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PROJECT AND PARTICIPANTS

PROJECT TITLE: W-6 Plant Genetic Resource Conservation and Utilization

COOPERATING AGENCIES AND PRINCIPAL LEADERS:

Administrative Advisor	Ralph Cavalieri
Regional Coordinator	Richard Hannan

State Experiment Station Representatives

Alaska	no representative	Montana	Jack Martin
Arizona	Dennis Ray	New Mexico	Ian Ray
California	Dan Parfitt	Oregon	Shawn Mehlenbacher
Colorado	Mark Brick	Utah	Kevin Jensen
Hawaii	no representative	Washington	Steve Jones
Idaho	Bob Zemetra	Wyoming	Robin Groose

U.S. Department of Agriculture

National Clonal Germplasm Repository, Corvallis, OR Kim Hummer

National Clonal Germplasm Repository for Citrus and Dates, Riverside, CA
Robert Kreuger

National Clonal Germplasm Repository for Tree Fruit/Nut Crops and Grapes, Davis CA
Chuck Simon

National Small Grains Collection (NSGC), Aberdeen, ID Harold Bockelman

ARS National Program Staff	Peter Bretting
ARS Plant Exchange Office	Edward Garvey
ARS Pacific West Area Director	Antoinette Betchart
Natural Resources Conservation Service	Mark Stannard
National Center for Agricultural Util. Research	Tom Abbott
National Center for Genetic Resources Preservation	Henry Shands

REGIONAL PROJECT W-6: Plant Genetic Resource Conservation and Utilization, 2003

WESTERN REGIONAL PLANT INTRODUCTION STATION

Research Leader/Station Coordinator	ARS	Dr. Richard Hannan	
Program Assistant	ARS	Ms. Vickie Lutes	
Information Tech/Collateral Duty Safety Officer	ARS	Ms. Gwen Pentecost	
Seed Manager/Data Specialist	ARS	Mr. Dave Stout	
Seed Storage Technician	WSU	Ms. Paula Lundt	
Facilities and Farm Manager (Pullman)	WSU	Mr. Wayne Olson	
Tractor Operator	ARS	Mr. Andrew Davis	
Plant Technician II (Seed Processing)	WSU	Ms. Jacqueline Cruver	
Facilities and Farm Manager (Central Ferry)	ARS	Mr. Kurt Tetrick	
Plant Technician III	WSU	Mr. Scott McGee	
Research Entomologist	ARS	Dr. Stephen Clement	
Biological Technician	ARS	Ms. Leslie Elberson	
Research Plant Pathologist	ARS	Dr. Frank Dugan	
Biological Technician	ARS	Ms. Shari Lupien	
Research Agronomist	ARS	Dr. Richard Johnson	
Biological Technician	ARS	Ms. Connie Foiles	
Geneticist	ARS	Dr. Theodore Kisha	
Agronomy Curator	ARS	Ms. Vicki Bradley	
Biological Technician	ARS	Mr. Bob Guenthner	
Horticulture Crops Curator	ARS	Ms. Barbara Hellier	
Biological Technican	WSU	Mr. Russell Staska	
Biological Technician	ARS	Mr. William Luna	
Phaseolus Curator	ARS	Dr. Molly Welsh	
Plant Technician II	WSU	Ms. Julie Thayer	
Biological Technician	ARS	Mr. Robert Yarbrough	
Cool Season Food Legume Curator	ARS	Dr. Clare Coyne	
Biological Technician	ARS	Mr. Michael Cashman	
Beta Curator	ARS	Dr. Alan Hodgdon	(Retired Jan. 2004)

National Forage Legume Genetic Resource Unit, Prosser, WA

Forage Legume Curator, Prosser, WA	ARS	Dr. Stephanie Greene
Biological Technician, Prosser, WA	ARS	Mr. Andrew Bell
Biological Technician , Prosser, WA	ARS	Ms. Estela Cervantes

National Arid Land Plant Genetic Resource Unit, Parlier, CA

Horticulturist/Curator, Parlier, CA	ARS	Dr. Maria Jenderek
Biological Technician, Parlier, CA	ARS	Mr. Gary Smith
Biological Technician, Parlier CA	ARS	Mr. Jerry Serimian

OTHER SUPPORT PERSONNEL

Employee	Supervisor	Status
Alt, Patricia	Connie Foiles	Service Worker
Ayling, Donna	Bill Luna	Service Worker
Bartz, Josua	Wayne Olson	Service Worker
Beckman, Amanda	Wayne Olson	Service Worker
Bishop, Kendra	Vicki Bradley	Service Worker
Bloomfield, Gary	Wayne Olson	Skilled Trades Worker
Bowers, Jama	Wayne Olson	Service Worker
Boyer, Kaitlyn	Ted Kisha	Tech. Asst. I
Bringhurst, Christy	Julie Thayer	Service Worker
Buschbach, Steve	Molly Welsh	Service Worker
Clarkson, Heather	Frank Dugan	Tech. Asst I
Davies, Andrew	Wayne Olson	Service Worker
Davis, Jillian	Connie Foiles	Service Worker
Flores, Normangela	Drew Bell	Service Worker
Foxe, David	Paula Lundt	Service Worker
Gerlinger, Roseann	Mike Cashman	Service Worker
Gonzalez, Francisco	Andrew Bell	Service Worker
Handy, Rebecca	Connie Foiles	Service Worker
Haskins, Samatha	Connie Foiles	Service Worker
Herzer, Shane	Molly Welsh	Service Worker
Hewitt, Anna	Shari Lupien	Tech. Asst. I
Hewitt, Leah	Wayne Olson	Service Worker
Hogue, Joyce	Connie Foiles	Service Worker
Johnston, Ellen	Frank Dugan	Tech. Asst. II
Kynaston, Ma'Lady	Leslie Elberson	Tech. Asst. I
Law, Andrew	Alan Hodgdon	Service Worker
Law, Szeming	Ted Kisha	Tech. Asst. I
LeClaire, Terri	Vicki Bradley	Service Worker
Lee, Hyun Soep	Richard Hannan	Service Worker
Lutes, Ann	Ted Kisha	Tech. Asst. II
Martinson, Jennie	Ted Kisha	Tech. Asst. I
Moran, Jessica	Mike Cashman	Service Worker
Myrick, Erin	Leslie Elberson	Tech. Asst. I
North, Casey	Gwen Pentecost	Tech. Asst. I
O'Dell, Melissa	Mike Cashman	Service Worker

Pavelka, Marie	Bill Luna	Service Worker
Pavelka, Marisha	Bill Luna	Service Worker
Peppel, Duane	Wayne Olson	Service Worker
Phillips, Frank	Kurt Tetrick	Service Worker
Prieto, Jesus	Andrew Bell	Service Worker
Rasai, Leon	Clarice Coyne	Tech. Asst. II
Rathke, Renee	Bob Guenthner	Service Worker
Roy, Francine	Stephen Clement	Service Worker
Russo, Jennifer	Ted Kisha	Tech. Asst. I
Shull, Annie	Clarice Coyne	Tech. Asst. I
Swedberg, Erica	Paula Lundt	Service Worker
Vincent, Tracy	Clarice Coyne	Service Worker
Vusovich, Horace	Connie Foiles	Service Worker

EXECUTIVE SUMMARY AND HIGHLIGHTS FOR CY 2003

Successful agricultural production of most crops in the United States is based upon plant species that are not native to this country. Scientists rely on introduced germplasm to provide new genes to improve major crops, minor regional crops, and to develop new crops. Collectively, the Western Regional Plant Introduction Station (WRPIS) personnel at Pullman and other associated sites conduct one of the most extensive and well-established genetic resource management projects in the United States. Activities at the WRPIS are the collection, preservation, evaluation, distribution and research of plant germplasm. We utilize current technologies and information to best achieve germplasm conservation. This Management Unit (MU) includes CRIS projects located in Pullman, WA (Western Regional Plant Introduction Station), Prosser, WA (National Temperate Forage Legume Genetic Resources Unit) and Parlier, CA (National Arid Land Plant Genetic Resources Unit). The range in environments provides conditions amenable to the production of high quality seed of a wide and diverse array of plant germplasm. An integral and important goal of each site in the MU is to integrate the disciplines of plant pathology, entomology, genetics, plant physiology, botany, and general agricultural production into research programs. As part of a Regional Research Project (W-6), all sites work in close association and collaboration with the State Agricultural Experiment Station scientists as well as scientists from other state and federal agencies and the private sector. Collaborative projects also exist with scientists at international centers, foreign institutes, foreign national programs, and in the private sector.

-There are 2,770 taxa in 446 genera with a total of 71,847 accessions. This includes special genetic stock collections of pea and bean. There were 682 accessions in 45 genera added to the WRPIS collections from plant explorations, germplasm exchanges and from NCGRP in FY03. During the year, 11,598 accessions were distributed in 17,072 packets, with 693 accessions sent to NCGRP for long term storage.

-One of the biggest achievements for us was to prepare, submit and successfully obtain 'accepted with minor revision' responses from the OSQR panel for the Pullman, Prosser and Parlier CRIS projects.

-Advances were made in regeneration protocols (grass transplants, *in situ* site development, greenhouse production, IPM practices, etc.). Superior seed quality in our distributions was the result.

-Steve Clement, Research Entomologist, was awarded a Visiting Fellowship by the Grains Research and Development Corporation of Australia to conduct cooperative research at a research facility of the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Perth, Western Australia from September to December 2002. The project involved evaluation of chickpea germplasm from the Western Regional Plant Introduction Station (WRPIS) for resistance to the world's worst insect pest of cultivated chickpea, the gram podborer.

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-The first year of a two-year study on the optimum pollinator density for *Allium ampeloprasum* was completed and the second year is in progress. Field samples of two native North American

Allium were collected to look at the genetic diversity within and between six populations using molecular techniques.

-The Plant Pathology program has reported *Fusarium proliferatum* rot of garlic bulbs, which is a first report in North America. Frank Dugan contributed to a revision of the genera *Mycosphaerella* and *Cladosporium*, published a key to graminicolous species of *Alternaria*, and documented *F. oxysporum* f.sp. *cepae* and *Embellisia allii* on garlic in Washington State.

-Understanding the relationships and interactions between monocot species naturally infested with fungal endophytes provides information on the biology of insect resistance in important grass crops. Greenhouse experiments to evaluate 18 tall fescue accessions for resistance to rose grass aphid were completed. Concurrently, a series of laboratory experiments to examine the susceptibility of endophyte-infected wild barley accessions to Hessian fly were conducted. Resulting data indicates that endophyte presence in tall fescue does not mediate resistance to rose grass aphid. With the Hessian fly/barley interactions preliminary results indicate that some endophyte-infected accessions are resistant.

-A cost effective sampling methods that maximizes the effective population size was researched and developed. The reduction in effective population size associated with variation in seed production per plant in three grass species was determined. Also, the utility of inflorescence sampling procedures for a wide range of species and accessions was determined, and lastly we compared cutting, rubbing, and inflorescence sampling methods in three grass species to determine effective population size differences. This research provides a scientific basis for germplasm conservation that minimizes genetic drift within an accession, and provides an efficient and economic strategy for best maintaining large grass germplasm collections.

-Characterizing germplasm collections at both the morphological and molecular levels is critical to the effective utilization of these collections by the scientific community and seed industry. The cool season food legume research program expanded genetic marker and comparative genomic characterizations of selected grain legume accessions, and developed, maintained, and enhanced genetic marker and genomic data management and bioinformatic capabilities associated with these crops. We developed a SNP assay to assess allelic diversity in the pea core collection. Collaborative efforts in molecular genetics of disease resistance in *Pisum sativum* germplasm are under investigation in multiple environments (Washington, Minnesota, France, New Zealand).

-Bean germplasm is occasionally received that has been stored for long periods of time under poor storage conditions, and is in danger of being lost. An embryo rescue and tissue culture program was continued.

-Determining duplication of accessions in a germplasm collection is an important step in the efficient and effective conservation of large collections. A project to determine methods for genotyping accessions in alfalfa, a very heterogenetic species was started. Three alfalfa accessions each with a duplicate set of cultivar names were used. Different sampling methods and marker systems were used to determine the most effective sampling/marker system

combination for genotyping alfalfa.

-Dr. Clement was invited by the Organizing Committee of the XXII International Congress of Entomology to serve as the Overseas Convenor for a session which will be held in Australia in 2003. Domestic and foreign interest in Dr. Clement's research on wild pea resistance to pea weevil was demonstrated by a request for cooperative pea-weevil resistance research from a commercial pea breeder and from breeders and entomologists in Turkey and South Africa.

-Dr. Coyne has constructed a large Bacterial Artificial Chromosome (BAC) library for chickpea. Chickpea is an economically important crop throughout the world. The chickpea BAC library provides a valuable tool for geneticists to study the structure and function of plant disease resistance genes, other economic traits, and comparative genomics with other cool season food legume crops.

