

2008 Annual Report

USDA Agricultural Research Service
The Western Regional Plant Introduction Station (WRPIS)
59 Johnson Hall, Washington State University
Pullman, WA

Phone: (509) 335-3683 Fax: (509) 335-6654

Email: Jinguo.Hu@ars.usda.gov



Lettuce seed increase on the WRPIS Pullman farm

June 2009

Table of Contents

EXECUTIVE SUMMARY AND HIGHLIGHTS	2
REPORT.....	4
ADMINISTRATION	4
Personnel.....	4
Research Project.....	4
Funding.....	5
Facilities.....	5
GERMPLASM MANAGEMENT.....	5
Germplasm Acquisition.....	6
Germplasm conservation.....	7
Germplasm evaluation and characterization.....	8
Germplasm distribution.....	9
MISSION-RELATED RESEARCH.....	9
Agronomy.....	9
Entomology.....	10
Genetics.....	11
Plant Pathology.....	11
COMMITTEES, PRESENTATIONS AND RECOGNITIONS.....	11
PUBLICATIONS.....	12
Appendix 1: WRPIS Staffing List as of December, 2008.....	14
Appendix 2: Scientific and Service Activities.....	15

EXECUTIVE SUMMARY AND HIGHLIGHTS

Most US agricultural crops did not originate from the US or North America. Thus, introduced germplasm resources are critical for providing desirable traits and genes to sustain and improve crop productivity for food, fuel, fiber and other industrial uses. The Western Regional Plant Introduction Station (WRPIS) is recognized as one of the most extensive and well-established genetic resource management projects in the United States. Activities at WRPIS focus on collecting, preserving, evaluating, documenting and distributing plant species assigned to the station and conducting research related to its primary mission. This station includes 10 SY in six service programs (five curatorial and one DNA marker lab) and four research programs (agronomy, entomology, plant pathology and genetics). There are two CRIS projects managed through the Pullman Station; the Plant Germplasm Introduction and Testing Research Unit at Pullman, WA, and the National Temperate Forage Legume Genetic Resources Unit at Prosser, WA. These two sites provide different environmental conditions amenable to the production of high quality seeds of a wide and diverse array of plant germplasm. We achieve our goals through close collaboration among sites and scientists in various disciplines such as agronomy, horticulture, plant pathology, entomology, genetics, plant physiology and botany. As part of a Regional Research Project (W-6), we work in close association and collaboration with scientists of the State Agricultural Experiment Station, scientists from other state and federal agencies as well as scientists in the private sector. Collaborative projects also exist with scientists at international centers, foreign institutes, foreign national programs and foreign companies.

In 2008, we continued to provide useful germplasm and information for the crop plant research community, and our research programs generated relevant and high-impact results:

- The total number of WRPIS accessions exceeded 80,000 in 2008. As of May 29, 2009, there were 80,914 accessions comprising 797 genera, 3,642 species (3,970 taxa) in the WRPIS collection. This includes 9,501 accessions of horticultural crops, 20,175 accessions of cool season legumes, 14,696 accessions of beans, 12,604 accessions of temperate legume forage, 22,810 accessions of grasses and 1,128 accessions of native plant species recently obtained through cooperative BLM projects.
- We acquired 1,136 new inventories including 253 native plant accessions, 134 from the 2001 Russian Federation collection trip, 99 *Poa pratensis* from Germany and 94 Chinese *Vicia faba* accessions from Australia.
- We regenerated/increased seeds of 1,152 inventories from a broad range of plant species. A total of 852 inventories were sent to NCGRP at Fort Collins, Colorado and 2,343 inventories sent to the Svalbard Global Seed Vault, Longyearbyen, Svalbard via NCGRP for secured backup.
- We continued evaluation/characterization data entry to the GRIN database: A total of 44,600 observation data points for 161 descriptors of 21 crops on 5,457 accessions. Two percent of the data came from cooperators and the other ninety-eight per cent came from personnel at our station.

- We distributed a record high of 28,592 seed packets representing 17,740 accessions in 983 seed orders from 730 researchers. Among them, 17,433 (61%) packets were sent to addresses in the USA and 11,159 (39%) packets to foreign countries. The most requested plant group is grasses (9,842), followed by beans, peas and alfalfa, clover, safflower and Cicer, each with between 1,000 to 3,000 packets.
- We developed seed transfer zones to guide future revegetation in the Blue Mountains of Washington and Oregon with Mountain Brome grass, an important native species.
- We completed a three-year, USAID funded research project with the International Crops Research Institute for the Semi-Arid Tropics (ICRIST)-India that identified insect-resistant chickpea germplasm and developed a recombinant inbred line population for expanded evaluation throughout India by ICRIST.
- We demonstrated, for the first time, biological control of *Ascochyta* blight of chickpea in the field in collaboration with researchers in the Department of Plant Pathology, WSU and USDA-ARS Grain Legume Genetics, Pullman, WA.
- We discovered that potyvirus is infesting some *Lupinus* species in the germplasm collection and published the first report of Bean Yellow Mosaic Virus on lupine in WA, in collaboration with an ARS plant virologist.
- We assessed the genetic diversity and relationship among 29 *Brachypodium* accessions maintained in Pullman by using AFLP and TRAP markers.
- During 2008 WRPIS scientists and curators made over 30 oral or poster presentations at either scientific or general public meetings, contributed three book chapters and published 20 peer reviewed scientific journal papers.

REPORT

ADMINISTRATION

Ralph Cavalieri (Administrative Advisor)

Ann Marie Thro (CSREES Representative)

Michael Fitzner (CSREES Representative)

Peter Bretting (ARS National Program Staff)

Andrew Hammond (ARS, PWA Area Director)

Dan Skinner (Acting Research Leader, from January 1 to March 30, 2008)

Jinguo Hu (Research Leader, from March 31, 2008)

Jannis Bacani (Program Support Assistant)

Personnel

Dr. Dan Skinner (Research Leader of the ARS Wheat Genetics, Quality, Physiology and Disease Research Unit at Pullman, WA) served as station RL until Dr. Jinguo Hu came on board at the end of March, 2008. Dr. Hu obtained his Ph. D. from University of California at Davis and conducted research in rice, Brassica species, and tomato before joining USDA-ARS in the Sunflower Research Unit in Fargo, ND, where he developed an internationally-recognized program in research of applying molecular markers to sunflower germplasm enhancement. The Research Leader position was converted from Category 4 into a Category 1 position, meaning that the RL now has the same level of research responsibility as other research scientists in the ARS system. The ARS PWA Area Office has secured and allocated funds to hire a postdoctoral research associate to support the RL's research program. The recruitment is in process.

