USDA-ARS / USWBSI
FY04 Final Performance Report
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Cover Page

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Year:	**FY2004** (approx. May 04 – April 05)
FY04 ARS Agreement ID:	**58-5430-2-327**
FY04 ARS Agreement Title:	**Diversity of American, Asian and Australian Populations of *Gibberella zeae*.**
FY04 ARS Award Amount:	**$ 53,610**

USWBSI Individual Project(s)

USWBSI Research Area*	Project Title	ARS Adjusted Award Amount
EDM	Diversity of American, Asian and Australian Populations of *Gibberella zeae*.	$ 53,610
	Total ARS Award Amount	**$ 53,610**

15 July 2005
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

(Form – FPR04)

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?

Fusarium graminearum is a diverse species in which a series of phylogenetic lineages have been identified. We are determining the global distribution of these lineages and evaluating them for differences in pathogenicity, fertility, anonymous nuclear markers (AFLPs), and DNA sequences of phylogenetically useful genes. Acceptance of the proposed species status for the various phylogenetic lineages has the potential to raise non-tariff trade barriers and to suggest that significant biological differences are present when perhaps none are. We have used sexual crosses to define species within *Fusarium* and are applying these concepts to *F. graminearum*. If significant gene flow can occur, then the population within which the gene flow is occurring should be considered a single species. The degree of gene flow also is important in determining whether the genes in a foreign strain type are likely to be incorporated into the existing population via recombination or whether an introduced strain must outcompete all of the other strains in the existing population to become established.

Lineage differences may be correlated with differences in pathogenicity. Such differences mean that local differences in the fungal population could affect the efficacy of screening efforts. In the northern United States we have shown that the *F. graminearum* populations appear to be essentially panmictic and that differences in host reactions are due to factors other than variation in the pathogen population. At locations outside the United States the situation is less clear. This year we have focused on strains near CIMMYT since diverse wheat germplasm is grown and screened there for scab resistance. If the *F. graminearum* population near CIMMYT is not comparable to that found in the United States then host resistance identified at CIMMYT might not be functional in the United States.

2. What were the most significant accomplishments?

We used three "heterothallic" strains from lineage 7 constructed in the lab of Dr. Yin-Won Lee, our Korean collaborator, to evaluate the cross fertility of strains from different lineages. The "heterothallic" strains can serve as the female parent in a cross but are not self-fertile, as are most field strains of *F. graminearum*. We made crosses using a fixed number of conidia to fertilize the "heterothallic" strains and then quantitatively measured the number of spores produced. We found that strains from all nine lineages were cross-fertile with one and often all three of the "heterothallic" strains. Fertility was not sensitive to the lineage of origin, but the relative fertility of the "heterothallic" strains did depend on the strain (but not the lineage) used as the fertilizing parent. These results are consistent with the hypothesis that *F. graminearum* is a single species that contains genetic diversity reflective of its global distribution, and that the nine phylogenetic lineages should not be accorded species status.

Strains collected near CIMMYT are almost all lineage 3 (lineage 7 dominates in the United States). The lineage 3 strains are somewhat less fertile and probably produce fewer ascospores under field conditions, suggesting that they may have additional means of entering the plant other than through the germination of ascospores. Some of these Mexican strains also have a second copy of the β-tubulin gene that can be amplified with some of the primers used to distinguish the phylogenetic lineages. This co-amplification makes strain identification that relies on this gene more difficult. Differences in screening trials at CIMMYT and in the United States may be due to differences in the *F. graminearum* populations to which they are exposed.

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 you 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. Bowden, R. L., J. F. Leslie, J. E. Jurgenson & J. Lee. 2004. Genetic mapping in *Gibberella zeae*. *Proceedings of the 2nd International Symposium on Fusarium Head Blight (Orlando, Florida)*. p. 555-556.

3. Bowden, R. L., J. F. Leslie, J. Lee & Y.-W. Lee. 2004. Cross fertility of *Gibberella zeae*. *Proceedings of the 2nd International Symposium on Fusarium Head Blight (Orlando, Florida)*. p. 554.

4. 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.

5. Lee, J., J. E. Jurgenson, J. F. Leslie & R. L. Bowden. 2004. The alignment between physical and genetic maps of *Gibberella zeae*. *Proceedings of the 2nd International Symposium on Fusarium Head Blight (Orlando, Florida)*. p. 569.

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

7. Leslie, J. F., K. A. Zeller, A. Logrieco, G. Mulè, A. Moretti & A. Ritieni. 2004. Species diversity and toxin production by strains in the *Gibberella fujikuroi* species complex isolated from native prairie grasses in Kansas. *Applied and Environmental Microbiology* **70:** 2254-2262.

8. Smith, J. S., J. Fotso, J. F. Leslie, X. Wu, D. van der Velde & R. A. Thakur. 2004. Characterization of bostrycoidin: an analytical analog of zearalenone. *Journal of Food Science* **69:** 227-232.

9. Summerell, B. A., and 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.

10. 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.