Annual Report on *Making peanut significantly more drought- and salt-tolerant*
(a TPPB sponsored project for 2008)

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Summary:

The goal of this project is to create transgenic peanut plants that will use water more efficiently and increase peanut production in the semi-arid land of West Texas. We proposed to introduce the Arabidopsis gene *AVP1* into peanut, because previous works in our collaborator's laboratory and ours had shown that overexpression of *AVP1* could significantly improved drought- and salt-tolerance in Arabidopsis, tomato, and cotton plants. With the support from Texas Peanut Producers Board, we used Agrobacterium-mediated transformation method and obtained 37 putative transgenic peanut plants (Fig. 1). Since the procedure that we used could generate some false positives (~50%), we expect to get about 20 transgnic peanut plants that would express *AVP1*. Our preliminary PCR experiments with the first group of 10 putative transgenic plants indicate that indeed about half of them contain *AVP1* transgene (6 lines tested positive and 4 lines negative in generating *AVP1* fragment in PCR experiment). We will continue to analyze the rest of our putative transgenic plants and conduct RNA blot experiment to confirm the positive ones. We will start to analyze the *AVP1*-expressing peanut plants under drought and salt conditions after we obtain the seeds from the first generation of the transgenic plants in the second year.

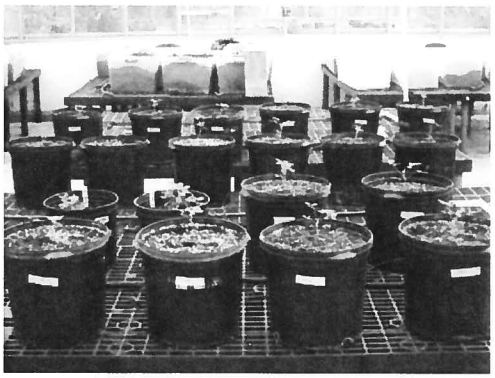

Fig. 1. First generation of putative transgenic peanut plants obtained from Agrobacterium-mediated transformation.

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Goal of the project

The yield and flavor of peanut are drastically affected by environmental stresses such as drought, heat, and salt in the arid and semi-arid regions of US. Therefore, developing peanut cultivars with improved resistance to abiotic stress is critical for maintaining the viability of US peanut production. The proposed research addresses the goal of National Peanut Board to increase peanut yield and to make peanut production profitable in water-limited areas. Our overall goal is to create peanut that can use water more efficiently and increase peanut production in the arid and semi-arid areas of US Southwest.

Progress reort

We initially generated 34 putative transgenic peanut plants from tissue culture, but we found that only half of them contained the *AVP1* transgene by PCR analysis. Our RNA blot analysis indicated that *AVP1* is expressed in all *AVP1*-containing plants. We then tested if *AVP1*-expressing plants are more salt tolerant by conducting salt stress experiment. After 125 mM NaCl treatment for 20 days, transgenic plants were visually larger and greener than wild-type plants. The leaf chlorophyll content in the *AVP1*-expressing plants were much higher than that in wild-type plants. We measured the photosynthetic performance of wild-type and *AVP1*-expressing peanut plants under both normal and salt conditions. There were no differences in photosynthetic performance between wild-type and *AVP1*-expressing plants under normal conditions. However, under 125 mM NaCl treatment, *AVP1*-expressing peanut demonstrated significantly higher photosynthetic rates, stomatal conductance, and transpiration than wild-type plants did. To study how *AVP1*-expressing peanut plants would perform in field conditions, we analyzed the yields of *AVP1*-expressing peanut plants that were grown in the Experimental Farm of USDA-ARS in Lubbock, Texas in 2010. These plants were grown as in dryland conditions, only watered when no rain conditions occurred for >7 days consecutively. The *AVP1*-expressing peanut plants out performed wild-type plants and non-transgenic plants (that came from tissue culture) by producing at least 25% more seeds.