The personnel in WRPIS was stable during 2008 with no changes in the research and curatorial staff except for the addition of Dr. Hu. During 2008 there were 34 full-time federal and state employees in the station. A list of the current WRPIS staff is provided as Appendix 1. Among them, six were funded by the multistate W006 project, two were supported by grants and the rest were either permanent or temporary federal employees. One technician left the National Temperate Forage Legume Genetic Resources Unit in Prosser WA in 2007 and the vacancy was filled in 2008. Due to the labor-intensive nature of our operation we hired 43 part time helpers (mostly WSU students) for field, greenhouse and laboratory activities throughout the year.

Research Project

The renewal of the W-6 project was delayed for a year due to vacancy of the research leader position in 2007. Dr. Hu led the development of the current W006 Project entitled "Plant Genetic Resource Management, Preservation, Characterization and Utilization." The draft was sent to TAC for review and comment in November 2008 and the final version was submitted in January 2009. The project was approved with no revision after external review by a panel of experts in May 2009.

The National Arid Land Plant Genetic Resources Unit (NALPGRU) located at Parlier, CA was administered through the WRPIS until September 2008. This unit's management was moved to the ARS National Clonal Germplasm Repository for Tree Fruit and Nut Crops and Grapes located in Davis, CA. Dr. Hu led the development of a new five year CRIS Project Plan for the Parlier unit with contributions from Dr. Rich Hannan (retired RL of WRPIS) and Dr. Allan Brown (postdoctoral research associate who served as the acting curator of NALPGRU). The plan was approved with minor revisions by the Office of Scientific Quality Review.

Funding

The FY 08 budget (NTL) for this MU is \$2,147,351 (Pullman, WA) and \$274,845 (Prosser, WA) for a total ARS budget of \$2,422,196. This allows for \$19,293 discretionary dollars per SY. The IRC, R&M and O&M (951 account) totaled \$145,900. In addition, we received \$355,560 'in kind' support from a CSREES Multi-State Research Project W-6, through Washington State University. Projected discretionary funds per SY were \$15,484 for FY09 and \$9,506 for FY10. National Program Staff and PWA Office have worked out an increase in base funds necessary for this station's continued operation.

Our staff scientists have received the following grant funds: Reimbursable Agreement with Bureau of Land Management of \$125,000 by Richard Johnson entitled "Maintenance Characterization, Storage and Distribution of Key Native Germplasm." This grant supports two temporary full time employees (a GS-11 scientist and a GS-5 technician), other temporary help, supplies and travel.

Facilities

WRPIS occupies 34,800 square feet of growth facilities (22,375 sq ft Federal, 12,425 sq ft Washington State University), farms totaling 157.3 acres of land (86.2 acres Federal, 71.1 acres WSU), occupies 12 laboratories (5 Federal labs, 7 WSU labs), and 22 offices (4 in Federal buildings, 6 in Federal mobile office building, 12 in WSU buildings). We have kept our facilities in good working order, and there was no major project in 2008. We have renewed the five year permit with the Army Corps of Engineers in October 2008 for use of the land at our Central Ferry Research Farm location. We also completed the negotiations for the use of water from our existing well to expand the existing irrigation system to the adjacent 40 acres on lease with Washington State University using CSREES Multi-State Research Project W-6 funds.

GERMPLASM MANAGEMENT

The crop species assigned to WRPIS by the National Plant Germplasm System (NPGS) can be roughly divided into ten groups: 1) forage and turf grasses, 2) cool season food legumes (pea, lentil, chickpea, fava bean, lupine, etc.), 3) forage legume crops, 4) beans, 5) lettuce, 6) safflower, 7) garlic, wild onion and onion relatives, 8) sugar beet, 9) selected ornamentals, and 10) medicinal plant species. The 80,000 accessions held at WRPIS account for almost 16% of 509,000 accessions in the NPGS, which comprises 25 seed and clonal repositories including the related Regional Research Projects (North Central NC-7, Northeastern NE-9, and Southern S-9). Most WRPIS accessions are

maintained as seed, with a small proportion (garlic and relatives and some ornamentals) vegetatively-propagated. Figure 1 shows that total number of accessions at WRPIS has grown steadily over the past six years.

As of May 29, 2009, the number of accessions held at WRPIS was 80,914 comprising 797 genera, 3,642 species (3,970 taxa). These are managed by five curatorial programs: The Agronomy Program (Vicki Bradley) manages Grasses and safflower collections with a total of 22,810 accessions. The Bean Program (Molly Welsh) manages the Phaseolus germplasm of 14, 696 accessions. The Cool Season Legume Program (Clarice Coyne) curates the germplasm of pea, chickpea, lentil, faba bean and lupine with a total of 20,175

