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Poster Presentation

Expression of trehalose-6-phosphate synthase gene from *Arabidopsis thaliana* in transgenic tobacco: a strategy to increase temperature stress tolerance

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Background

Genetic engineering of plants towards osmoprotectant accumulation is gaining increased importance within the broad context of abiotic stress tolerance [1]. An enzyme, trehalose-6-phosphate synthase, is believed to play a key role in the synthesis of the disaccharide trehalose and hence on the improvement of abiotic stress tolerance [2]. We used *Agrobacterium* to transform tobacco plants to express the trehalose-6-phosphate synthase gene from *Arabidopsis thaliana*, under the control of CaMV 35S promoter and using the vector pGreen 0229 [3]. Transgenic T2 plants were evaluated for gene expression by northern and western blots. Seeds were sown in media germinated at: 15, 25 and 35°C for evaluating germination rates under high and low temperatures.

Results

Three of the transgenic lines obtained (B5A, B5H and B1F) have distinct levels of gene expression: B5H and B5A are high expressing lines while B1F is a low expressing one. In non-transgenic controls no expression was detected (Figure 1).

Transgenic lines were shown to have significantly higher germination rates under low and high temperatures (respectively, 15 and 35°C) than wild type plants (Table 1).

Conclusion

Our results demonstrate that transgenic plants accumulating trehalose-6-phosphate synthase have an altered phenotype that includes temperature stress tolerance upon germination. We suggest that AtTPS1 can be used to engi-

Table 1: Germination rates (Number of seeds germinated per 100 seeds placed on germination medium) of three transgenic lines at three different temperatures.

Temperature	WT	B5A	B5H	B1F
24°C	99.0[a](1.0)	99.0[a](1.50)	99.0[a](2.00)	100.0[a](0.00)
15°C	32.3[a](4.1)	95.0[b](3.97)	97.4[b](2.95)	97.0[b](2.80)
35°C	18.0[a](3.8)	88.0[b](7.9)	85.2[b](6.35)	83.2[b](5.9)

[a, b]Percentages with different superscripts indicate statistical significance ($p < 0.05$); Standard deviations are shown between parenthesis; WT – Wild Type plants; B5A, B5H and B1F – Transgenic lines

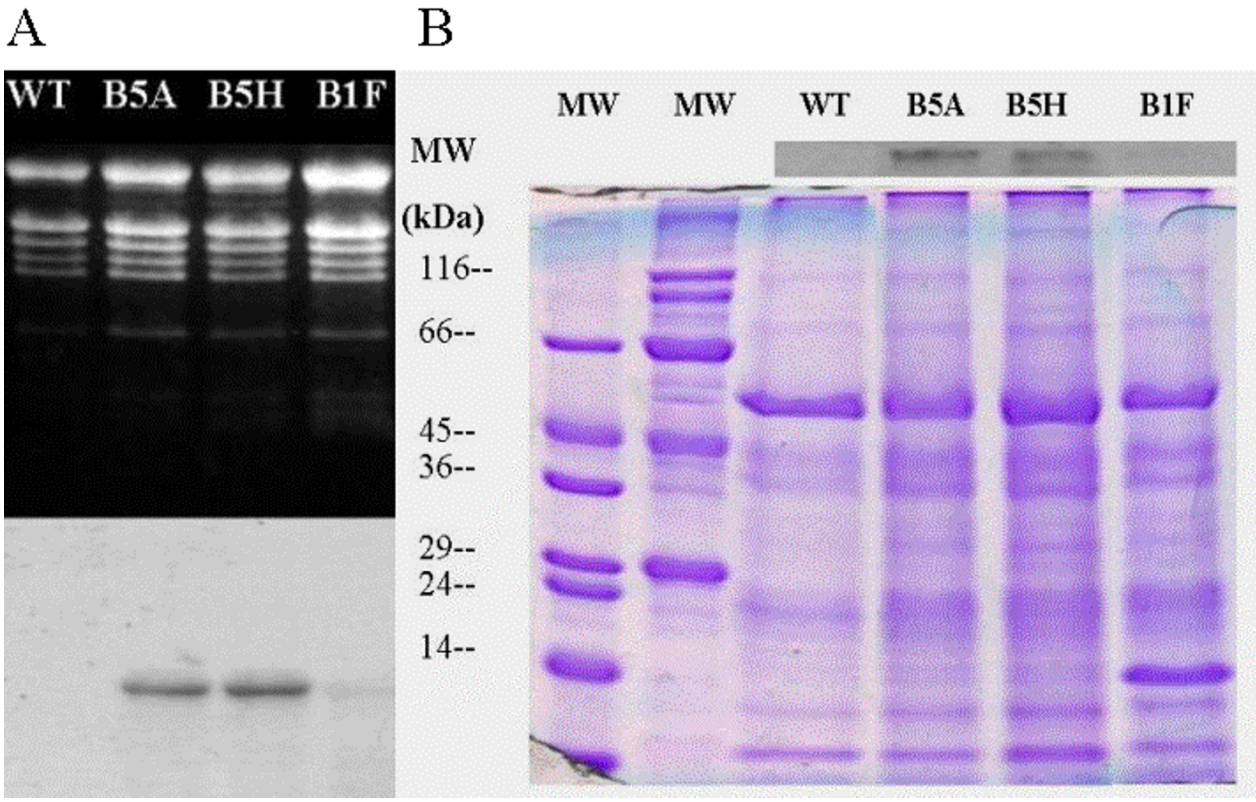

Figure 1
AtTPS1 gene expression analysis in WT and transgenic tobacco lines. A – Northern blot B – Western blot. In both cases, no AtTPS1 protein production was detected in control wild type plants while transgenic lines showed accumulation of AtTPS1 transcripts and enzyme. **WT** – Wild Type; **B5A**, **B5H** and **B1F** – Transgenic line. MW – Molecular weight markers (kDa).

neer important crop plants such as maize, wheat or rice to withstand different environmental stresses.

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References
1. Nuccio ML, Rhodes D, Mcneil SD, Hanson AD: **Metabolic engineering of plants for osmotic stress resistance.** *Curr Opin Plant Biol* 1999, **2:**128-134.
2. Romero C, Bellés JM, Vayá JL, Serrano R, Culiañez-Maciá FA: **Expression of the yeast trehalose-6-phosphate synthase gene in transgenic tobacco plants: pleiotropic phenotypes include drought tolerance.** *Planta* 1997, **201:**293-297.
3. Almeida AM, Villalobos E, Araújo SS, Leyman B, van Dijck P, Cardoso LA, Fevereiro PS, Torné JM, Santos DM: **Transformation of tobacco with an *Arabidopsis thaliana* gene involved in trehalose biosynthesis increases tolerance to several abiotic stresses.** *Euphytica* 2005, **146:**165-176.