-In January, 2003, Dr. Greene began an ARS-Former Soviet Union Scientific Cooperative Program entitled "Development of a GIS-based Interactive Agricultural Atlas to Promote Food Security in the Former Soviet Union". Also in January 2003, Dr. Greene was invited to Vietnam to present "Agrobiodiversity, Pilot Conservation Projects and the Taxonomy Gap" at the First International Workshop and to conduct training on the use of GPS, GIS software, and data management to support the UNDP project entitled "In situ conservation of native landraces and their wild relatives in Vietnam (VIE/01/G35). Dr. Greene has organized week-long GIS training workshop for NPGS personnel, which will be held in September, 2003.

-Dr. Hannan initiated a collaborative project with the Nez Perce Tribe in Lapwai, Idaho and the University of Idaho Extension Service that will serve as a multifunctional project. The goals (tech transfer) are education in small plot, no-till gardening; genetic conservation of traditional food species of the Tribe; and generating fresh produce for distribution at the USDA, Food Distribution Center in Lapwai.

-Barbara Hellier and Rich Hannan were invited to participate in a multinational plant exploration trip to Tajikistan. At the very last moment, they could not go due to lack of country clearance by the US State Department.

REPORTS BY PROJECT

ADMINISTRATION (R. Hannan, V. Lutes)

Visitors to the WRPIS, Pullman/Central Ferry, Washington

Apr. 22 Rita Atta and Franky Reese, USDA, ARS, Human Resources. Beltsville, MD.

Mar. 17 – 19 Neil Clark from the Crop Diversification Centre North- Alberta Agriculture. Neil visited to consult about seed storage and database management for germplasm collections.

May 5 Kathy Hedberg, Newpaper Reporter, Lewiston Morning Tribune, Lewiston, Idaho.

Jun. 3 Richard Webly, WSDA, Spokane, WA. Came down to inspect the garlic nursery for phytosanitary certificatIion.

Jun. 18 Vicky Erickson, US Forest Service concerning cooperative project for evaluation of Blue Wildrye and Mountain Brome.

Jun. 19 Gail Timmerman-Vaughn, Christchurch, New Zealand, visiting scientist worked in the WRPIS molecular genetics lab on Cool Season Food Legume projects.

Jun. 25-27 Carol Spurrier, BLM, Botany Program Leader, Washington DC, on potential for cooperative project for the conservation of native plants for revegetation and restoration.

Jul. 1 Sara Murray, Christchurch New Zealand, visiting scientist collected molecular data for a USDA-Foreign Agriculture Service project on "Increasing the productivity of food legumes: identifying genes controlling seed size and seed number in pea".

Jul. 17 Dr. Haeng-Hoon Kim, Genetic Resources Director, National Institute of Agricultural Biotechnology, Rural Development Administration, Suwon, Republic of Korea.

Aug. Dr. Sujaya Rao, Oregon State University, to confer on plant-endophyte-insect research and to acquire experimental plants from Dr. Clement.

Aug. 13 Dr. Ron Voss, UC Davis, Davis, CA. Toured garlic nursery and fertility evaluation trial.

Sep. 14-19 Estella Cervantes from WRPIS Prosser program trained for one week and extracted genomic DNA for molecular characterization of the *Medicago truncatula* collection.

Sep. 12 Birte Boelt, Head of Research Unit, Senior Scientist, Department of Plant Biology, Danish Institute of Agricultural Sciences. Concerning grass seed production and genetic resources.

Nov. 2002-May 2003 Shim Kang Bo was a visiting scientist from Korea for six months working on safflower molecular characterization. Funding was provided by the South Korean government.

Dec. 2 V., Scientist-Campus, New Celiocha Lamo, NBPGR, New Delhi, India, visiting scientist. Dr. Celia Chalam, Division of Plant Quarantine, National Bureau of Plant Genetic Resources, Pusa Delhi, INDIA

Matt Moffet, Montana State University, visited for one week to extracted BAC library DNA pools on 10,000 clones for a new collaboration with Drs. Norman Weeden and Darleen DeMason on functional pea genomics.

Drs. Nalini Mallikarjuna and H.D. Upadhyaya from ICRISAT crop improvement program toured the CSFL program as part of a USAID Linkage Initiative "Enhanced collaboration on genetic resources and the use of wild relatives in chickpea.

Visitors to the NTFLGRU, Prosser, Washington

Visitors to the NALPGRU, Parlier, California

Feb. 5-6	Dr. C. Erickson, USDA, ARS, Aberdeen, ID (cereal)
Feb. 10-13	Ms. Greg Line, USDA, ARS, Maricopa, AZ (cereal)
Feb. 19	Dr. G. Jolliff, OSU, Corvallis, OR (Limnanthes)
Feb. 26	Mr. Kurt Tetrick, USDA, ARS, WRPIS, Pullman, WA (equipment)
Mar. 25	Dr. B. Waldron, USDA, ARS, UT (Bassia)
Apr. 15-16	Dr. H. Bockelman, Aberdeen, ID (cereal)
Apr. 28	Dr. J. Nunez, UC, Cooperative Extension, Bakersfield, CA (garlic rust)
Jun. 2-3	Ms. B. Hellier, USDA, ARS, Pullman, WA (garlic)
Jun. 13-14	Dr. C. Erickson, USDA, ARS, Aberdeen, ID (cereal)
Aug. 25-26	Dr. P. Felker, Argentina (Opuntia and other arid land plants)

Personnel

Due to the increased research activities in the molecular genetics laboratory by all of the Unit scientists, we will hire a GS5 laboratory technician to assist the SY managing the lab. Ted Kisha began search for Biological Science Technician for the Molecular Biology Laboratory. He received 21 quality applicants, and selection and hiring will commence in January of 2004.
As proposed in the memo to modify the management plan, since we received an increase in the base funding Pullman project, added one wage grade position to the farm crew in order to accommodate the 40 acre increase in the Central Ferry Farm and the increase in germplasm seed increase plots, particularly in the grass collections. Scott McGee transferred to Central Ferry as

a full-time employee November 10. Scott was a great asset to Wayne Olson at the Pullman farm. Scott has already improved the quality of work done at Central Ferry and shows a motivation to perfection. On December 15, 2003 Andy Davis was selected for the new position the Pullman Plant Introduction Farm. Andy will join the Pullman Farm January 12, 2004. We look forward to Andy's work in many different areas of research and conservation as an addition to the Pullman Farm.

Shim Kang Bo was a visiting scientist from Korea for six months from November 2002 to May 2004 working on safflower molecular characterization. Funding was provided by the Soth Korean government.

Planning is underway for the arrival of Yuping Rong , from the China Agricultural University, to study from May through November 2004 as a visiting scientist. She will be working on evaluation and maintenance of grass germplasm. Funding is being provided by the China Agricultural University.

A student internship project for Joyce Hogue was completed in 2003 involving molecular characterization of the important native species *Elymus glaucus* (blue wildrye). This is part of a cooperative project with Vicky Erickson from US Forest Service. Vicky had identified clusters of *Elymus glaucus* based on crop descriptors. Joyce is determining if these clusters will be evident in AFLP markers. If so it means that widespread characterization of *Elymus* glaucus will be possible using molecular markers rather than more laborious field trails.

January 6, 2003 previous Farm Manager, Gary Bloomfield, was hired part-time to help in technical design and construction of equipment and facilities. Working only a few hours a week, Gary's projects for 2003 have included a "heavy duty turn-plate" design and construction for the back blade for the greenhouse Kabota. Gary designed and installed a retractable stairway for the Seed Cleaning lab, and produced three replications of his earlier design of a belt thresher now used for threshing close to 80 percent of our Seed Lab crops. One of these three threshers with a new and different belt material will the added to the Pullman Plant Introduction Lab. The other two threshers were produced for, and will be sent to our affiliate Units at Prosser, Washington and Parlier, California. Parts are produced, but not completely assembled for a future "new generation" thresher which will be produced possibly in 2004.

The Cool Season Food Legume program, Biological Science Technician position was converted from a term position to a permanent position. Michael Cashman was selected to fill this position.

Supervision of Bill Luna was reassigned to Barbara Hellier.

Alan Hodgdon, beet curator, notified us that he will retire in January 2004. His position will be filled in CY 2004, but the management of the beet collection has been incorporated into Barbara Hellier's, Horticultural Crops program.

Civil Rights activities included active recruitment and employment for several of our program of a diverse group of students who include mostly Asian, Central-Asian, Hispanic and women students at Washington State University or Pullman High School in Pullman, or in the Prosser area. Rich Hannan began a collaborative program with the Nez Pierce Indian Tribe of Idaho, the University of Idaho Extension Service, and the USDA, ARS to develop a demonstration garden that addresses goals toward education, food supply to economically distressed families, and the conservation of plant species used as traditional food. Leon Razai, who works for our unit in Dr. Clare Coyne's program, is the Student Director of the Whitman County Special Olympics (WCSO). Once again, and for the 15th year, Dr. Clement served as a Faculty Advisor to Alpha

Zeta, the honorary fraternity for men and women in the College of Agriculture and Home Economics (CAHE), Washington State University. Leslie Elberson, Biological Technician for Dr. Steve Clement, continues to work as a volunteer in the Palouse Area Therapeutic Horsemanship (PATH) Center. It is a program that provides recreational therapeutic horseback riding to people with emotional, mental, and physical disabilities. PATH is a part of WSU Veterinary Medicine People - Pet Partnership. Vicki Bradley, Agronomy Curator, and Barbara Hellier, Horticultural Crops Curator, serve on the Career and Community Development Committee at the Pullman location. Lastly, our Farm Manager, Wayne Olson, has been working and talking with FFA Instructors from around this area. Frank Dugan, Plant Pathologist, provided literature, advice, lab space & equipment to a African American female grad student in Food Science, whose project centers on fungi in grapes & wine. The student is funded by a food safety initiative grant from USDA obtained by her major professor.

Funding

The FY 03 budget (NTL) for this MU is now $2,077,955 (Pullman, WA) and $269,879 (Prosser, WA), and $610,680 (NALPGRU, located at the San Joaquin Agricultural Science and Research Center, Parlier, CA). In addition, we received $350,706 (original allocation of 353K – 0.65% cut) in Regional Research Funds from the Regional Project W-6, through Washington State University. The Pullman CRIS received an increase of $178,830 (NTL) in FY03 as part of an overall National Plant Germplasm System increase. The increase to the Pullman location supported increased personnel costs as identified in the FY03 management plans, as well as augmented the research programs of our crop collection maintenance and research.

In addition, Dr. Steve Clement, Research Entomologist, was awarded a Visiting Fellowship by the Grains Research and Development Corporation of Australia. This award included $10,000 to cover lodging costs in Australia. Dr. Clare Coyne. SCA. Germplasm evaluation. CSU, Ft. Collins, CO. $4,960 Pass through, and Dr. Clare Coyne. New Zealand. $1,700 as part of visiting scientist program.

Facilities

In accordance with the infra structure development and modifications proposed, the following items were done. Construction of the proposed drying shed was completed, and the facility is being utilized as both a drying shed and post harvest seed handling facility. A new elastomeric coating was applied to the roof of the seed storage unit. All but the final coat were applied in the Fall of 2002, but due to an early season temperature drop the final coat was delayed until spring of 2003. Headquarters provided most of the funding for the computerized greenhouse temperature control system, ARGUS.

We contracted with WSU for the installation of a new transformer ($95,000) to provide dedicated power to the Seed Storage unit. We will begin the installation of a new irrigation system on the new 40-acre piece at Central Ferry. Also we will install two more 10,000 gallon tanks into the existing drip irrigation system. We contracted with WSU to purchase a used trailer to be used as modular office space on the WSU campus because there is no space available in Johnson Hall.

In Prosser the equipment storage and post-harvest drying shed was completed. Also, the space assigned to our unit by WSU was modified into a tissue culture lab. Basically, we solved most of our space problems for the time being. Also, in Prosser, the greenhouse project that was proposed in the FY03 ARMPS has not developed. At this time the status of this greenhouse

project is unknown.

Talks and Presentations for R. Hannan

Travel, Invitations, Special Awards and/or Training for Hannan or as indicated.

Oct. 21-25 Phoenix, AZ to attend the USDA-ARS Leadership Conference .

Jan. 28-Feb. 01 Traveled to Parlier, CA and Tucson, AZ to do a site visitation and attend the Desert Legume Program Advisory Goard Meeting respectively.

Apr. 21-25 Vickie Lutes traveled to New Orleans, LA to attend the National Conference for ARS Office Support Professionals.

May 20-21 Traveled to Parlier, CA for site visit.