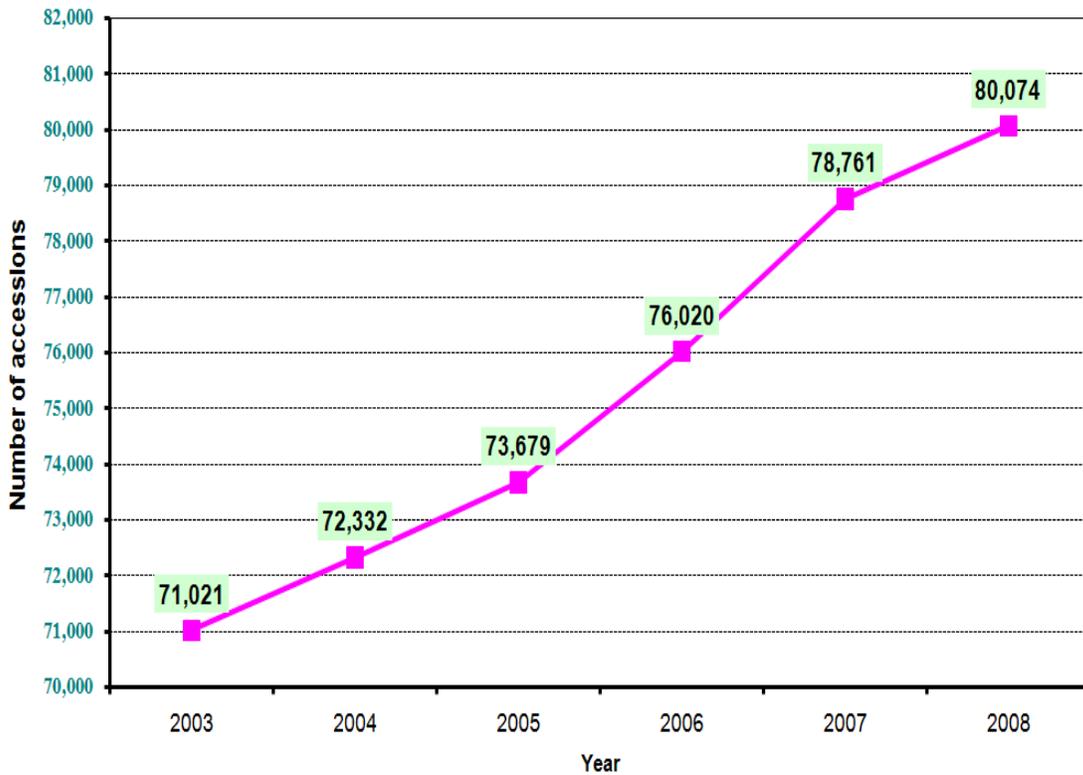


Figure 1. Changes of total number of accessions at WRPIS since 2003.

accessions. The Horticultural Program (Barbara Hellier) cares for 9,501 accessions of Allium, sugar beet, lettuce and many miscellaneous species that have potential use for ornamental or medicinal purposes. The Temperate Forage Program (Stephanie Greene) manages the germplasm of alfalfa, clover lotus and wild clovers with a total of 12,604 accessions. In addition, there are 1,128 accessions of native species generated by the research activities supported by grants from the BLM's Seeds of Success project, the Great Basin Restoration Initiative, and the Forest Service to Richard Johnson (WRPIS' Research Agronomist). Many of these accessions are being transferred to existing NPGS

curators for permanent management. Figure 2 shows the number of accessions for major crop groups maintained at WRPIS.

Germplasm Acquisition

In 2008, WRPIS scientists carried out three international collection trips in collaboration with their collaborators. Barbara Hellier collected 28 accessions of *Taraxacum kok-sagyz* (TKS) seed and/or root pieces from Kazakhstan. This represents the largest living collection of this species in a public germplasm collection. TKS is a potential crop for producing natural rubber. Richard Johnson collected over 400 new grass accessions from Italy and Germany. Stephanie Greene went to the Crimean Peninsula in Ukraine and collected 225 accessions of annual medics and clovers. These new resources may provide breeders with useful traits such as cold tolerance and salt tolerance.

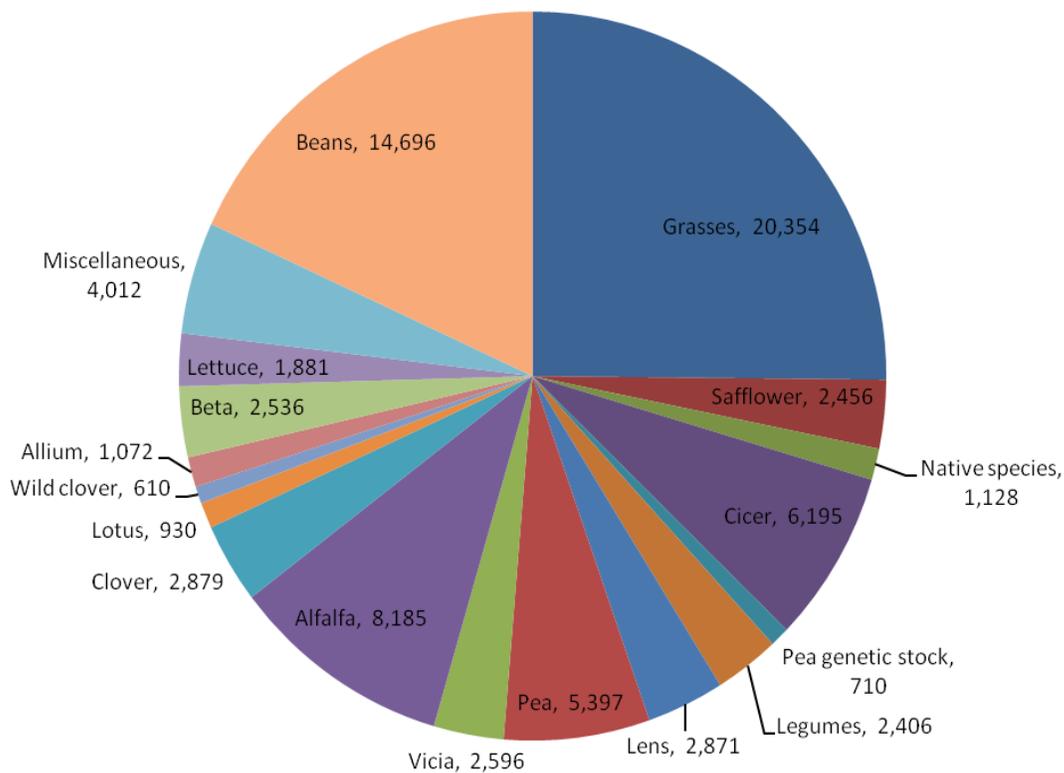


Figure 2. Number of accessions for major crop groups maintained at WRPIS (as of May 29, 2009).

Germplasm conservation

In 2008, WRPIS curators regenerated 1,152 inventories by following our established, labor-intensive procedures and protocols for maintaining the genetic integrity and health of all germplasm collections. These included physical isolation, hand planting and transplanting, controlled hand and insect pollination, hand harvesting and careful storage and distribution. Figure 3 shows a few samples of these activities.

Seed viability tests were carried out on 2,278 inventories (WRPIS tested 946 in Pullman, WA, NCGRP tested 1,242 in Fort Collins, CO and other locations tested 312 inventories). A total of 2,500 records were entered into the GRIN database. Seed quantities of 5,501 inventories in our storage were updated by weighting and converting to seed numbers.

For security back-ups, we sent 852 inventories to NCGRP at Fort Collins, CO and 2,343 inventories to the Svalbard Global Seed Vault, Longyearbyen, Svalbard through the NCGRP during 2008.



Figure 3. Photos of planting and harvesting during WRPIS germplasm regeneration. A: Planting faba bean; B: Transplanting grasses; C: harvesting garlic and D: Harvesting *Brachypodium* seeds.

