

**USDA-ARS/
U.S. Wheat and Barley Scab Initiative
FY05 Final Performance Report (approx. May 05 – April 06)
July 14, 2006**

Cover Page

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| Fiscal Year: | 2005 |
| FY05 ARS Agreement ID: | NA |
| Agreement Title: | Tissue-Specific Overexpression of Antifungal Lemma Thionin Genes in Barley. |
| FY05 ARS Award Amount: | \$ 35,421 |

USWBSI Individual Project(s)

| USWBSI Research Area* | Project Title | ARS Adjusted Award Amount |
|------------------------------|-----------------------------------------------------------------------------|----------------------------------|
| BIO | Tissue-Specific Overexpression of Antifungal Lemma Thionin Genes in Barley. | \$ 35,421 |
| | Total Award Amount | \$ 35,421 |

Principal Investigator

Date

* BIO – Biotechnology
CBC – Chemical & Biological Control
EDM – Epidemiology & Disease Management
FSTU – Food Safety, Toxicology, & Utilization
GIE – Germplasm Introduction & Enhancement
VDUN – Variety Development & Uniform Nurseries

Project 1: *Tissue-Specific Overexpression of Antifungal Lemma Thionin Genes in Barley.***1. What major problem or issue is being resolved and how are you resolving it?**

There are no known barley lines with biochemical resistance to *Fusarium*. Thus, it may be necessary to introduce resistance through genetic transformation. Many technical obstacles must be overcome before stable pathogen-resistant transgenic cereals can be introduced into the field. It is necessary to learn the requirements for strong re-directed expression of endogenous antifungal genes in specific tissues. Antifungal proteins must be expressed in the most appropriate tissue and subcellular compartment to avoid placing a metabolic burden on the plant and to minimize pressures which select for resistant pathogen strains. The long-range goal is to produce an antifungal gene/targeting vector that can be used in both barley and wheat.

2. List the most important accomplishment and its impact (how is it being used?).

Complete all three sections (repeat sections for each major accomplishment):

Accomplishment: Barley was transformed with lemma vacuolar thionin behind a lemma-specific promoter using the Agrobacterium system.

Impact: The knowledge of the use of lemma-specific promoters will lead to targeted expression of anti-*Fusarium* genes. When transformants mature and are analyzed, the vectors will be available to other labs for transformation projects. Results to date will be presented at the 8th Internatl. Congress of Plant Molecular Biology.

As a result of that accomplishment, what does your particular clientele, the scientific community, and agriculture as a whole have now that they didn't have before?:

The Community now has the knowledge that 1) lemmas have several classes of thionin genes, and the putative vacuolar form is toxic to *F. graminearum* and that 2) a binary vector, modified to express lemma thionin, hygromycin resistance and gfp can be used as a highly selective Agrobacterium-mediated transformation vector.

Include below a list of the publications, presentations, peer-reviewed articles, and non-peer reviewed articles written about your work that resulted from all of the projects included in the grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

Federico ML, LI-L Federico, RW Skadsen, HF Kaeppler. 2006. Spatial and temporal divergence of expression in duplicated barley germin-like protein-encoding genes. *Genetics* (published ahead of print in June issue).

Carlson A, R Skadsen, HF Kaeppler. 2006. Barley hordothionin accumulates in transgenic oat seeds and purified protein retains antifungal properties *in vitro*. *In Vitro Cellular and Developmental Biology - Plant* (in press)

Skadsen RW, ML Federico, T Abebe, M Patel. 2005. Fighting *Fusarium* head blight of barley with members of the thionin gene family. *Proc 39th Ann Conf on Gene Families and Isozymes*. p. 26. log # 0000188138

Federico ML, FL Iniguez-Luy, RW Skadsen, HF Kaeppler. 2006. Spatial and temporal divergence of expression in duplicate barley GLP-encoding genes. *Proc of 14th Ann Plant and Animal Genome Conf*. p. 334. log # 0000188134

Federico M, T Abebe, S Puthigae, H Kaeppler, RW Skadsen. 2005. Barley promoters for organs susceptible to *Fusarium graminearum*. *Proc Am Soc Plant Biologists, Ann Mtg*. Paper no. 1105-311. log # 0000188163