USDA-ARS / USWBSI
FY03 Final Performance Report (approx. May 03 – April 04)
July 15, 2004

Cover Page

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Year:	**FY2003 (approx. May 03 – April 04)**
FY03 ARS Agreement ID:	**58-5430-2-327**
FY03 ARS Agreement Title:	**Diversity of American, Asian and Australian populations of Gibberella zeae.**
FY03 ARS Award Amount:	**$ 42,900**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EDM	Diversity of American, Asian and Australian populations of Gibberella zeae.	$ 42900
	Total Amount Recommended	**$ 42,900**

20 July 2004
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: ***Diversity of American, Asian and Australian populations of Gibberella zeae.***

1. What major problem or issue is being resolved and how are you resolving it?

The major issue being addressed is the genetic homogeneity of *Fusarium graminearum* strains both within the United States and in other agriculturally important portions of the world. We have been using presumably neutral genetic markers, Amplified Fragment Length Polymorphisms or AFLPs, anchored in our genetic map, to measure genetic diversity within populations and to determine if the diversity is uniformly distributed or whether populations in some areas are significantly different from one another. The major focus this year has been on a relatively large study from North America. To deal with the populations in a meaningful manner and to be certain we have identified rarer genotypes, we must collect, purify and analyze relatively large numbers of isolates (at least hundreds per total population). We also have been examining populations from Mexico and South America, where a great deal of germplasm exchange occurs, to determine if wheat planted in these regions is attacked by populations of *G. zeae* that are similar to those found in the United States. Samples from Korea are now being included as well because of the threat that isolates from Asia, or South America and Mexico, might pose to US farmers if global populations are not comparable. A proposal to split *G. zeae* into nine different species has recently been made. Data from the populations we are analyzing and the approach we are taking (AFLPs cover the breadth of the genome rather than being limited to a relatively few genes that are examined in detail) and tests of sexual cross-fertility provide independent tests of the multiple species hypothesis. The difference in pathogenicity of representative isolates also will be examined to determine if the groups identified based on molecular sequence differences also differ in pathogenicity.

2. What were the most significant accomplishments?

We previously published that *G. zeae* populations from the Central United States are very closely related to each other, that extensive gene flow occurs between these populations, and that the genetic diversity in the pathogen inoculum differs little, if any, across fairly large distances or over several years of time. This year we published an extension of this analysis to a much larger set of strains from eight locations from Montana to Virginia. Again there was evidence for extensive gene flow and no evidence for linkage disequilibrium, but in this study there was a correlation between physical and genetic distances that might be useable to estimate the time it takes for differences in allele frequencies (and therefore for differences in pathogenicity) to diffuse across the country. The differences between populations were small, and required a relatively large number (30) of polymorphic genotypes to be detectable. We also found that our AFLP markers cannot distinguish between the two DON chemotypes reported by others. Analyses of populations from outside the United States have now become our focus, with a set of isolates from near CIMMYT in Mexico being the best analyzed thus far. These populations are genetically distinct from and more clonal than those in the United States. The populations from Uruguay and Southern Brazil are closely related to, but distinct enough from those found in the United States that a different set of markers is needed to evaluate variation within them. Korean populations are more diverse than those from either North or South America and contain putative hybrids between strains different lineages (now species) of *G. zeae*.

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 your grant. Please reference each item using an accepted journal format. If you need more space, continue the list on the next page.

1. Bowden, R. L., J. E. Jurgenson, J.-K. Lee, Y.-W. Lee, S. H. Hun, K. A. Zeller & J. F. Leslie. 2004. A second generation genetic map of *Gibberella zeae*. *Proceedings of the 15th International Plant Protection Congress*: 355.

2. Cumagun, C. J. R., R. L. Bowden, J. E. Jurgenson, J. F. Leslie & T. Miedaner. 2004. Genetic mapping of pathogenicity and aggressiveness of *Gibberella zeae* (*Fusarium graminearum*) towards wheat. *Phytopathology* **94:** 520-526.

3. Leslie, J. F. 2004. Genetics of *Gibberella zeae*. *Proceedings of the 15th International Plant Protection Congress*: 353.

4. Summerell, B. A., & J. F. Leslie. 2004. Genetic diversity and population structure of plant pathogenic species in the genus *Fusarium*. In: *Plant Microbiology* (M. Gillings & A. Holmes, eds.), pp. 207-223. Bios, Oxford, United Kingdom. 290 pp.

5. Summerell, B. A., B. Salleh & J. F. Leslie. 2003. A utilitarian approach to *Fusarium* identification. *Plant Disease* **87:** 117-128.

6. Zeller, K. A., R. L. Bowden & J. F. Leslie. 2004. Population differentiation and recombination in wheat scab populations of *Gibberella zeae* in the United States. *Molecular Ecology* **13:** 563-571.

7. Zeller, K. A., J. I. Vargas, R. L. Bowden, L. Gilchrist, and J. F. Leslie. 2003. Population structure of *Gibberella zeae* (*Fusarium graminearum*) causing Fusarium Head Blight of wheat in Mexico. *Proc. 2003 Natl. Fusarium Head Blight Forum*: 185.