Germplasm evaluation and characterization

In 2008, we entered into the GRIN database a total of 30,194 observation data points comprising 161 descriptors of 21 crops on 5,457 accessions. Data points by crop are: 93 of alfalfa, 2,036 of *Allium* garlic, 4 of *Allium* wild relatives, 12 of *Astragalus*, 1,980 of chickpea, 270 of clover, 685 of faba bean, 483 of cool-season grasses, 150 of *Lathyrus*, 198 on lentil, 29 of lettuce, 474 of lupine, 33 of *Medicago*, 1,2647 of pea, 3,972 of pea genetic stocks, 4317 of *Phaseolus*, 1658 of safflower, 4 of sugar beet, 120 of trefoil, 18 of *Trigonella*, 733 of vetch and 278 of W-6-miscellaneous species. Two percent of the data came from our collaborators and the other ninety-eight per cent came from personnel at our station.

Available DNA marker techniques were applied to assess phylogenetic and genetic diversity of germplasm collections of priority crops. Progress in 2008 in this area included genotyping the Pea (*Pisum sativum*) core collection with SSR markers at 20 loci; studying the genetic variation using AFLP molecular markers among 96 entries of bulked samples of Indian Ricegrass (*Ancatherum hymenoides*) populations collected throughout the great basin; analyzing with SRAP markers 96 entries of bulked samples of Taper-tip onion (*Allium acuminatum*) populations collected throughout the great basin and determining duplicates from 40 accessions of Onion (*Allium cepa*) using both SSR and TRAP markers.

Germplasm distribution

During the year 28,592 packets of 17,740 accessions were distributed. This is a record high for distribution of packets sent out by WRPIS in one year. Among them, 17,433 (61%) packets were sent to addresses in the USA and 11,159 (39%) packets to foreign countries. There were 983 orders filled by 730 different requestors. The most requested plant group is grasses (9,842), followed by beans, peas and alfalfa, clover, safflower, Cicer, each had between 1,000 to 3,000 packets. Figure 4 shows the WRPIS distribution data in the past six years.

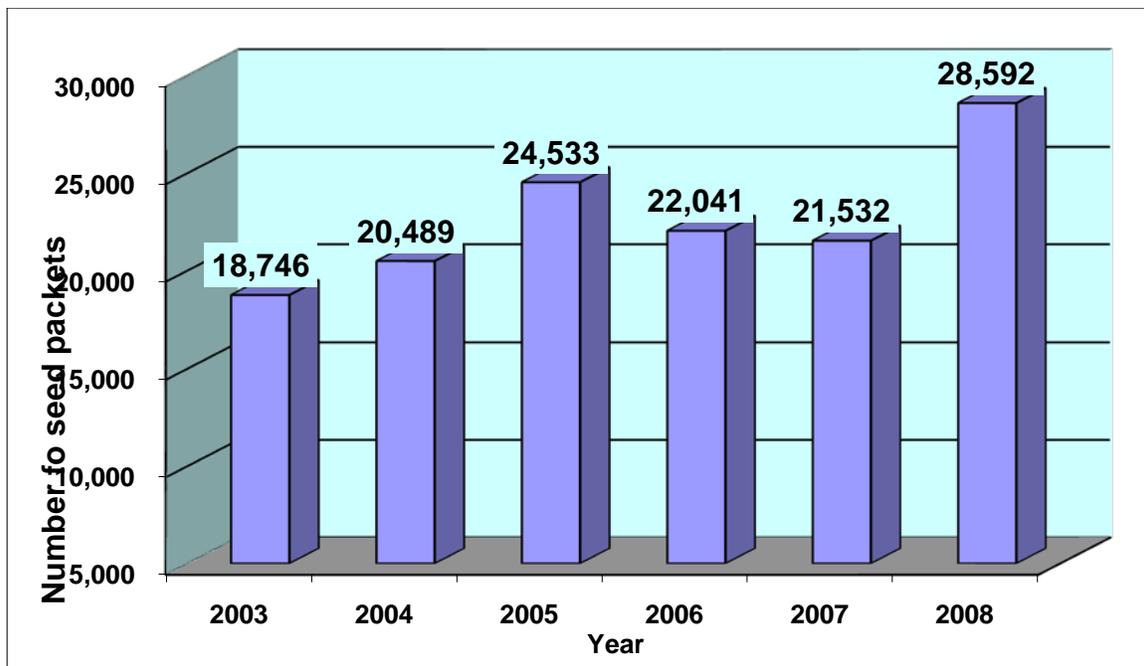


Figure 4. Number of seed packets distributed by WRPIS in the past six years.

MISSION-RELATED RESEARCH

Agronomy

In many semi-arid regions a winter annual broadleaf is needed in a rotation system with wheat. Recent work has led to the release of winter hardy safflower lines that could

address that need. Fall planted safflower develops earlier and has higher yield potential than spring planted safflower. Additional research showed that safflower winter hardiness was related to both prostrate habit and high winter acclimation capacity in the fall. Thus both of these factors must be considered as winter safflower cultivars are developed.

Tall fescue is grown on more than 14 million hectares in the U.S. but often exposed to summer droughts that reduce forage production. Low carbon isotope discrimination (CID) is associated with high water use efficiency in tall fescue. Research showed that CID is heritable and can be used in a breeding program. Selection would be most efficient with one cycle of selection on spaced plants. These recommendations are being implemented to develop Tall Fescue cultivars with improved water-use efficiency.

In response to the critical need for key native species for revegetation in the Great Basin, a project is underway to acquire, characterize, conserve and utilize native plant germplasm. Genecology studies are underway for Taper-tip onion, Indian ricegrass, Bluebunch wheatgrass and Sandberg bluegrass accessions in replicated common garden studies at two or more plot sites. 2008 was the second year for data collection in established plots. Preliminary analyses have shown that a great deal of genetic variation exists within these species. Complete data analysis and assessment plant adaptation zones will be completed for these species within the next 1-2 years. This information will guide management decisions concerning seed sources used for ongoing revegetation efforts.

Entomology

Chickpea is an important grain legume crop in the world with major U.S. production in the Palouse region of eastern Washington and northern Idaho. Although insects impact chickpea yields in the Palouse region, they are more damaging to chickpea crops on the Indian subcontinent and Australia. Teamed up with scientists from the USDA-ARS, Washington State University, and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India, we developed a recombinant inbred line (RIL) population with an insect-resistant wild chickpea accession and an insect susceptible accession from the WRPIS chickpea collection. Preliminary experimental data revealed that larval fed on selected RIL showed significant differences in body weights and mortality. In 2008, we completed this three-year, USAID funded research project and the developed insect-resistant chickpea germplasm and the RIL population were transferred to ICRISAT for expanded evaluation throughout India and other countries.

