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Molecular responses to water deficit in two soybean contrasting genotypes: a role for specific control mechanisms of protein synthesis during drought stress

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Water is usually the main limiting factor of soybean growth and productivity in Uruguay. Genetic improvement for drought resistance is an attractive but rather a complex goal in soybean breeding programs. Canopy wilting is the first visible symptom of stress caused by water deficit in soybean. Several plant introductions exhibiting slow wilting trait under drought conditions, have been discovered and used in soybean breeding programs. Yet, the current understanding of the mechanisms involved in this trait, is poor. In this study, we analyzed the molecular and physiological responses of two soybean genotypes showing contrasting phenotypes under water deficit conditions. One of the cultivar (N7001) is a stabilized offspring of a cross between a cultivar and the slow wilting PI 416937, whereas the other cultivar used in this study (TJS2049), is considered to be highly susceptible to water deficit.

In order to identify novel components involved in the molecular mechanisms underlying water-stress responses, suppression subtractive hybridization was employed to construct a cDNA library enriched in drought induced genes from the N7001 cultivar. The clones obtained from the forward subtracted library were sequenced and the expression level of the corresponding genes was analyzed in both N7001 and TJS2049 genotypes, using reverse Northern dot blots.

One of the genes exhibiting a marked differential expression profile between the two genotypes in response to dehydration, encoded a eukaryotic translation initiation factor. By ectopically expressing this gene in Arabidopsis, we provide the first experimental evidence showing a direct involvement of a translation initiation factor of this class in abiotic stress tolerance. Our results suggest that the control of protein synthesis during stress can be a central mechanism involved in drought tolerance. Furthermore, the results provide an insight into the mechanisms employed by the two contrasting cultivars, to deal with water deficit.