Jun. 10-13 Traveled to Miami, FL to attend the Plant Germplasm Operations Committee Meeting.

Jun. 23-24 Traveled to Parlier, CA for a site visit.

Sep. 10-14 Traveled to Tucson, AZ to attend the Desert Legume Program Advisory Board Meeting and collect wild *Phaselous* in eastern Arizona.

Sep. 24-28 Traveled to College Station, TX to participate in the panel review of the USDA cotton germplasm maintenance program.

Nov. 17-21 Vickie Lutes traveled to Houston, TX, to attend the USDA-ARS Administrative and Financial Management Workshop.

Committees, Other Assignments, Activities and News

Advisory Board to the Desert Legume Program (DELEP), Tucson, AZ, (Chair 2000-03)
WSU, Graduate School Representative for Ph.D. and MS defenses
WSU, Adjunct Faculty, Department of Horticulture and Landscape Architecture
Serve on Committee for Doctoral Candidate, Khalid Al-Saad (completed 5/2003)
Serve on Committee for Doctoral Candidate, Mark Minton (completed 9/2003)
Bean Improvement Cooperative (BIC)
Plant Germplasm Operations Committee (PGOC) (Chair 2003-04)
PGOC, Policy for Acquisition and Distribution Subcommittee (2001-present)
Washington State University Plant Growth Facilities Committee
Sigma Xi

AGRONOMIC, GRASS AND SAFFLOWER (V. Bradley, B. Guenthner)
Germplasm Conservation Activities

The Agronomy Regeneration Program personnel are responsible for maintaining the cool-season grass and the *Carthamus* collections.

CARTHAMUS
The *Carthamus* collection at the Western Regional Plant Introduction Station consists of 2,423 accessions. We acquired ten new safflower (*Carthamus tinctorius)* accessions from South Korea in 2003. Five hundred and thirty-six *Carthamus* seed packets (24 orders) were distributed. One hundred and twenty-three samples were sent to the NCGRP for back-up.

Two hundred and sixteen accessions of safflower were planted for regeneration at Central Ferry, Washington this year. In addition, 80 accessions were regenerated by the staff at the National Arid Land Plant Genetic Resource Unit at Parlier, California.

A replicated evaluation nursery of 79 accessions was planted at Central Ferry, Washington. Descriptor data, including fresh-flower-color, dry-flower-color, head size, head shape, height, spines, branching, and bloom date, were collected on these accessions. Digital images of the accessions were taken for downloading into the Germplasm Resources Information Network (GRIN).

The data from the project to collect seed descriptors on all safflower accessions were downloaded into GRIN. Seed color, (White, Cream, Grey, Grey Stripe, Tan, Tan Stripe, Brown, Brown Stripe, Black), seed shape (Oval, Conical, Crescent) and presence or absence of pappus was recorded as a percentage of the entire distribution sample. For example: The distribution sample of PI 613384 was recorded as having 5% gray-stripe-colored seeds and 95% cream-colored seeds.

GRASS
The temperate grass collection consists of 17,973 accessions in 974 taxa. We planted 620 grass accessions for regeneration in the 2003 nurseries. Five-hundred and thirty of them germinated. Twelve of the 90 accessions that did not germinate had few seeds and we attempted to germinate all of the seeds. These accessions will be de-accessioned in GRIN in 2004. Others (approximately 15) will be archived (placed in the freezer) and inactivated because multiple attempts did not yield plants. The rest will be considered for regeneration in the future. However, unless these accessions are decided to be of great importance at this time, resources will be used to regenerate accessions that are more likely to produce seed. We harvested approximately 417 grasses in the second year nurseries as well as 70 first year grasses. We received 247 new accessions, and Seed Storage personnel distributed 4,711 packets (152 orders) of grass in 2003. Three hundred and twenty-two samples were sent to the NCGRP for back-up.

Last year, we changed our grass harvest technique to improve the effective population size during regeneration. Ten heads were cut from each plant in accessions with more than 60 plants. A back-up sample of heads was harvested in case the quantity of seed from the ten-head-sample

was not adequate. These two sample types were weighed to determine seed quantity. This information was used in 2003 to determine the number of heads to harvest in order to acquire an adequate quantity of seed in different species of grass. As we anticipated, the data indicated that grass species was only one factor we should consider when harvesting. Other factors were number of plants in the accession plot, number of heads per plant, seed set, and seed shattering. Since harvest methods differed among species this year, we recorded this information and it will be linked in GRIN to the 2003 seed inventory for each accession.

The *Phleum* collection contained several inventory samples of each accession when we received it from Geneva, New York. Most of these inventories were not needed for distribution or regeneration. In an effort to clear seed storage space, we took small samples of seed of 650 W6-numbered and PI-numbered *Phleum* accessions to be archived and placed them in foil packets to be sent to NCGRP. We also created regeneration packets if they were needed. The old paper packets were photographed in case data from them are needed in the future, and the extra seed and old packets were discarded. A data file of this information was compiled for downloading into GRIN.

Research Activities

The two-year replicated evaluation of 127 accessions of *Lolium multiflorum* and 6 check cultivars was completed this year. Single plant data were taken for ten descriptors. Data were entered for statistical analysis and for downloading into GRIN.

We are continuing a study to identify duplicate accessions within our grass germplasm collection. Twenty-four plants from two populations of *Dactylis glomerata* `Latar´, two populations of *Eragrostis trichoides* `Bend´, and four populations of *Bromus inermis* `Manchar´ were grown in the greenhouse. After tissue samples were collected the plants were planted at Central Ferry, Washington in a replicated evaluation plot. Descriptor data will be collected on these plants for two years. We will use AFLP analysis on the DNA extracted from the tissue samples.

Talks and Presentations

Mar. 25 Vicki Bradley presented “Biodiversity Prospecting, the Convention on Biological Diversity (CBD), and the International Undertaking on Plant Genetic Resources for Food and Agriculture (IU)” ,to the History of Genetics Class at WSU.

Nov. 2 Vicki Bradley presented the annual summary of the grass regeneration program at the Forage and Turfgrass CGC meeting at the Crop Science Society of America National Meetings, Denver, Colorado.

Nov. 5 Vicki Bradley presented “ The National Plant Germplasm System: The Western

Regional Plant
Introduction Station.", at the Forest Service Native Plant Meetings in Portland Oregon.

Travel, Invitations, Special Awards and/or Training

Jan. 21 – Apr. 8 Vicki Bradley attended WSU Crop and Soil Sciences Class: History of Genetics.
Apr. 1-3 Vicki Bradley attended the Intermountain Native Plant Summit in Boise, Idaho to establish
contacts with people working with native plants.
Jan. 9-10 Bob Guenthner attended Pesticide re-certification training. University Inn, Moscow, ID.
Feb. 19 Bob Guenthner attended the annual respirator fit test and training at Pullman, WA.
Jun. 10 Vicki Bradley and Bob Guenthner completed mandatory ADA training.
Nov. 1-2 Vicki Bradley attended Forage and Turfgrass CGC, Denver, Colorado.
Nov. 3-6 Vicki Bradley attended Forest Service Native Plant Meetings, Portland, Oregon.

Committees, Other Assignments, Activities and News

Ex-officio member Forage and Turf GrassCGC.
Ex-officio member New Crops CGC.
Member Association for the Advancement of Industrial Crops.
Member Crop Science Society of America.
Member Western Society of Crop Science.
Member USDA,ARS Pullman location Career and Community Development Committee.
Adjunct Scientist, Crop and Soil Sciences Department, Washington State University.
Editor of WRPIS safflower data link on FAO Ecoport website.
Editor of Safflower webpage.
Member Descriptor Subcommittee of the Forage and Turf Grass CGC.
Oct. 7 Vicki Bradley submitted an annual report on the safflower collection to the New Crops Crop
Germplasm Committee.
Nov. 7 Vicki Bradley hosted the Veteran's Day Pot-Luck.

Plans for 2004

1. Regenerate 540 grasses and 200 safflower.
2. Complete data analysis on *Lolium multiflorum* accessions.
3. Collect evaluation and AFLP data for duplicate accession study.
4. Edit safflower seed descriptor "example" images for downloading into GRIN.
5. Attend PGOC meetings.
6. Continue work to bring more native grasses into our collection.

7. Collect native grass germplasm in Montana.

Cool Season Food Legumes (C. Coyne, M.Cashman)

Germplasm Conservation Activities

1,025 accessions (annual and perennial *Cicer*, *Lathyrus*, *Lens*, *Lupinus*, *Pisum*, *Trigonella*, and *Vicia* species) planted for regeneration and descriptor data. 657 accessions (238 *Cicer* and 419 *Pisum*) were distributed for cooperator evaluations. Transplant production program was expanded to include perennial *Lathyrus*, *Vicia*, *Lupinus* and wild annual *Trigonella*. A shadehouse was constructed outside the CSFL greenhouse for preparing transplants for the field. Assembled software and hardware for automating the collection of descriptor trait evaluations. 34,586 descriptor data and digital images from replicated field trials, accession single plots, and from cooperators were prepared and released for entry into the GRIN database.

Research Activities

Planned, organized, obtained external funding and conducted replicated field trail in two cooperator locations for QTL mapping of quantitative resistance to Aphanomyces root rot and Fusarium root rot and presented data at two meetings to peers and one to the U.S. grain legume industry. Cooperated on germplasm evaluations of pea and chickpea for Fusarium root rot and Ascochyta blight, respectively resulting in one peer-reviewed manuscript, two non-peer reviewed manuscripts, and two meeting presentations. Planned, obtained external funds and conducted analysis to determine seed protein concentration data on 482 accessions of the pea core collection and presented results to peers and industry. Planned, organized, obtained external funding and conducted pea BAC library characterization and utilization experiments in collaboration with visiting scientists. Conceived, planned evaluation experiments, and mentored student-applicant awarded graduate research fellowship to study perennial *Cicer* (declined). Conceived, planned, submitted and was awarded funding for a USDA-ARS Postdoctoral Fellowship project on haplotyping for association mapping studies in the cool season food legume collections.

Talks and Presentations

Jan. 30 USDA-CSREES Special Grant Program for Cool Season Food Legumes Research Review with industry and grower stakeholders and legume researchers, Moscow, ID. Presented research project progress report. Presented new research proposal “Co-dominant markers for rapid selection of Fusarium and Aphanomyces root rot resistant lines in fall-sown pea”, Inglis and Coyne, co-principle investigators.

Jun. 18 Presented talk on the “Application of SNPs in identifying new positive alleles for genetic resistance to Aphanomyces root rot in pea germplasm” 2nd International Aphanomyces Workshop, Pasco, WA.

Jun. 20 Presented talk on "Pea BAC library update" at a mini-symposium on legume research of ARS and WSU for five visiting scientists from New Zealand, France and USADry Pea and Lentil Council representative.

Aug. 9 –13 Poster presentation "Characterization of chickpea differentials for *Ascochyta rabiei* using an improved virulence assay". Chen, W., C.J. Coyne, T. Peever, and F. Muehlbauer. American Phytopathological Society, Charlotte, North Carolina.

Oct. 24-25 Presented talk "Allele discovery in the U.S. pea core collection". Poster presentations "Incidence of Potyvirus the U.S. *Lupinus* Germplasm Collection", "Resistance to Fusarium root rot in the Pisum core collection", and "Variation for protein in the USDA pea core collection". North American Pulse Improvement Assoc. Biannual Meeting Abstracts, Sacramento, CA.

Oct. 28 Poster presentation at Washington State University Department of Crop and Soil Sciences Genetics Poster Symposium, Pullman, WA.

Nov. 2-6 Poster presentations "Refined pea core collection based on qualitative and quantitative characteristics" and "To Classify or Not To Classify: A Case Study in White Lupin. To Classify or Not To Classify: A Case Study in White Lupin". Noffsinger S. L., C. J. Coyne, and E. Van Santen. ASA-CSSA-SSSA Annual Meeting, Denver, CO.

Travel, Invitations, Special Awards and/or Training

Jan. 11-13 International Plant and Animal Genome meeting to participate in legume and germplasm allele mining workshops in San Diego, CA.

Oct. 13-17 Attended bioinformatics training course on allele mining and *in silico* research methodologies, Albany, CA.

Oct. 24-25 Participated in North American Pulse Improvement Assoc. Biannual Meeting, presented one research talk, one curator report to the *Pisum* Crop Germplasm Committee and three posters, Sacramento, CA.

Nov. 2-6 Symposium Organizer and Chair for the annual meeting of CSSA C-8 Section on "Sustainable

Agriculture and Plant Genetic Resources", presented two curator reports to Cool Season Food

Legume, and Clover and Special Purpose Legumes Crop Germplasm Committees, and presented

two posters, Denver, CO.