Some grass-endophyte associations produce alkaloid chemicals that are toxic to grazing animals like cattle and sheep, while some endophyte strains in grass hosts do not produce alkaloids toxic to mammals. These 'non-toxic' endophyte strains have been deliberately sought by scientists to resolve mammalian toxicity problems and they have found these strains in grass collections at the WRPIS. This important microbial germplasm (Neotyphodium endophytes) must be preserved. A multi-year, cooperative research between USDA-ARS scientists in Pullman and Corvallis, Oregon, revealed that seed-regeneration activities and procedures at the WRPIS are optimal for preserving viable endophytes. This study also documented the presence of viable endophytes in seed of 20 Mediterranean tall fescue accessions stored for four to ten years in the WRPIS seed storage.

Genetics

The small grass species *Brachypodium* has emerged as a model plant in grass genomics research for its small and simple genome, minimum growth requirements and rapid generation time. Functional genes discovered in *Brachypodium* have great potential applications for the genetic improvement of cereal food crops (wheat and barley) and bio-fuel crop (switch grass). WRPIS has distributed over one thousand seed samples to requestors around the world. We applied AFLP and TRAP marker techniques to assess genetic variation in our *Brachypodium* collection and found that there is a substantial high level of genetic diversity among 30 *Brachypodium* accessions maintained in Pullman. This finding indicated that this collection is useful in the upcoming functional genomics study.

Plant Pathology

Ascochyta blight is a serious fungal disease of chickpea. The initial inoculum for disease development often originates from sexually produced spores (ascospores) of the pathogen, *Didymella rabiei*, which has survived in post-harvest chickpea debris over the winter. Ascospores are released in the spring. Laboratory studies have indicated that application of the common fungus *Aureobasidium pullulans* (AuP) to chickpea debris can suppress reproduction of *D. rabiei*. In collaboration with researchers in the Department of Plant Pathology, WSU and USDA-ARS Grain Legume Genetics, Pullman, WA, we confirmed that analogous application of AuP to over-wintering chickpea debris can suppress disease development in either the greenhouse or the field. Manipulation of the fungal flora colonizing chickpea debris may represent another tool for disease management in chickpea.

The collection of garlic cultivars (mostly *Allium sativum*, with some *A. longicuspis*) in WRPIS represents one of the largest collections of garlic worldwide. Garlic is known as a host for several viruses, which vary in impact on the host cultivar depending on both virus and host. We have noticed symptomatic garlic accessions over several seasons. In 2008 we reported the results of our systematic survey of the collection for important garlic viruses using modern molecular diagnostic techniques: Garlic common latent virus (GCLV), Iris yellow spot virus (IYSV), Leek yellow stripe virus (LYSV), Onion yellow dwarf virus (OYDV), Shallot latent virus (SLV), plus Tobacco rattle virus (TRV). Of these, we found GCLV, LYSV or OYDV, with some plants showing mixed infections of OYDV and GCLV. The most prevalent virus was OYDV (accounting for 60% of infected material), followed by GCLV (25%) and LYSV (15%). Incidence of symptomatic plants ranged from less than 10% to 100% in individual accessions. Survey results can be used for location of potential sources of resistance to viral infection.

COMMITTEES, PRESENTATIONS AND RECOGNITIONS

During 2008 WRPIS scientists and curators serve as committee members or chairs of the respective national Crop Germplasm Committees (CGC) and other academic or social organizations. WRPIS Agronomist **Richard Johnson** is the Chair of the International Safflower Germplasm Committee, Member of the Technical Advisory Committee for the Special Grant, Grass Seed Cropping Systems for Sustainable Agriculture, and active Ex-officio member of the Forage and Turf grass CGC. Steve Clement, WRPIS Entomologist, is a member of the International Affairs Committee, Entomological Society of America, and a member of two graduate student research committees, Department of Entomology,

Washington State University. WRPIS Horticulture Curator **Barbara Hellier** is the Ex-officio member of six CGCs (Root and Bulb, Leafy Vegetable, the Herbaceous Ornamental, New Crops, the Clover and Special Purpose Legume and sugar beet) and a member of two PGOC subcommittees (Medicinal Plant and *In Situ* Conservation). WRPIS Agronomy Curator **Vicki Bradley** is the Ex-officio member of Forage and Turf Grass CGC (Descriptor Subcommittee Secretary) and New Crops CGC. WRPIS Cool Season Food Legumes Curator **Clarice Coyne** is the Ex-officio member of the Food Legume CGC and the member of the Plant Germplasm Operations Committee. The WRPIS temperate forage legume curator **Stephanie Greene** is Chair and Ex-officio of the Alfalfa CGC, and Ex-officio of the Clover and Special Purpose Legume CGC. She Chaired the CSSA Frank Myer Medal committee and is a member of the CSSA Calvin Sperling Memorial Lectureship, the Desert Legume Program (DELEP) Advisory Committee, Tucson, AZ and the WSU Legume Variety Release Committee. WRPIS Phaseolus Curator **Molly Welsh** serves as member in the following organizations: *Phaseolus* CGC, Bean Improvement Cooperative Genetics Committee, W1150 Regional Project and Seed Savers Exchange. By participating in the regular meetings and other activities of these organizations we effectively outreach and interact with our stakeholders, customers and general public.

WRPIS scientists and curators made over 30 oral or poster presentations at either scientific or general public meetings, contributed three book chapters and published 18 peer reviewed scientific journal papers in 2008.

WRPIS staff also received outstanding recognitions from the scientific community for their contributions. **Stephen Clement** was the first entomologist awarded the Washington State Crop Improvement Association O. A. Vogel Award in November 2008. **Richard Johnson** was invited to deliver a Keynote address at the 7th International Safflower Conference, November 2008, Wagga Wagga, Australia. **Frank Dugan** was sole author on two of the top ten best-selling titles for APS Press in 2008 and he was invited to make a presentation entitled "Microbial Germplasm in Seed Banks and Clonal Repositories" at the APS Annual Meeting, Minneapolis, August 2008. **Jinguo Hu** was invited to serve as an Associate Editor for Crop Science. **Theodore Kisha** won the USDA-ARS National Outreach, Diversity and Equal Opportunity Award. **Rich Hannan**, the retired Research Leader of WRPIS, was the 2008 Recipient of Frank Myer Medal from the Crop Science Society of America.

