

# **Exploring the Mechanism of Soybean Oil Deposition and Increasing Soybean Oil Content through Genetic Engineering**

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## **IMBA Project 2007-5**

Project Period: 1/1/07-12/31/08

**Progress Report** (covering period of 1/1/08-12/31/08)

### **a. Executive Summary**

Since soybean is a major oil seed crop and a major source of oil for biodiesel, increasing the oil content could be a desirable goal. Previous work with Arabidopsis pointed to the FUS3 transcription factor as a target gene for increasing the oil content of seed. The gene was cloned from both Arabidopsis and soybean and has been inserted into soybean by particle bombardment in a construct under the control of the seed specific lectin promoter. Most of the lines carrying the Arabidopsis gene were difficult to regenerate into plants and were then often infertile indicating that expression might be detrimental to seed development. Plants are just now being regenerated that should contain the soybean FUS3 gene. Future work will utilize other genes that appear to be good targets for increasing oil biosynthesis.

### **b. Research activities and progress for the past year**

We have bombarded embryogenic cultures of the soybean cv. Jack with constructs containing the Arabidopsis FUS3 gene (AtFUS3) and the soybean FUS3 gene (GmFUS3) both driven by the seed-specific lectin promoter and have selected transformed lines using the antibiotic hygromycin since the constructs also contained the hygromycin phosphotransferase selectable marker gene. In the case of AtFUS3, 19 lines were selected but only nine regenerated plants and only three of these set more than one seed. This poor regeneration and seed set may indicate that high expression of this transcription factor in somatic embryos and in developing seed might be detrimental to normal development.

Cultures has also been bombarded with the GmFUS3 construct and four lines selected so far. One line regenerated plants that are hygromycin resistant and two are now regenerating and one is still in selection.

A graduate student who cloned the genes, made the constructs, and did studies with Arabidopsis, Hongyun Wang, finished his Ph.D. on December 3, 2008. he expects to take a job on Feb. 1, 2009. The title of his thesis is "Developmental Regulation of Oil Deposition in Arabidopsis Seeds". As part of this thesis, Hongyun made a model for seed oil biosynthesis that implicated some transcription factors as possible targets to increase oil.

### **c. Preliminary/interesting finds**

It appears that FUS3 gene expression is detrimental to seed development, but we need to determine if indeed expression is occurring in these lines.

**d. Work planned for the coming year**

While this project will officially end on June 30, 2009 and the funds are essentially depleted, we will continue to generate FUS3 transformed soybean and will determine if FUS3 expression affects the oil levels of seeds. We will also generate constructs with other genes that would appear to be important from the modeling results of Hongyun Wang and the microarray results of Lila Vodkin.

**e. Equipment purchase**

None

**f. Publications**

Wang, H., J. Guo, K.N. Lambert and Y. Lin (2007) Developmental control of Arabidopsis seed oil biosynthesis. *Planta* 226:773-783.

Wang, H., Ph.D. thesis, Developmental regulation of oil deposition in Arabidopsis seeds, University of Illinois, 2008.