Committees, Other Assignments, Activities and News

Ex-officio member of the Food Legume Crop Germplasm Committee.
Member, Plant Germplasm Operating Committee

Plans for 2004

1. Plant three bays of 109B greenhouse kept full 12 months of transplants or new collected accessions with very few seed, accessions with low viability (primarily *Vicia* sp. and a few *Pisum sativum*), and accessions without sufficient seed for field or screenhouse seed regeneration.
2. Continue *in vitro* germination to new accessions to increase population size for regeneration of perennial *Cicer* species. Increasing the effective population size should increase conservation of genetic variance and increase the opportunity to discover intra-accession diversity.
3. Continue *in vitro* germination to new accessions to increase population size for regeneration of wild annual *Cicer* species. Increasing the effective population size should increase conservation of genetic variance and increase the opportunity to discover intra-accession diversity.
4. Continue expanding planting of perennial *Cicer* species with drip irrigation and rabbit protection.
5. Continue the transplant program for of germplasm assigned to the Cool Season Legume Program.
6. Continue virus-testing of all annual *Lupinus* species for seed-borne poty viruses Plant two cycles of *Pisum* regenerations in the east screen houses. Plant once cycle of Pisum in the west screenhouse and one cycle of low-seed accessions after pea in the west screenhouse.
7. Continue second cycle planting in both screenhouses to pregerminated seed in transplant flats started in the cooler greenhouse in June/early July.
8. Initiate replicated environment x genotype experiment on the pea core collection, three years and two environments.
9. Deaccession non-viable W6 accessions in the Lens and Vicia collections.
10. For pea germplasm, evaluating disease resistance in the field and greenhouse using traditional and molecular techniques, prepare and present results to the USDA-CRSEES Cool Season Food Legume grant program. Present progress report on Fusarium wilt race 2 and on Co-dominant markers for rapid selection of Fusarium and Aphanomyces root rot resistant lines in fall-sown pea, and January 28, 2004.
11. On the *Pisum* core collection, continue assessing genetic diversity of germplasm using traditional and molecular techniques (genetic markers and genomics).
12. Hire a USDA-ARS post-doctoral proposal on the *Pisum* core collection, continue assessing genetic diversity of germplasm using single nucleotide polymorphisms (SNPs).

13. USDA National Research Initiative 2004 grant proposals on genomic approaches to legume germplasm characterization with Norman Weeden, Montana State University and Fred Muehlbauer on chickpea genomics.
14. USDA National Research Initiative grant proposal: Pea seed-borne mosaic virus of pea: Martin, USDA-ARS Hort Crops Research unit, Corvallis, OR (resubmitted 2005 to Plant-Microbe Interaction).
15. Submit new proposal to the USDA-CRSEES Cool Season Food Legume special grant program: January 28, 2004.
16. Conduct experiments for funded USDA-Foreign Agriculture Service grant for Increasing the productivity of food legumes: identifying genes controlling seed size and seed number in pea: Target Subject Area: Promoting Food Security through Food Productivity
17. Prepare 2004 exchange proposal with ICRISAT on molecular characterization of chickpea mini-core published by ICRISAT during visit to ICRISAT in 2004.
18. Conduct 2004 plant exploration proposal to collect *Lathyrus* and *Lupinus* species from the Pacific northwest
in coordination with Greene, Hellier and Raven.

HORTICULTURE CROPS (B. Hellier, R. Staska)

Germplasm Conservation Activities

The Western Regional Plant Introduction Station Horticulture Crops Program has curatorial responsibility for 225 genera, and maintains a total of 5,613 accessions.

In 2003 the Horticulture Crops Program had increase plots in 11 locations: Greenhouse 3, Greenhouse 44, the shop Greenhouse, 109 perennial garden (PG), lone pine perennial garden (LPPG), the WSU Tukey Orchard, NRCS PMC (fields 2A & 2, field B, field X, lone pine) and at Central Ferry.

Greenhouse increases included accessions of *Allium, Lactuca, Callistephus, Scabiosa, Hippocrepis, Plantago, Polygonum, Triglochin*, and *Astragalus*. The bulk of our greenhouse space is dedicated to *Lactuca*. There were 53 accessions of *Lactuca sativa* started, and 49 were harvested. Twenty-three accessions of wild *Lactuca* species were started with 15 germinating. We also finished harvesting 24 accessions of *Lactuca serriola* planted in 2002.

For the 8 field locations, a total of 560 accessions were harvested, terminated, maintained and/or established. The accessions in the field encompassed 30 genera and 168 species. New nurseries started in 2003 at Central Ferry were field 2A&2. Thirty-five broadleaf accessions were planted for increase in fields 2A and 2. We also seeded nine accessions of annual broadleaves at lone pine. We're still trying to determine the best method for starting annual broadleaves. In the past we had started seed in the greenhouse for transplanting but the seedlings would initiate flowering before we were able to get them in the field . This year, we direct seeded the annual broadleaf accessions. We got mixed results with this method of increase. Some accessions were very vigorous, while others did not germinate well.

At Central Ferry two new nurseries were established.. In the bunkhouse field we planted 48 accessions of onion relatives and chives. These are for increase and/or reidentification. Wild *Allium* accessions from Kazakhstan and a few miscellaneous *Allium* accessions were planted in the new nursery west of the greenhouse.

Our controlled pollination program using screen cages was very successful in 2003. We caged 16 broadleaf and 18 *Allium* accessions in the field and three *Callistephus* and one *Scabiosa* accession in the greenhouse. We used both honey bees and blow flies as pollinators. As of December, all the 2003 caged accessions for which the seed had been cleaned produced excellent amounts of seed . For 2003, we used 55,000 blow fly pupae at a cost of $343.50. We used 18 honey bee nuc's, two of which were produced in house from the hives kept at Central Ferry. The total cost for the 16 honey bee nuc's purchased from WSU Bee Research program was $720.00.

2003 was another interesting year of events related to garlic increase. We dealt with severe erosion in the spring and hard soil at harvest. Heroic efforts were taken in both seasons to preserve the nursery: recovering bulbs with soil while slogging through thick mud, using crow bars to lift bulbs at harvest, hand watering plots to soften soil before digging. To try to prevent erosion and hard soil from happening in 2004, we are trying some new soil management practices in the 2003-2004 nursery. After discussions with the farm crew, we decided to plant winter canola between the rows for erosion control. To combat hard soil, peat moss was banded into the rows. Although disease incidence was lower this year than last, to try to further decrease the amount of *Fusarium* infection, all of the accessions planted in the 2003-2004 nursery were treated with fungicide prior to planting.

Research Activities

Papaver bracteatum pollination: At Central Ferry we tested the efficacy of blow flies and honey bees on two accessions of *Papaver bracteatum*. Plants of the accessions were covered by 4 cages; two cages for each accession. Honey bees and blow flies were used as pollinators in separate cages for each accession. The plants pollinated by honey bees produced far more seed than those pollinated by the blow flies for both accessions.

Optimizing pollinator density for *Allium ampeloprasum* increase: We transplanted the seedlings needed for the second year field trial in September. This experiment will be finished in 2004.

Allium sativum fertility evaluation: Fertility characteristics were taken on all the hardneck garlic accessions. This included flower, spathe, bulbol, anther and pollen data. Evaluation was funded with money received from an NPGS Evaluation Proposal.

Talks and Presentations

Jan. 24 to the Colton 4H club.	Russ Staska, Colton, WA. Participated in a leading a bulb forcing seminar
Oct. 3	Barbara Hellier, Providence, RI. Presented a program summary report to the Leafy Vegetable CGC.
Oct. 5	Barbara Hellier, Providence, RI. Presented a program summary report to the Root and Bulb CGC.
Nov. 2	Barbara Hellier, Denver, CO. Presented a program summary report to the Clover and Special Purpose Legume CGC.

Travel, Invitations, Special Awards and/or Training

Jan. 9-10	Russ Staska, Moscow, ID. Washington State Pesticide Applicators Recertification meeting.
Jan 2003-May 2003	Russ Staska, Pullman, WA. Attended WSU Entomology 361 & 362 Apiculture (26 classes).
March 4,11,	Russ Staska, Clarkston, WA. Attended Master Gardening recertification classes.

14, 25

Apr. 1-4 Barbara Hellier, Boise, ID. Attend the Intermountain Native Plant Summit. Attended this meeting to establish contacts with land management agency personnel to foster native plant collection.

Jun. 2-6 Barbara Hellier, Dever, CO. Attended the OPM Women's Leadership Seminar.

Jun. 30- Barbara Hellier, Parlier, CA. Visited the NALPGRU to learn garlic fertility

Jul. 2 evaluation methods from Dr. Maria Jenderek.

Jul. 13-15 Barbara Hellier, Columbus, OH. Attended the Herbaceous Ornamental CGC meeting held in conjunction with the Ohio Floriculture Short Course.

Aug. 7 Barbara Hellier, Seattle, WA. Traveled to Seattle, WA to experience the inefficient system of communication between the field offices and headquarters of the USDA-ARS travel staff.

Oct. 2-6 Barbara Hellier, Providence, RI. Attended the Leafy Vegetable and Root and

Bulb CGC meetings held in conjunction with the American Society for Horticultural Science.

Nov. 1-3 Barbara Hellier, Denver, CO. Attended the Clover and Special Purpose Legume CGC meeting.

Nov. 19 Barbara Hellier, Pasco, WA. Attended the Pacific Northwest Vegetable Growers Association conference.

Nov. 19-20 Russ Staska, Pasco, WA. Attended the Pacific Northwest Vegetable Growers Association conference.

Committees, Other Assignments, Activities and News

Barbara Hellier, Ex-officio member of the Root and Bulb Crop Germplasm Committee.
Barbara Hellier, Ex-officio member of the Leafy Vegetable Crop Germplasm Committee.
Barbara Hellier, Ex-officio member of the Herbaceous Ornamental Crop Germplasm Committee.
Barbara Hellier, Ex-officio member of the New Crops Crop Germplasm Committee.
Barbara Hellier, Ex-officio member of the Clover and Special Purpose Legume Crop Germplasm Committee.
Barbara Hellier, Member of the PGOC Medicinal Plant Subcommittee.
Barbara Hellier, Member of the American Society for Horticultural Science.

Plans for 2004

BEETS (A. Hodgdon)

Activities

Seed Increases

Thirty-eight accessions were started for seed increase at W-6 in 2003. Sixty-one accessions were harvested from plants started in 2000, 2001, 2002, and 2003. Nine accessions in the increase program in 2003 did not germinate. Four of these were hard seeded accessions which typically have low germination rates. I tried to germinate three accessions which were inactive PI numbers in GRIN. These did not germinate. Ten accessions started in 2002 were increased out doors at the Lone Pine site at W-6. Five of these accessions were not isolated at pollination, and were discarded. Four of the isolated accessions had good plant numbers and excellent seed yield. Germination tests of the 2003 increase seed will be done in 2004. The *Beta* increase program has a carryover of forty-five accessions from 2003 to 2004. Five of these are being revernalized due to incomplete flowering induction.

Seed Germination

One hundred twenty-two accessions were germination tested in 2003. All of these had greater than seventy percent viability, but seed dormancy was higher than fifty percent in sixty accessions tested.

Seed Storage Activity

A total of 480 accessions were distributed in 2003 in thirty-two seed orders. We acquired eighty-six new accessions in 2003. Two accessions were backed up at NSSL.

Accession Evaluations

In 2003 we continued the accession evaluation program with seven evaluators participating from stations around the United States. Evaluation data is entered into GRIN by W-6 staff.

In 2003 I compiled descriptor information on all accessions in the increase program. Descriptor records from increases from 1993 to 2003 have been entered into GRIN. The descriptor project is ongoing with the records for 2003 up to date and in Grin for the accessions that have been completed. In 2003 I took photos of twenty eight accession and all of these have been entered into GRIN.

Travel, Invitations, Special Awards and/or Training

In late February, 2003 I traveled to San Antonio, Texas to attend the meeting of the American Society of Sugar Beet Technologists. I presented my final report to the *Beta* Crop Germplasm Committee on the *Beta* germplasm activity at W-6.

Committees, Other Aassignments, Activities and News

WSU Growth Facilities Advisory Committee
Beta Crop Germplasm Committee

Plans for 2004

1. In 2004 I plan to retire on January 24.
2. NOTE: The entire *Beta* collection will be maintained as part of the Horticultural Crops Program now
managed by Barabara Hellier.

PHASEOLUS (M. Welsh, J. Thayer, R. Yarbrough)

Germplasm Conservation Activities:

During the year 2003, 447 accessions from the bean collection were increased under greenhouse conditions. There were 101 accessions of species other than *Phaseolus vulgaris* grown in the increase cycle, including very successful production of several wild species. All accessions grown were tested for the presence of BCMV. Presently 21.2% of the collection is labeled 'tested virus-free'. In addition to lines cleaned up while being increased, 32 accessions, previously testing positive, were run through the virus cleanup program and are now labeled 'tested virus-free'.