PUBLICATIONS (PEER REVIEWED, PUBLISHED IN 2008 ONLY)

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Appendix 1

Western Regional Plant Introduction Station
Current Staffing List as of December, 2008

Position	Name	Federal or State	Posit. Type
Pullman Station			
Research Leader/Station Coordinator	Jinguo Hu	Fed	PFT
Program Support Assistant	Jannis Bacani	Fed	PFT
IT Specialist	Gwen Pentecost	Fed	PFT
Seed Manager/Computer Specialist	Dave Stout	Fed	PFT
Plant Technician	Paula Lundt	Sta	PFT
Farm Manager, Pullman	Wayne Olson	Sta	PFT
Plant Technician	Jacqueline Cruver	Sta	PFT
Plant Technician	Sean Vail	Sta	PFT
Farm Manager, Central Ferry	Kurt Tetrick	Fed	PFT
Plant Technician	Scott McGee	Sta	PFT
Research Entomologist	Steve Clement	Fed	PFT
Biological Science Technician	Leslie Elbersen	Fed	PFT
Research Plant Pathologist	Frank Dugan	Fed	PFT
Biological Science Technician	Shari Lupien	Fed	PFT
Research Agronomist	Richard Johnson	Fed	PFT
Biological Science Technician	Connie Foiles	Fed	PFT
Plant Biologist	Michael Cashman	Fed	TFT
Biological Science Technician	Melissa Scholten	Fed	TFT
Geneticist	Theodore Kisha	Fed	PFT
Biological Science Technician	Lisa Taylor	Fed	PFT
Agronomy Curator	Vicki Bradley	Fed	PFT
Biological Science Technician	Bob Guenther	Fed	PFT
Cool Season Food Legume Curator	Clarice Coyne	Fed	PFT
Biological Science Technician	Landon Charlo	Fed	PFT
Hort Crops and Beet Curator	Barbara Hellier	Fed	PFT
Biological Science Technician	William Luna	Fed	PFT
Biological Science Technician	John Connett	Fed	TFT
Biological Science Technician	Marie Pavelka	Fed	PFT
Phaseolus Curator	Molly Welsh	Fed	PFT
Plant Technician	Julie Thayer	Sta	PFT
Prosser Station			
Forage Curator	Stephanie Greene	Fed	PFT
Biological Science Technician	Martha Cervantes	Fed	PFT
Biological Science Aid	Jesus Prieto	Fed	TFT

Appendix 2

Scientific and Service Activities

January 2, RC Johnson accepted offer to serve on the World Conservation Union Crop Wild Relative Specialist Group (CWRSRG)

January 3, Barbara Hellier consultation phone conversation with Matt Walsh, J-9 Foundation, regarding *Salvia hispanica* culture

January 6, Steve Clement invited by Dr. Hamed Abbas, ARS Research Plant Pathologist, to be a Guest Editor of a special issue of Toxin Reviews and to write and submit a review article on mycotoxins. Declined.

January 8, Steve Clement. At request of editor, reviewed predator-prey manuscript for Biological Control.

January 10, RC Johnson consulted with Ken Graham, Analytical Chemist, Arcadia Biosciences Inc., regarding analysis of safflower oil for cathartic and bitter phenolic glycosides

January 12-16. Clare Coyne presented an invited talk. International Plant and Animal Genome Conference, San Diego, CA

January 17, Steve Clement. At request of editor, reviewed cotton insect manuscript for Journal of Economic Entomology.

January 19, Steve Clement consulted with Alan Stewart, PPG Wrightson Seeds of New Zealand and Australia about recent discovery of Neotyphodium endophyte in wild timothy accession in Pullman PI collection. Cooperative research planned.

January 22, Steve Clement, upon request, consulted with Dr. Scott Hutchins, Global Director, Crop Protection Research and Development, Dow AgroSciences, about exploring the development of a World Association of Entomology Associations.

January 22, Steve Clement, upon request, provided information about pea weevil resistance in pea germplasm to Dr. Oonagh Byrne, University of Western Australia.

January 23, Steve Clement, upon request, provide up-to-date pea insect pest information to Dr. David Bragg, WSU Extension Specialist, for meeting organized by Blue Mountain Seed, Inc.

January 24, Steve Clement, upon request, wrote a letter in support of an applicant for Departmental Head position, Department of Entomology, University of Massachusetts.

January 24, Vicki Bradley hosted grass breeding staff from Jacklin Seed by Simplot. They toured the seed cleaning room and seed storage area to gather ideas for updating

their facilities, and discussed our procedures for germinating and planting regeneration nurseries

January 29, Ted Kisha participated in the Career fair at WSU

January 29 - 30, Vicki Bradley represented the ARS at the Career Fairs at WSU and U of I

January 30, Steve Clement, at request of editor, reviewed paper on forage grass grubs for Bulletin of Entomological Research, Royal Entomological Society.

January 30, RC Johnson consulted with Brent Barrett, Ag Research, New Zealand, concerning germplasm needed for starting a breeding and evaluation program. Germplasm sent and new program started based on a six year grant obtained by Barrett

January 31, Steve Clement asked by California Department of Food Agriculture to review grant proposals submitted to Pierce's Disease Control Program.

February 1, Steve Clement asked by Dr. K.L. Heong, IRRI, to submit letter to support application of scientist applying for open Entomologist position in rice. Dr. Clement wrote and mailed the letter.

February 1, RC Johnson, peer review "Oil content and fatty acid composition in seeds of three safflower species" for Industrial Oil Crops
February 4-6, RC Johnson participated in the Society of Range Management meetings, Reno NV, and presented oral paper "Adapted Germplasm for the Great Basin: Tapertip Onion, Indian Ricegrass, Bluebunch Wheatgrass and Friends"

February 7, Ted Kisha participated in the Graduate Committee Meeting of student Susanne Canwell

February 10, Steve Clement, upon request, provided rice midge information to Dr. Mark Stevens, the rice entomologist for all of Australia (located in Yanco NSW).

February 19, Steve Clement reviewed 44 NSF proposals by early career scientists to attend meetings and present papers at International Congress of Entomology 2008, South Africa.

