants, and identifying the genes responsible for high TE.

For further information, contact k.Sharma@cgiar.org or v.vadez@cgiar.org