The BCMV files continued to be updated as data obtained during the increase cycles was collected. The program to eradicate BCMV in the day length neutral accessions labeled "non-BF" in GH 44 has been quite successful with the number of lines "cleaned-up" increased substantially. Greenhouse 44 is now dedicated full-time to BCMV clean-up.

Within the collection 19 accessions were identified taxonomically to species or were re-identified to correct species. A uniform system of recording germplasm increase information, including plant character data, BCMV testing results and harvest results is used in the *Phaseolus* germplasm increase program. The collection and recording of this information was done on a regular basis. More plant character descriptors have been added to the list to improve the information collected and made available.

The *Phaseolus* collection received 108 new accessions during the year, which included nine species other than *P. vulgaris*. We were particularly heartened to receive 2 species, *P. costaricensis* and *P. talamancensis*, not previously represented in the collection. Plans are under way to increase these accessions as soon as possible.

Information contained in the GRIN web-page descriptor site has been updated and continues to be monitored and changed as additional data is obtained. Emphasis is placed on updating the information to keep it a current resource. A program to update and clarify the information in the GRIN passport data successfully entered data not previously available in the system and, simultaneously, any needed corrections were made.

Fifty-eight accessions, not previously deposited, were sent to the NCGRD for long-term back-up storage; four species were represented in the seed sent for long-term storage.

The program for biological control of insect pests in the greenhouses continues to have varied success. We hope the new equipment, which will increase the levels of humidity in GH 109, will help us to have greater success. Higher humidity encourages beneficial predator insects and discourages the insect pests.

Research Activities:

Seed has been collected from plants that were successfully regenerated via the embryo rescue and tissue culture program. These include *Phaseolus vulgaris*, *P. coccineus*, *P. acutifolius* and a few wild *Phaseolus* accessions: *P. polystachios* var. *sinuatus*, obtained in 1999; *P. maculatus* obtained in 1995; *P. ritensis*, obtained in 1985; an unknown *P. spp.*, obtained in 1985; and a P. spp. (*carter*i-nom. inval.), obtained in 1985. None of these accessions had been grown before at this station. We have had excellent success in this part of the increase program. The tissue culture approach will continue to be applied to the attempts to "rescue" endangered or recalcitrant accessions.

We returned to Guatemala more of the seed from the accessions that we had received in an exchange program, which we had received seed in trade for growing some for them. This has been a very successful way to get more seed into the collection and could be used, I think, to improve our relationship with other countries regard to germplasm acquisition.

The program to reduce the number of duplicates in the collection has been initiated. With the help of Ted Kisha we will look at DNA profiles of selected groups of "old world" accessions that have a greater probability of containing duplicate accessions. The candidates were selected through a screening system using passport and morphological data. Tissue from the first series of 47 accessions has been submitted to the molecular biology lab.

Talks and Presentations

No presentations.

Travel, Invitations, Special Awards and/or Training

Oct. 22-25 Molly Welsh went to Sacramento, CA to attend the B.I.C.-Bean Improvement Cooperative, the *Phaseolus* Crop Germplasm Committee, and the W-150 Regional Project meetings.

Committees, Other Assignments, Activities and News

Member, *Phaseolus* Crop Germplasm Committee
Member, Bean Improvement Cooperative Genetics Committee
Member, W150 Regional Project
Member, Seed Savers Exchange

Jan 27-31 Molly Welsh served as the Acting Research Leader while Rich Hannan-Research Leader-was out of the office.

Mar. 24 Molly Welsh was asked to review a project proposal of the International Science Center (ISTC)-Russia & the Science and Technology Center-Ukraine (STCU) submitted to the Civilian Research and Development Foundation

of the United States.

Plans for 2004

1. Continue the expansion of the knowledge base of information concerning increase of wild or difficult to maintain species.
2. "Map out" sections of GH 109 for purpose of expanding the number of "non-vulgaris" accessions, in particular "wild ones".
3. Optimize the GH 109 floor plan that allows different species to be grown in the most favorable area for their optimum development.
4. Further explore the possibility of increasing wild P. coccineus accessions, using caged bees for pollination.
5. Expand the program that uses molecular marker to identify duplicates within the collection.
6. Further acquisition of germplasm: a) donations from collection trips, b) contributions from the accessions placed in storage at NSSL, c) requests for accessions from CIAT.
7. Improve the yield of day-length sensitive accessions through introduction of supplemental lighting and better control of humidity and heat.
8. Further cooperate with international agencies involved in similar work to promote and enhance germplasm preservation, in particular ideas about 'in situ' conservation.
9. Continue the upgrade and correction of data in GRIN-through search in old records and verification of stored seed.
10. Begin work on a pictorial record of original seed.

ENTOMOLOGY (S. Clement, L. Elberson)

Germplasm Conservation Activities

Steve Clement advised curators on management of insect and mite pests of greenhouse and field plants, and assisted Dave Stout in resolving status of an insect pest (khapra beetle) before a seed shipment could take place. Steve Clement also secured the identity of a bruchid pest that arrived in bean seed shipped to the Pullman seedbank from the USDA-ARS National Center for Genetic Resources Preservation in Ft. Collins, Colorado. Steve Clement's 8 January 2003 letter to Loren Wiesner alerted him of the insect's identity and the potential for accidentally importing a potential pest of regulatory concern into the U.S. Dr. Clement also hosted a class from the University of Idaho and talked about the germplasm conservation activities at the Western Regional Plant Introduction Station.

Research Activities

PCR Detection of Viable Tall Fescue Endophyte. The first phase of this cooperative project with Ted Kisha was completed in 2003. A poster by Ted Kisha at the Crop Science meeting summarized results. Additional research showed that this method can detect endophyte in tall fescue seed, so planned research on preservation of viable endophyte over the course of seed regeneration can proceed in 2004. It is the aim of new research to determine if current seed regeneration procedures at the Pullman facility are adequate to maintain viable endophyte in seed.

Regeneration of Caged Allium Germplasm with Flies. Data from the 2002 research season were summarized and statistically analyzed so Barbara Hellier could present a poster at the 2003 Horticulture meetings. The results showed that the bottle fly is far superior to the house fly for field cage pollination of *Allium ampeloprasum* and that a rate of 500 bottle flies per cage produced the most seed (Fig. 1). This cooperative Horticulture-Entomology project will continue in 2004 with some changes, namely, only bottle flies will be evaluated and the study will involve two accessions of *A. ampeloprasum*. This way, we will test the ability of the bottle fly to pollinate multiple accessions.

Wild Barley – Endophytes – Hessian Fly Interactions. Additional research in 2003 confirmed earlier results that *Neotyphodium* endophyte in wild barley confers plant resistance to Hessian fly (Table 1). Our aim was to develop a stronger data base to support publication of this research in a good scientific journal. A poster of this research was presented by Steve Clement at the 2003 national meetings of the Entomological Society of America in Cincinnati, Ohio.
Figure 1. Relationship between pollinating fly rate and leek seed yield weight.

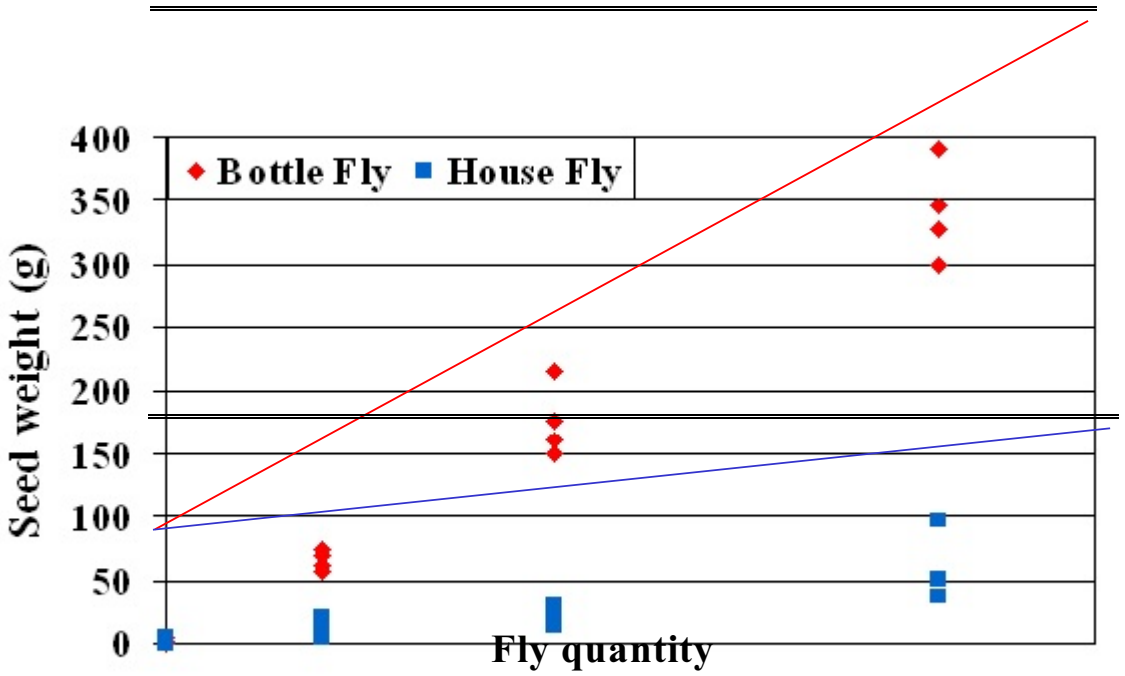

Table 1. Mean number of Hessian fly on endophyte-infected and endophyte-free wild barley accessions.

Expt	PI accession	Endophyte status[a]	n	Mean counts Larvae	Puparia
1&5[b]	440420[c]	E+	12	0	0.0
		E–	13	8.31	3.70
2	314696[d]	E+	10	0.10	0.0
		E–	10	8.50	0.10
3	269406[d]	E+	6	0.83	2.50
		E–	8	6.25	8.75

4	440413 [d]	E+	7	2.57	1.43
		E–	5	8.40	3.00

[a] E+, infected; E–, uninfected.
[b] Means computed from pooled values of experiments 1 and 5.
[c] ***H. brevisubulatum.***
[d] ***H. bogdanii.***

Pea Weevil Resistance in *Pisum sativum x P. fulvum* Crosses. A glasshouse experiment evaluated 160 F_3 *P. sativum* x *P. fulvum* plants for pea seed weevil resistance. The study involved the transfer of thousands of mature weevil eggs to pod surfaces with subsequent daily observations for determining the fate of every egg and hatching neonate (hatch, no-hatch, behavior after hatch, neonate survival to seed, etc.). We also recorded several plant traits (first flower, flower color, nodes, number of pods, seeds per pod, etc.) and the level of seed damage using a scale developed earlier and published in Crop Science (2002, 42:2167-2173). Briefly, we discovered pod-based resistance in several crosses but no seed resistance. We are in the process of summarizing and analyzing the large data set.

Cereal Leaf Beetle – Fungal Endophyte – Grass Interactions. The cereal leaf beetle is a fairly new pest in the Pacific Northwest. Its host range includes wheat and many grass species, including taxa maintained by the Pullman PI Station. Low numbers of the beetle have been detected at Central Ferry, so the insect has the potential to harm grass nursery plants. Pilot studies were initiated in 2003 to determine the susceptibility of temperate grass taxa (tall fescue, perennial ryegrass, wild barley) to feeding by cereal leaf beetle adults. This cooperative project with Terry Miller, Department of Entomology, Washington State University, quantified adult feeding and survival on replicate plants of each taxa in greenhouse cages. Adults were collected in an irrigated spring wheat field near Connell, Washington and transported to Pullman for the experiments. Briefly, adults readily fed on mature plants of tall fescue, perennial ryegrass, and wild barley. In addition, data from these pilot studies showed less feeding and higher adult mortality on endophyte-infected tall fescue compared to endophyte-free plants of the same grass. The endophyte in perennial ryegrass and wild barley did not appear to adversely affect adult feeding and survival. This study will be expanded in 2004.

Talks and Presentations

Jan. 24 Seminar talk 'The U.S. National Plant Germplasm System and the Pullman Gene Bank: Preserving Plant Biodiversity for Today and Tomorrow. Department of Entomology, Washington State University.

Feb. 10 Lecture on the Pullman gene bank for Entomology class at University of Idaho.

Mar. 25 Invited symposium talk. 'Novel Sources of Plant Resistance to Insect Pests of Grain Legumes and Grasses.' Tucson, Arizona, ESA Pacific Branch.

Apr. 9 Brown bag talk for Pullman PI group on entomology program.