February 27, Ted Kisha met with perspective summer interns from the Upward Bound program in Omak. WA

February 28, Barbara Hellier peer review of "Genetic Diversity of Rhubarb Cultivars" manuscript for the Journal of the American Society for Horticultural Science
March 3, RC Johnson, peer review "Development of SCAR markers linked to male sterility and very high linoleic acid content in safflower, for Molecular Breeding

March 4, Barbara Hellier as a member of the selection panel, reviewed applications for

the Arctic Germplasm repository curator position

March 6, RC Johnson, peer review “Novel Safflower germplasm with increased saturated fatty acid content,” for Crop Science

March 10, Steve Clement, upon request, provided grass endophyte information to Stuart Kemp, Managing Director, PastureWise Pty Ltd., Victoria, Australia.

March 19, Steve Clement, upon request of instructor of Crops Science 202, WSU, agreed to be interviewed by undergraduate students for research at PI Station. Steve met with three students.

March 21, Steve Clement at request of editor reviewed yellow starthistle biocontrol paper for Northwest Science.

March 24, Ted Kisha presented a guest lecture on “Molecular Markers and Genetic Diversity Analysis” to Plant Sciences 205 class at the University of Idaho

March 27, Steve Clement, upon request, provided Dr. Ranko Ganter in Croatia with information about pea resistance to pea weevil.

March 30, Steve Clement, upon request, shipped seed of endophyte wild timothy to AgResearch in New Zealand.

March 31-April 2. Steve Clement attended Pacific Branch meeting of Entomological Society of America, Napa, California, where he organized and co-moderated a symposium on biocontrol of yellow starthistle. He secured \$1500 program enhancement funds to bring in speakers, and gave opening talk.

April 3, Steve Clement, upon request, reviewed a wheat-insect resistance paper for editor of Cereal Research Communications.

April 4, Barbara Hellier peer review of "Morphologic Variation in the USDA/ARS Rhubarb Germplasm Collection" manuscript for the Journal of the American Society for Horticultural Science

April 5, Steve Clement responded to a request for Dr. Kevin Reed, forage grass consultant, Victoria, Australia, for information about novel grass endophytes.

April 8, Steve Clement received request from editor of Northwest Science to review a manuscript. Declined.

April 8, Ted Kisha presented a seminar entitled “The US national Plant Germplasm System: Preserving Plant Biodiversity for Today and Tomorrow” at Prosser, WA for WSU and ARS Scientists in Horticulture, Plant Pathology, and Agriculture

April 10, Steve Clement at request of editor of International Journal of Tropical Science reviewed a manuscript on legume-insects.

April 12, Jinguo Hu visited the National Arid Land Plant Genetic Resources Unit (NALPGRU) located at Parlier, CA

April 16, Steve Clement responded to a request from Dr. Vicki Yokoyama, ARS Research Entomologist, for information about Hessian fly distribution in central Washington.

April 21, Vicki Bradley participated in a PWA Workforce Diversity Committee teleconference

April 23, Steve Clement, upon request from Clint Kellner of LSA Associates, Richmond, California, provided information about *Euparagia scutellaris* in line with an environmental assessment being done by LSA. Mr. Kellner contacted Dr. Clement upon reading his 1968 paper on this wasp, done as an undergraduate research project at UC-Davis. This paper is still the seminal research on this wasp.

April 25, Barbara Hellier consultation phone conversation with Friedrich Kopisch-Obuch, Plant Breeding Institute, Germany, on beet accessions exhibiting delayed bolting behavior

April 30, Steve Clement at request of editor reviewed grass endophyte-insect paper for Journal of Economic Entomology.

April 30, Steve Clement at request of editor reviewed a grass endophyte-rice leaf bug paper for *Entomologia Experimentalis et Applicata*.

May 5, Steve Clement, upon request, mailed copies of his pollination papers to Dr. Ekaterina Kozuharova, Sofia, Bulgaria, and advised about pollination requirements for legume plants.

May 5-8, Clare Coyne served on Arctic Germplasm Curator Selection Committee, Palmer, AK

May 7, Ted Kisha met with ARS summer interns and presented information on WRPIS research

May 11-25, Clare Coyne conducted a germplasm exchange with John Innes Centre, Norwich UK

May 20, RC Johnson was ask to participate in review of BLM National Plant Conservation Program (phone interview) June 2, Stephanie Greene attended North American Alfalfa Improvement Conference, A Cornucopia of Diversity: U.S. Germplasm Accessions Worthy of Future Research (invited oral presentation), Houston, TX

May 27, Steve Clement, upon request of Dr. Jinguo Hu, edited sections of the ARS project plan for Parlier station.

May 30, Steve Clement, upon request of editor, was asked to review another endophyte paper for *Entomologia Experimentalis et Applicata*. Declined.

June 2-5, Clare Coyne presented an invited talk, Plant Germplasm Operating Committee, Fort Collins, CO

June 2-5, Ted Kisha participated in the PGOC at Ft Collins, CO

June 6, Steve Clement received report from ARS Systematic Entomology Laboratory about his submission of bruchids that attacked some of Barbara Hellier's legume nurseries in 2007. Identification came back as *Acanthoscelides fraterculus*, which is not surprising as this bruchid is a native insect that can be expected to attack some Pullman germplasm.

June 6. Stephanie Greene attended Plant Genetic Operations Committee Meeting, Annual report of PGOC, GIS Subcommittee (oral report), Fort Collins, CO

June 6, Steve Clement provided updated information about the Cereal Leaf Beetle, a new invasive insect, at Central Ferry to Dr. Diana Roberts, WSU extension specialist.

June 10, RC Johnson gave an invited oral presentation, "Winter Safflower, a Potential New Crop for N.E. Oregon" Columbia Basin Agricultural Research Center Field Day, Pendleton, OR

June 10, Jinguo Hu attended the Columbia Basin Agricultural Research Center Field Day, Pendleton, OR

June 11, Steve Clement, upon request, provided information about chickpea insect pest management to Larry Smith, University Idaho extension specialist, Lewiston, Idaho.

June 13, Barbara Hellier peer review of "Row covers reduce insect populations and damage, and improve early season Crisphead Lettuce production" for the *International Journal of Vegetable Science*

June 13- July 12, Stephanie Greene conducted a Plant Exploration to Crimean peninsula, Ukraine

June 18-19, Frank Dugan attended the Biennial Statewide Department of Plant Pathology (WSU) Meeting, Richland, WA, and presented (with D. Glawe) a poster, North American Fungi: An online, open access venue for research, reviews, reports, links and more

June 19, Vicki Bradley was a tour chaperone for Native American youth attending the WSU Science Camp

June 19, Steve Clement was asked by the editor of *Oecologia* to review an endophyte manuscript. Declined.