Jun. 19 Reviewed efforts to locate pea weevil resistance in *Pisum* germplasm for group of visiting scientists from France.

Oct. 24 Invited seminar talk. 'Research Peregrinations: Grass-Endophyte-Insect Interactions. Department of Entomology, University of Kentucky, Lexington, KY.

Oct. 29 Poster presentation 'Consequences of wild barley-fungal endophyte associations on phytophagous insect survival. National meeting of the Entomological Society of America, Cincinnati, OH.

Dec. 4 Seminar 'Research Peregrinations: Grass-Endophyte-Insect Interactions, Department of Horticulture and Landscape Horticulture, Washington State University.

Travel, Invitations, Special Awards and/or Training

Jan. Invited by Dr. C.M. Smith, Kansas State University, and Dr. Chen-Zhu Wang, China, to present talk in symposium at International Plant Protection Congress, Beijing, China, July 2003. (Declined).

Jan Invited by Dr. Zinzhi Ni, Montana State University, to review my host-plant resistance research in symposium at International Plant Protection Congress, Beijing, China, July 2003. (Declined).

Jan Invited by Dr. M. Schauff, Research Leader, USDA-ARS-SEL, to serve as a member of review team for his research group.

Jan. 12-14 Portland, Oregon. Annual Pacific Northwest Insect Management Conference.

Mar. 23-26 Tucson, Arizona. Pacific Branch meeting, Entomological Society of America.

Apr. 12 Awarded Certificate of Appreciation from WSU College of Agriculture and Home Economics for serving as Advisor to Alpha Zeta.

May 6-9 Washington D.C. and Beltsville, MD. Member of review team for Systematic Entomology Laboratory and programs, USDA, ARS.

May 20-22 St. Louis, MO. RPES duty.

Aug. 19-21 Mt. Vernon, WA. Faculty retreat, Department of Entomology, Washington State University.

Aug.-Dec. Leslie Elberson audited a statistics course (Analysis of Variance of Designed Experiments, Statistics 512), Washington State University.

Oct. 7 Leslie Elberson, entomology research technician, completed a formal course in 'Geographic Information Training' at the Environmental Systems Research Institute, Seattle, Washington.

Oct. 23-30 Lexington, KY, University of Kentucky, and Cincinnati, OH for national meeting of the Entomological Society of America.

Oct 24 Invited seminar talk. 'Research Peregrinations: Grass-Endophyte-Insect Interactions. Department of

Entomology, University of Kentucky, Lexington, KY.
Oct 29 Poster presentation 'Consequences of wild barley-fungal endophyte associations on phytophagous insect
survival. National meeting of the Entomological Society of America, Cincinnati, OH.
Nov. Invited by Dr. Mustapha El Bouhssini, ICARDA, Aleppo, Syria to attend the Sunn pest conference in Aleppo
in July 2004 and give a keynote paper on role of endophytes in wheat relatives for insect resistance. Dr.
Clement declined because of potential restrictions on travel to Syria.
Nov. Invited by Dr. Devra Jarvis, IPGRI, Rome, Italy, to attend planning meeting 6-9 January 2004 at Yunnan
Agricultural University, China, for the UN funded project on preserving rice landraces for pest resistance.
Declined because of other commitments.
Dec 4 Seminar 'Research Peregrinations: Grass-Endophyte-Insect Interactions, Department of Horticulture and
Landscape Horticulture, Washington State University.

Leslie Elberson's outreach activities were extensive via participation as a volunteer for the Palouse Area Therapeutic Horsemanship Center (PATH), a nonproft/public service organization in the Center for the Study of Animal Well-Being, College of Veterinary Medicine, Washington State University.

Committees, Other Assignments, Activities and News

Member, Graduate Faculties, Entomology, University of Idaho and Washington State University.
Member of Ad Hoc Panel, RPES.
Research Committee Member, M.S. Students, one in Entomology and one in Horticulture, Washington State
University.
Faculty Advisor, Alpha Zeta, Washington State University.
At request of Editors, reviewed manuscripts under consideration for publication in Journal of Economic Entomology,
Ecology , BioControl, and Journal of the Kansas Entomological Society. Reviewed two NRI grant proposals.
Wrote several letters of recommendation for WSU students and graduates applying for graduate school, jobs, and
scholarships. Wrote letters on behalf of two professors for prestigious national awards.
Acting Research Leader on one occasion in absence of Dr. Hannan.
Student poster judging committee.
Entomological Society of America, 2003 national meeting.

Plans for 2004

1. Continue working with Ted Kisha on PCR for detecting endophyte in tall fescue plants and seed.

Determine retention of endophyte in field harvested seed from plots of two tall fescue accessions.

2. Conduct cooperative research with Barbara Hellier on fly pollination of caged Leek accessions.

3. Initiate new bird cherry-oat aphid research with wild fescue and endophytes to assess resistance in plants of

different ages. Part of this study will involve cooperative research with scientists at University of Kentucky.

4. Expand glasshouse research involving susceptibility of endophyte-infected and endophyte-free plants of tall

fescue,perennial ryegrass, and wild barley to Cereal Leaf Beetle.

5. Initiate new research with Dr. Hari Sharma, ICRISAT, on pod-boring Lepidoptera resistance in wild *Cicer*

accessions, and coordinate with CSIRO researchers. Research to be conducted if ARS approves USAID

funding for Dr. Clement.

6. Analyze pea weevil data from 2003 research involving crosses between cultivated pea and wild pea.

7. Will write at least one peer reviewed journal article on completed grass-endophyte-insect research.

PLANT PATHOLOGY (F. Dugan, S. Lupien)

Activities

Pathogens report:

Requests for diagnosis or descriptive literature were received from the following agencies, academic institutions or businesses: University of Idaho Cooperative Extension, Lewiston, ID (for information on ergot); University of Arkansas (for information on storage of living fungi); Washington State University Cooperative Extension (for information on pests of laurel); USDA-Forest Service, La Grand OR (for literature on *Selenophoma juncea*); Davey Company (plant health diagnostics) for information on commercial sources of mycological and phytopathological literature; USDA-ARS-EBCL (for information on sources of seed of grasses native to North America, for testing resistance); Genesee Union, ID (diagnosis of *Phoma medicaginis* var. *pinodella* on winter pea). Copies of WSU Bulletin on Pink Seed of Pea (see Publications) sent to cooperator, USDA Federal Grain Inspection Service.

Requests for information or diagnosis pertinent to pathogens were received from colleagues in WRPIS in the following instances: Information on ergot, and distribution of pathogens of oatgrass, to agronomy curator. Identification of rust on garlic (confirmed as as *Puccinia allii*) was solicited from the horticultural crops curator in Parlier. Identification of rust on species of onion (also *P. allii*) was solicited from horticultural curator in Pullman.

Fusarium proliferatum was for the first time reported as a disease of garlic in North America (Plant Pathology 52: 426, 2003). First Report of onion rust *Puccinia allii* on *Allium pskemense* and *A. altaicum* was accepted for publication by Plant Disease. First report of *Pythium irregulare* on lentil (with USDA-ARS Cereal Legumes and USDA-ARS Root Disease, Pullman WA and USDA-ARS Forage Crops, Prosser WA) as accepted by Plant Disease contingent on minor revision.

Informational materials were distributed in response to 30 miscellaneous requests from bone fide researchers for reprints or presentations regarding plant pathogens, preservation/storage of plant pathogens, or laws & regulations on plant pathogens.

Provision/curation of microbial strains:

Cladosporium oxysporum and *C. sphaerospermum* isolated from coastal waters are preserved for collaborators at University of Puerto Rico. Representative strains of *Phoma herbarum* (type species of *Phoma*), *Didymella exigua* (type species of *Didymella*), and *Mycosphaerella punctiformis* (type species of *Mycosphaerella*) were obtained and distributed to collaborators at Washington State University, Pullman. Strains of *Pythium irregulare* pathogenic to lentil were stored at request of USDA-ARS collaborators. Nineteen strains of *Cladosporium cladosporioides* and three of *C. oxysporum* were deposited into Centraalbureau voor Schimmelcultures. Strains of *Ascochyta rabiei* and *Ascochyta* from vetch were shared with WSU Department of Plant Pathology collaborators, as were strains of *Phoma medicaginis* var. *pinodella*.

Research Activities

The alternative strategies of eradication and prevention of fungal infections of garlic bulbs are being testing using systemic fungicides. Both natural and artificial infection of garlic cloves by *Fusarium proliferatum*, *F. oxysporum* f. sp. *cepae* and/or *Embellisia allii* can result in infection of the clove along its central, longitudinal axis. Results indicate that such deep seated infections are not eradicated by benomyl or thiophanate methyl, even with prolonged treatment times. The alternative strategy of prevention via fungicide treatment of planting cloves is being tested in the greenhouse and in the field.

Koch's postulates have been completed with *Pythium irregulare* on lentil (varieties Mason and Brewer). *P. irregulare* was responsible for damping off and stunting; *P. abappressorium* (from wheat, and common in the region of eastern Washington / western Idaho) had no such effects. Tests used both pasteurized soil and untreated field soil. Identification has been confirmed with molecular genetic methods. (Collaborative research with USDA-ARS Root Disease and USDA-ARS Grain Legume units, Pullman, and USDA- ARS, Prosser, WA.)

Molecular-genetic methods are being utilized to investigate the phylogeny of *Ascochyta* and *Phoma* species attacking legumes. Isolates from Washington State University and WRPIS collections are being compared to standard descriptions for cultural & morphological characters and symptomatology in addition to molecular-genetic characterization. Representative strains of type species for *Phoma*, *Ascochyta*, *Didymella* and *Mycosphaerella* are also being utilized. (Collaborative research with WSU Department of Plant Pathology.)

Initial tests with a prospective agent for biological control of *A. rabiei* in chickpea debris have demonstrated that the growth of the agent equals or exceeds that of *A. rabiei* over a range of humidity, and that reaction zones form between colonies of the biological control agent and *A. rabiei* on chickpea debris. Fungal floristic studies of chickpea debris have been initiated. (Collaborative research with USDA-ARS Grain Legumes unit, and WSU Department of Plant Pathology).

A list of 600+ names in *Cladosporium* is under construction in collaboration with Martin Luther University (Halle, Germany). The list will encompass names, authors, places of publication, hosts, geographic range, sources of material (types, authentic and representative specimens), synonyms, useful re-descriptions & illustrations, and other information.

Talks and Presentations

Jun. 19 Dugan, F.M. Invited talk: Movement, preservation and deposit of phytopathogenic fungi.
INRA/USDA *Aphanomyces* Meeting, Pullman, WA.

Nov. 12 Dugan, F.M. Research at the Western Regional Plant Introduction Station Plant Pathology Lab.
USDA-ARS WRPIS Brown Bag Series, Pullman, WA.

Travel, Invitations, Special Awards and/or Training

Aug. 11 Dugan, F.M. Charlotte NC. Invited talk at Annual Meeting of American Phytopathological Society, "Biodiversity of plant pathogens: new obstacles and opportunities."

Plans for 2004

1. Continue experimental control of bulb rot of garlic (*Allium sativum*), which has caused losses in the WRPIS clonal garlic collection in 2001, 2002 and 2003. Field trials with Maxim, Benlate and Topsin, initiated in fall 2003, will be evaluated at harvest in 2004. Greenhouse trials initiated fall 2003 will be evaluated. Trials will be conducted with fungicidal drenches for post-harvest treatment of bulbs. (In vitro trials in 2003 have already demonstrated the inability of Benlate or Topsin to eradicate deep-seated infections in seed cloves, so the above field and greenhouse experiments reflect a change in emphasis from treatment to prevention. Benlate is no longer on the market; it is used here as a basis for comparison to Topsin, the product intended to replace Benlate.)
2. Complete the nomenclatural manuscript, "Check-list of *Cladosporium* names (currently ca. 759 names). Coauthors Konstanze Schubert and Uwe Braun are at Martin Luther University in Germany. Pedro Crous, Director at Centraalbureau voor Schimmelcultures, Netherlands, is interested in posting an electronic version on the CBS web site. Publication is slated for Schlechtendalia.
3. Determine the identity of the primary fungal colonists of chickpea debris, measure their comparative growth rates and inhibitory potential with regard to *Ascochyta rabiei* in that substrate, and designate potential taxa and/or strains for biological control of *A. rabiei* in chickpea debris. The project is a collaborative project with Tobin Peever, WSU Plant Pathology, and Weidong Chen (USDA-ARS, Pullman). (Preliminary data on one fungal colonist, *Aureobasidium pullulans*, has been garnered as of winter 2003.)
4. Compare ITS sequences of our isolates of *Ascochyta rabiei, A. pisi, Phoma medicaginis* var. *pinodella* (PMP), and *Mycosphaerella pinodes* (MP) with ITS sequences from representative strains of *Mycosphaerella punctiformis* (type species of *Mycosphaerella*), *Didymella exigua* (type species of *Didymella*), *Phoma herbarum* (type species of Phoma) and *A. pisi*. *A. pisi* is the type species of *Ascochyta*. The objective is resolve debates about the correct generic assignment of pathogens of legumes, and to determine an accurate phylogenetic affiliation for a local isolate than bears characters of both PMP and MP. This is a collaborative project with Tobin Peever and Weidong Chen.
5. Utilize molecular genetics to augment cultural/morphological data we already have from in vitro morphological studies on graminicolous *Selenophoma* (*Pseudoseptoria*) species. Because existing taxonomic literature is based completely on in planta characters, which have proven highly variable, it is essential to conduct alternative analyses in order to devise objective criteria for species assignment. RAPDS, or ITS, beta-tubulin or endo-PG sequences are possible avenues of approach.

6. Pursue collaborations with Tobin Peever in molecular-genetic studies of graminicolous *Alternaria* species. Conclusions by Dugan and Peever (Mycotaxon 83:229-264) are hypotheses to be tested here by molecular methods. We will utilize RAPDS and/or AFLPs and ITS plus endo-PG sequences to attempt differentiation of the following species groups: *A. alternata, A. infectoria, A. tenuissima, A. metachromatica, A. oregonensis, A. triticimaculans,* and *A. triticina*. Ex-type, authentic and/or representative cultures of this species will be employed, as will strains isolated from PI materials and local grass populations. PPQ permits for strains in the above taxa are being renewed.
7. Conduct annual survey of the WRPIS curators with regard to plant disease problems. The intention is to compile long-term records as a guide to WRPIS research priorities and plant health management. This survey was initiated in 2001. Also incorporated will be documentation from the miscellaneous diagnoses and identifications performed in service to WRPIS curators, scientists and technicians. A summary of the survey will comprise a portion of the Research Pathologist's yearly report.

AGRONOMY (R. Johnson, C. Foiles)

Activities

Through cooperation with Federico Bertoli, we obtained accessions of *Poa pratensis* collected from diverse locations in Italy. Dr. Bertoli extensively evaluated this material in Italy, and some may have potential for low input turf grass. Continued cooperation to obtain Mediterranean germplasm underrepresented in out collection is expected.

Cooperation with other agencies to strengthen our collection of native range plants is gaining momentum. This will greatly strengthen our collections of key native species used in revegetation activities. Both the US Forest Service and BLM have carefully collected and documented many key species but have no proper storage or distribution system. Vicki Bradley, Barbara Hellier, and I are working with US Forest Service and BLM personnel to identify species and accessions that should be incorporated into our collections. This will allow genetic material to be available and conserved at a small fraction of what it would cost without this cooperation.

Work continues with Vicki Bradley, Grass Curator, on methods to improve regeneration protocols. Vicki continues to apply the results of research to our regeneration program in out-crossing grasses. Current work showing the value of inflorescence sampling is improving effective population size of regeneration populations and thereby reducing genetic drift in grass accessions.

Research Activities

Effective Population Size of Heterogenetic Grass Accessions. (Cooperative with Vicki Bradley, Grass curator, and Marc Evans, Department of Statistics, WSU.)

With the next publication (Johnson et al. 2004 , in press Crop Science) we will finish research that gives us new ways to reduce genetic drift in regeneration populations of heterogenetic accessions. In diverse grass species and accessions, we found sampling a constant number of inflorescences from each plant enhances effective population size compared to combining all the seeds from each plant. This work not only gives us a cost effective way to improve sampling, but also makes a contribution to population genetics as it relates to effective population size. Species and environment may change the initial slope or amplitude of the curve describing inflorescence number per plant and effective population size, but the basic shape is always the same. Moreover, most of the benefit of inflorescence sampling is derived when only 3-5 samples per plant are taken. This makes it a practical to use in regeneration programs, germplasm collecting, and in breeding were reducing genetic drift is desirable.

Genotyping germplasm collections for duplication and diversity analysis. (Cooperative with Ted Kisha and Stephanie Greene.)

Molecular markers can be used to identify duplication, develop and test special groups of collections (such as core collections), estimate and compare diversity among countries or regions,

and identify acquisition needs. Studies have been undertaken to develop the techniques needed for sampling and testing heterogenetic accessions to distinguish accessions. This is being done in three alfalfa cultivars with existing duplicates in our collection. This project has also been used to develop expertise with the various marker techniques, which has served as a template for all other lab projects.

The three cultivars are 'Hunter River,' 'Aragon,' and 'Yonca.' The marker systems we are using include primers developed from the alfalfa chloroplast genome, AFLP's (Amplified fragment length polymorphisms), RAPD's (Random amplified polymorphic DNA), and SSR's (Simple Sequence Repeats). These all have advantages and disadvantages in terms of cost, number of markers generated, and how informative they may be. The intial work on each marker system has been done on populations of 98 individual plants from each cultivar. We also developed samples with different populations of bulked leaf tissue and extracted DNA. We will be able to examine population size, bulking, marker system, and interactions to develop the most efficient method of genotyping populations.

So far we have completed data collection for nearly all markers systems for three alfalfa cultivar populations. Yonca was clearly differed from the other cultivars but more work will be needed to determine in a significant difference can be shown between Aragon and Hunter River. In 2004 we will score the gels and complete data analysis. This will be
the basis of a manuscript and serve to select procedures for the next step; to examine original seed duplicates existing within the collection for each of the three cultivars.

Enhancement of Kentucky Bluegrass (KBG) germplasm for seed production in alternative residue management systems. (Cooperative with Bill Johnston, David Bragg (WSU), and Federico Bertoli.)

Burning of Kentucky bluegrass seed production fields in the fall normally maximizes seed production the following year. With increased regulation of field burning, this practice has been increasingly restricted in the Pacific Northwest. Our work has shown that there is considerable genetic variation in seed production under non-thermal residue management systems and there is potential for selection within and among accessions to improve seed production. To sustain seed production at economically viable levels, new germplasm that enhances yield in non-thermal management systems needs to be identified, selections made, germplasm enhancement carried out, and ultimately, high yielding bluegrasses with good turf quality will be made available to growers.

We have also found that unlike other yield components that correlate negatively with yield, panicles per square meter appear to have little negative effect on turf quality, but positive effects on seed yield. Thus, the following objectives are being pursued:

1. Using accessions with potential value in non-thermal management, assess the within and among variation in agronomic and molecular attributes. Select individual plant genotypes for high overall seed yield, high seeds per panicle, high panicles per plant, and for high weight per seed.

2. Determine the selection response for yield and yield components by testing the resulting selections in Objective 1 for seed production under a residue removed (bale) management system in diverse environments and over years. In addition, selections will be tested for turf quality factors in different environments and years.

For Objective 1, AFLP gels have been completed showing within and among molecular variation for ten accessions selected for a range of seed production potential and turf quality. We have also harvested plants from all plots each of two years and are processing samples to select yield components. We will increase seeds of selected plants in 2004-05 so Objective 2 can be initiated.

Evaluation and Enhancement of Safflower Germplasm for Winter Conditions. (Cooperative with Vicki Bradley.)

Fall planted or winter safflower would provide excellent winter cover in a broadleaf plant that would greatly improve options for the control of grassy weeds in cereal crop rotation systems. Crop yield would be expected to be much greater for a fall planted safflower than a spring crop owing to the longer developmental time. Safflower seeds also have the potential to provide bio-diesel fuel and the whole plants could be effectively used in Syn-gas production on-farm. Some tentatively winter hardy material has already been identified from China and other countries. Many accessions of safflower have within accession variation that may be exploited through selection. We also have the Arizona Wild Composite (AWC) collection developed by Dr. Dave Rubis that is a highly variable population with genes introgressed from wild species. This is extremely useful material for plant selection. We therefore have identified a set of accessions for evaluation and enhancement of winter hardiness.

Evaluation plots were established at Pullman and Central Ferry in 6 m long rows on 1.5 m centers. In the 2002-03 season there were 11 entries and additional plots of the AWC to provide additional plants for selection. The experimental design was a randomized complete block with three replications at two locations. Plant counts were taken after fall emergence and during the winter and spring. One hypothesis is that more prostrate habit in the rosette stage will signal more winter hardiness. Plants in the rosette stage were assessed by measurements of crown width, height to first leaf, and height to last leaf. Surviving plants were counted, bagged to prevent outcrossing, and harvested. Seed from harvested plants was bulked within accessions and advanced in 2003-04 plantings and both Pullman and Central Ferry locations.

Clear differences in winter hardiness were found among accessions evaluated. The Chinese accession BJ-27 was the most winter hardy entry with essentially no plants lost in the mild 2002-03 Pullman winter. Fall and winter prostrate habit was a requirement for winter hardiness but did not appear to explain all the variation among accessions for hardiness. Material developed in Canada was the least hardy. This apparent anomaly was the result of selection in Canada for rapid early growth. This was needed in a spring-sown crop so that harvest could be completed before early fall frosts on the Canadian prairie. This material moves out of the rosette stage very quickly in the fall and is then killed during the first sharp frost. Material developed in California

also lacked winter hardiness, but material from Rubis's Arizona breeding program was more cold resistant. Spring frosts during the early years of the Rubis program in the 1950's were prevalent in the Tucson area, and some cold resistance was developed in his material (Dave Rubis, personal communication).

The winter hardiness found so far is quite striking for safflower but does not appear to be strong enough to ensure survival during severe winters in colder areas of Eastern Washington. However, it may well be strong enough for lower elevations in the Inland Northwest and elsewhere in the U.S..

Evaluation of Mountain Brome Collections for Seed Transfer Zones. (Cooperative with Vicky Erickson at the US Forest Service.)

Native plants are becoming increasingly important for rehabilitation, restoration, and revegetation efforts by federal agencies managing public lands. This has lead to a native grass seed industry with federal contracts for seed production of native species. A major controversy stems from disagreements regarding movement of germplasm from where it was collected to other areas. Federal land managers and others are worried about lack of genetic fitness and ecological damage that may occur when plants unadapted to one area are grown in another. Without more information they are reluctant to establish seed transfer zones over large geographic areas, which are most convenient for seed producers and less expensive for all concerned. Many seed growers would rather not grow numerous different populations of a single species and are worried that certain collections may even be required to be grown within a specific eco-regions.

Important questions arise. For a given species, how much variation is there among and within collection populations from different regions? If there is little difference among populations then a larger seed transfer zone can be justified. How much of the variation in populations can be explained by climate, elevation, soils and longitude? Despite the constant and heated debate, there is very little scientific information on any of these questions.

We are initiating cooperative work to evaluate Mountain Brome (*Bromus carinatus*), a self pollinated native grass of clear importance for revegetation though much of the Western states. The species has a number of attributes that make it well-suited for use in revegetating disturbed sites, such as rapid establishment and deep, wide-spreading roots that provide for good soil stabilization. Information from the study will be used to develop an improved framework for guiding the collection and utilization of Mountain brome, especially in the Blue Mountain region. Our objectives are:

1. Determine the amount and pattern of variation within and among Mountain Brome populations collected across the Umatilla National Forest.

2. Relate variation among collections to geographic and climatic trends, and to various spatial stratifications such as ecoregions, watersheds, conifer seed zones, and vegetative and edaphic classifications.

Seeds were collected in July-August, 2002 from a total of 167 locations representing a wide range of environments in the Blue Mountains of eastern Oregon and southeastern Washington. At each sampling location, seed was collected from individuals representing the same habitat and environmental setting, but separated by a minimum of 5 meters. Latitude, longitude, and elevation were recorded at each collection site, along with other location variables such as slope, aspect, and associated vegetation. Collection sites will be classified locations according to various spatial stratifications, such as eco-region, watershed, conifer seed zone, and vegetation and edaphic subdivisions.

Entries from the Blue Mountain collection of Mountain Brome described above and numerous PI's currently in the WRPIS collection were established in transplant containers over the summer of 2003 and planted in the early fall at Pullman and Central Ferry locations. A total of 225 entries were included with three replications at each location. Each plot or experimental unit consisted of two plants. Thus total plants at each location were 1350. Variation among collection sites will be assessed along with variation within site.

In the spring and summer of 2004 and 2005, descriptor data will be collected from each plant at both locations. The descriptors will be those developed by the Forage and Turf CGC and include morphological, phenological, and production factors. Data from approximately 15 descriptors will recorded over two years. Genotype by environmental interactions will be assessed and patterns of variation will be related to geographic, climatic, and ecological factors. Recommendations concerning seed transfer zones will be made and a manuscript prepared.