June 20, Steve Clement, upon request, provided information about pea aphid outbreaks on the Palouse to Larry Smith, University of Idaho extension specialist, Lewiston, Idaho.

June 23, Ted Kisha participated in a graduate committee meeting for student Susanne Canwell

June 24–25, Jinguo Hu attended the W-6 Technical Advisory Committee Meeting, Hilo, HI

June 24–July 7, RC Johnson collected grasses for the NPGS in Italy cooperative the Forage and Dairy Research Center, Lodi, Italy, and supported by the ARS Plant Exploitation Office

June 24–July 10, Barbara Hellier participated in plant exploration in Kazakhstan to collect *Taraxacum kok-sagyz*

June 26, Ted Kisha gave a demonstration on extracting DNA from bananas and strawberries using household products to 7th and 8th grade students participating in the Swant Summer Science Camp

June 28, RC Johnson peer review "Germination and Growth Characteristics along Altitudinal Gradients in Three Intermountain *Allium* spp. (Liliaceae)" submitted for the Native Plants Journal

July 1-31, Ted Kisha hosted a summer intern from the Upward Bound program

July 21–24, Barbara Hellier attended the Root and Bulb and Leafy Vegetable CGC meetings in conjunction with the American Society for Horticultural Science conference

July 25-29, Frank Dugan attended the annual meeting of the American Phytopathological Society, Minneapolis, MN and gave an invited talk, Microbial germplasm in seed banks and clonal repositories

July 29-August 3, Steve Clement served on RPES panel for ARS scientists.

August 5, Steve Clement reviewed a manuscript on Hessian fly for the editor of Journal of Applied Entomology.

August 5, Barbara Hellier in house review of "Environmentally stable phenotypic traits of ten garlic cultivars" for Dr. Gayle Volke of the NCGRP, Fort Collins, CO

August 14, Barbara Hellier gave Erica Wheeler, graduate student at University of Missouri-Columbia tour of WRPIS greenhouse and field plots focusing on Alliums

August 15, RC Johnson, peer reviewed 6 articles for the 7th International Safflower Conference Proceedings

August 20, Steve Clement appointed to the International Affairs Committee, a standing committee of the Entomological Society of America.

August 26-28, Ted Kisha participated in a GIS Workshop at the University of Idaho

August 29, Steve Clement responded to a request from Dr. Darryl Hardie, CRC Biosecurity-Australia, about blister beetles and their host affinities.

September 5, Steve Clement travelled to Knoxville, Tennessee where he gave an invited seminar in the Department of Entomology and Plant Pathology, University of Tennessee. Title: "Temperate Grasses, Fungal Endophytes, and Insects."

September 15, Steve Clement responded to a request from Dr. Dan Potter, University of Kentucky, for information about *Bonnetia compta*, a parasitoid wasp that Dr. Clement researched in the 1970s in the Corn Belt while a faculty member at the Ohio State University.

September 15, Vicki Bradley participated in a Crop and Soil Science Department meeting with Dr. Al Sanchez, General Manager of L&H Seeds in Connell, WA

September 18, Steve Clement was asked by editor of Journal of Economic Entomology to review another Hessian fly manuscript. Accomplished.

September 19, Barbara Hellier consultation phone conversation with Scott Zona, Florida International University, regarding the *Salvia* collection, NPGS collection proposals, NPGS evaluation proposals

September 22, Steve Clement received an inquiry from Giovanni Figliuolo, a leek researcher in Italy, for a copy of his leek germplasm pollination paper and advice on insect pollination.

September 22, Steve Clement gave invited seminar "Entomological Peregrinations I, Yellow Starthistle: A Biocontrol Project With Many Twists and Turns," Department of Plant, Soil, and Entomological Sciences," University of Idaho, Moscow.

September 22 – 24, Ted Kisha visited the National Arid Land Plant Genetic Resources Unit (NALPGRU) located at Parlier, CA

September 24, Barbara Hellier attended WSU chemical waste disposal training

September 29, Steve Clement gave invited seminar "Entomological Peregrinations II, Grass-Fungal Endophyte-Insect Interactions", Department of Plant, Soil, and Entomological Sciences," University of Idaho, Moscow.

October 2, Steve Clement received a request from Anthony Leddin, forage grass agronomist, Victoria, Australia for information about endophyte survival in grass seed.

October 13, Jinguo Hu gave a seminar entitled “The sunflower crop: production, research and prospect” to the Crop and Soil Science Department, WSU, Pullman, WA

October 15, Barbara Hellier in house review of “Regional specificity of diverse garlic cultivars” for Dr. Gayle Volke of the NCGRP, Fort Collins, CO

October 16, Stephanie Greene gave an oral presentation introducing Dr. Rich Hannan-2008 Recipient of Frank Myer Medal at the Annual conference of Crop Science Society of America, Houston, TX

October 27, Stephanie Greene gave a seminar entitled “Interactive Ecological Atlas of Russia and Neighboring Countries” to the Crop and Soil Science Department, WSU, Prosser, WA

October 5, Vicki Bradley attended the Forage and Turfgrass CGC meeting in Houston, TX

October 5-9, Clare Coyne presented a poster and participated in Food Legume Crop Germplasm Committee meeting, ASA-CSSA-SSSA Annual meeting, Houston, TX

29 October, Steve Clement was notified by Jerry Robinson, Washington State Crop Improvement Association, that he is the 2008 recipient of the OA Vogel Award. Dr. Clement is the first entomologist to receive this award.

November 6, RC Johnson was the keynote Speaker entitled “Safflower Germplasm: Past, Present, and Future” at the 7th International Safflower Conference, Wagga Wagga, Australia

November 7, Steve Clement served on M.S. Research Committee for Sam Hapke, Department of Entomology, WSU; Thesis defense on this date.

November 7, Barbara Hellier reviewed NPGS plant exploration proposals for the Plant Exchange Office.

November 10, Steve Clement was asked by editor of Journal of Economic Entomology to review another Hessian fly manuscript. Declined.

December 8, Steve Clement was asked by editor of Entomologia Experimentalis et Applicata to review a paper on aphids on transgenic wheat. Accomplished.

December 9, Steve Clement was asked by editor of Journal of Chemical Ecology to review a manuscript on sorghum, iso-flavonoids, and insect resistance. Declined.

December 9-11, RC Johnson participated in the symposium “Wildfires and Invasive Plants in American Deserts, Reno, NV.

December 12, Steve Clement, upon request, sent information to Dr. Pedro Gundel in Argentina about endophyte frequency in Pullman gene bank grass accessions.