Talks and Presentations

Apr. 1	Invited presentation, "Native plant collections at the Western Regional Gene Bank," to the Inter-Mountain Native Plant Summit, Boise, ID. Invited by Tom Jones.
May 19	Poster presentation, "Molecular variation among and within diverse Kentucky Bluegrass germplasm," at the Third International Molecular Breeding of Forage and Turf Grasses Dallas, Texas, 18-22 May, 2003.
Nov. 5	Invited presentation "Evaluation and Enhancement of Kentucky Bluegrass Genetic Resources for Sustainable Production" for Symposium–Germplasm's role in sustainable agriculture II, CSSA Annual Meeting, 2003, Denver CO. Invited by Clare Coyne.

Travel, Invitations, Special Awards and/or Training

Apr. 1-2	Native plant summit, Bosie ID. (Invited talk)
May 18-22	Molecular Breeding of Forage and Turf Third International Symposium, Dallas, TX (Poster presentation)
Mar. 26-27	Peer Review Panel Service for ARS, in-depth reviewer for two scientists and evaluated ten total cases.
Nov. 2-6	CSSA National Meetings, Denver CO. (Invited talk)

Nov. 12-13 Grass Seed Cropping Systems for a Sustainable Agriculture (GSCSA), Spokane WA. (As member of GSCSA technical Advisory Committee).

Committees, Other Assignments, Activities and News

Cooperative with Bill Johnston, WSU Crop and Soil Science Department, we received a $14,000 grant from the Washington State Department of Ecology and a $10,000 form the special grant Grass Seed Production for a Sustainable Agriculture, to advance our work on developing Kentucky bluegrass for non-thermal production systems. I am also Co-principal Investigator with Bill on the Hatch project WNP00332 "Evaluation and management of turfgrass species and cultivars".

Cooperative work with Vicky Erickson of the US Forest Service to study blue wildrye and Mountain Brome resulted in $5,000 support from US Forest Service for 2003, with $10,000 budgeted for 2004.

Thirteen peer reviews were completed for journals, projects, and ARS manuscripts.
Adjunct Professor, Crops and Soils Department, WSU
Ex-officio member of the Alfalfa and Forage and Turf Grass CGC's.
Member, International Safflower Germplasm Committee.
Member of International Research & Development Committee for the International Safflower Conference.
Member of the Technical Advisory Committee for the Grass Seed Cropping Systems for a Sustainable Agriculture Special Grant Program.
Secretary (2002) President Elect (2003) and President (2004), Grass Breeders Work Planning Conference.
Member, International Scientific Committee, VIth International Safflower Conference to be held June 6-10, 2005.
Executive member, International Council of Sustainable Agriculture, 2002-present.
Member of Graduate Faculty, WSU
Chair (2003-04), committee to select outstanding papers in Plant Genetic Resources section of the journal *Crop Science*.

Plans for 2004

1. Continue project on enhancement of germplasm for seed production in alternative residue management systems. Make selections for high yield and yield components in ten accessions of Kentucky Bluegrass (*Poa pratensis* L.) identified for high turf quality and yield in non-thermal residue management systems.
2. Continue studies to use molecular markers to genotype accessions, identify duplicates, and characterization germplasm collections in alfalfa.

3. Finish molecular characterization of *Elymus glaucus* (Blue wildrye) to determine the relationship between genetic variation and environment in germplasm used in revegetation on public land.
4. Continue studies on safflower (*Carthamus tinctorius* L.) to identify and enhance germplasm for improved winter-hardiness and sek to understand its basis. This will to help expand the utilization of safflower as an alternative crop.
5. Continue studies on safflower germplasm to relate molecular variation among and within geographic regions in Asia to morphological, agronomic and chemical (oil) attributes.
6. Continue agronomic evaluation studies on Mountain Brome germplasm, a key native grass for reclamation and revegetation on federal lands.
7. Initiate cooperative studies on non- and sparse flowering orchard grass (*Dactylis glomerata* L.) of potential value for improved livestock pastures.

MOLECULAR GENETICS LABORATORY (T. Kisha)

Germplasm Conservation Activities:

Participated in the Crop Germplasm Committee Meetings for Forage & Turf, Clover and Specialty Legumes, Cool Season Food Legumes at the Crop Science Society Meetings in Denver Colorado, November 2 – 4, 2003. Volunteered to help establish procedures for inclusion of molecular marker data in GRIN.

Research Activities:

Identification of duplicate accessions within a germplasm collection using molecular markers. Collaboration with Vicki Bradley and Molly Welsh

We began collection of plant material from five duplicate grass accessions and four duplicate *Phaseolus* accessions for examination using AFLP markers. This will be a continuation of the initial study using RAPD markers for grasses and a new start for the *Phaseolus* project.

Molecular marker analysis of wild *Allium.* Collaboration with Barbara Hellier.

DNA from five populations of *Allium columbianum* and five populations of *Allium fibrillum* were analyzed using RAPD markers. A set of about thirty polymorphic markers were obtained. To examine more loci, AFLP markers were also used. The result using the standard Life Technologies, AFLP Analysis System I were gels with too many polymorhpic bands to be easily analyzed.

We will continue this research in 2004 using primer sequences with added selective nucleotides to reduce the set of markers to a more readable number, as suggested by Gayle Volk of the Plant Germplasm Preservation Research Unit, at the National Center for Genetic Resources Preservation in Fort Collins, CO.

Introgression between cultivated alfalfa and wild relatives in Kazakhstan. Collaboration with Stephanie Greene.

Six wild *Medicago sativa* ssp *varia* accessions and five traditional *M. sativa* varieties collected in Kazakhstan in 2000 were compared at twenty microsatellite loci. The objective was to study the introgression of DNA between cultivated alfalfa and its wild relatives.

Comparison of molecular marker types for the analysis of genetic diversity in synthetic populations. Collaboration with R.C. Johnson and S.L. Greene

This was the second year for this extensive project. Three alfalfa accessions have been analyzed using 96 individual plants from each accession as well as bulked samples of varying size. We've assembled sets of Chloroplast, RAPD, AFLP, and microsatellite markers for comparison.

The work done here has served as the template for working out efficient procedures for every process normally associated with molecular marker analysis. Over the past two years, we've improved efficiency in DNA extraction, and all types of marker analysis used in the lab. It has also served as a model for gel analysis using software developed by Scanalytics and by Licor. The time invested in this project has paid dividends for the development of all other projects started since.

Molecular marker analysis *Elymus glaucus.* Collaboration with R.C. Johnson

Elymus glaucus Buckley (blue wildrye) accessions from 61 locations in the Blue Mountains Ecological Province were analyzed using AFLP markers. Cluster analysis using AFLP markers will be compared to that obtained from 20 phenotypic traits.

Identification of Neotyphodium infested grass accessions using PCR. Collaboration with Steve Clement.

Two *Neotyphodium*-infected tall fescue accessions were selected for this study: PI 598932 (W6

16150) from Sardinia, Italy and PI 610910 (W6 15841) from Morocco. The endophyte status of forty-eight potted plants per accession was determined in PDA culture and by amplification of a 444bp fragment of DNA unique to the endophyte. PCR analysis agreed 100% with results from PDA culture on a per plant basis.

Endophyte status was also determined in the seed lots using PCR amplification of DNA extracted from single seeds. The mean infection rate in the Morocco population was 91%, while that in the Sardinia population was 42%. These frequencies were not statistically different from the frequencies taken from PDA culture of plants from the same seed lots. This suggests that either PCR detected viable endophyte, or the number of seeds with non-viable endophyte was too small to detect with our sample size. More research is required to determine the usefulness of PCR for detecting only viable endophyte in tall fescue seed

In addition to having a lower frequency of infection, the Sardinia population took almost a week longer to exhibit mycelia on PDA. This may have been the result of a different, slower growing strain of endophyte; or it may have been from a lower initial titer of endophyte within the stem. Future analysis will include quantitative PCR to determine the density of infection.

RAPD molecular marker analysis of Asian safflower accessions. Collaboration with Vicki Bradley and R.C. Johnson.

This project was undertaken with cooperation from Dr. Shim Kang Bo from Korea. The object was to acquaint Dr Shim with the RAPD analysis, while comparing selected Korean safflower lines with Asian accessions taken from our core collection. Very few polymorphic markers were revealed from the 20 primer sequences used. Continuation of this effort will include AFLP marker analysis.

Rapid-extraction chloroplast marker analysis. Collaboration with Dan Skinner and R.C. Johnson

This is a spin-off from the Alfalfa Project. Two primer sets were identified for loci which produced hypervariable chloroplast markers. These two loci were able to distinguish the three populations we analyzed with greater efficiency than either RAPD or AFLP markers (fewer PCR amplifications and gels). Dr. Skinner is testing various rapid DNA extraction techniques followed by PCR amplification of the chloroplast markers and PAGE separation of the alleles to come up with a high-throughput method for distinguishing synthetic alfalfa populations.

Phaseomics Project with Molly Welsh.

Molly Welsh and I joined the Phaseomics Group and began planning for the analysis of *Phaseoulus coccineus* accession within the collection. We chose *P. coccineus* because of its use as a bridge species for gene diversity introduction into *P vulgaris*.

Talks and Presentations

Jun. 25 Presented seminar to WRPIS personnel entitled “Germplasm Conservation, Molecular Markers and Bioinformatics”

Oct. 23 Presented poster for the WSU Crop Genetics Group. (Same poster as for November 5 at the CSSA poster session)

Nov. 4 Presented a poster on *Neotyphodium* endophyte research.

Nov. 6 Toured the National Center for Genetic resources preservation in Fort Collins, CO.

Travel, Invitations, Special Awards, Training, and/or Assignments

Feb.13	Completed First Aid/CPR Refresher Training offered by WSU \ Department of Safety.
May 26-Jun. 8	Completed an intensive two-week course on bioinformatics. Topics Included: Biological databases and data models, Sequence submission, alignment and searching tools, BLAST and BLAST installations, Mathematics and Statistics for Bioinformatics, Gene prediction and moving from DNA to protein, Multiple sequence alignment and molecular evolution, Genome informatics, Perl for Bioinformatics, Moving from sequence to domains to structure prediction, Structure prediction for RNA, RNA evolution and motif search tools, and Current topics in Bioinformatics
Jun. 17	Attended a workshop provided by Beckman on the CEQ 8000 capillary electrophoresis machine and associated software.
Jun. 20	Attended a workshop on GrainGenes (Triticae Genome Database), a portal for the wheat genome project.
Aug. 7	Attended Fred Pryor Seminar on "Self Discipline and Emotional Control, Spokane, WA. How to focus on work and deal with distractions.
Nov. 1-6	ASA/CSSA/SSSA Annual Meetings, Denver, Colorado

Committees, Other Assignments, Activities and News

Chaired a combined Plant Genetic Resources (C-8) and Crop Breeding, Genetics, & Cytolgy (C-1) Symposium on the Evaluation and Enhancement of Genetic Diversity

Participated in Crop Germplasm Committee Meetings: Forage & Turf, Clover and Specialty Legumes, and Cool Season Food Legumes.

I received an appointment as an Adjunct Scientist with the Department of Crop and Soil Sciences at Washington State University. My first and very pleasant task was to participate as a Graduate Committee member in the successful completion by Kwang-Hyun Baek of his preliminary examination toward his Ph.D.

Plans for 2004

Effects of DNA ratios on the production of AFLP markers:

The polymerase chain reaction is a multi-order chemical reaction susceptible to competitive inhibition among primer binding sites when amplification occurs at multiple sites throughout the genome. Smith et al., (1994. Characterization of random amplified DNA (RAPD) products from *xanthomonas campestris* and some comments on the use of RAPD products in phylogenetic analysis. Mol. Phylogenet. Evol. 3(2):135-145.) demonstrated this clearly for RAPD marker analysis. The extent to which competitive inhibition alters results with AFLP markers has not been investigated.

We have been analyzing populations of alfalfa (an autotetraploid in synthetic populations) using

several marker types, including AFLP. One objective of our work has been to determine the feasibility of analyzing bulked plant samples from synthetic populations to assess relatedness among populations. The effects on the production of AFLP markers from broadening the span of allele ratios by bulking DNA are not presently known.
We will investigate the effects of bulking on the production of AFLP markers by analyzing ratios of DNA from known marker genotypes between plants with a similar genetic background (from the same synthetic population) and from plants from more distant backgrounds (between plants from different and more distant populations).

Establishment of a molecular marker database for virtual diversity analyses.

There is world-wide interest in the establishment of a searchable molecular marker data base which goes beyond simply added molecular marker information to databases such as GRIN (Frisch et al., 2002. Storage of molecular marker data in databases for efficient use in plant breeding programs. Zeitschrift fur Agrarinformatik 10:23-27.). Currently, there is no means to accurately compare the numerous diversity studies already in the literature, necessitating considerable duplication of marker analyses which result in incomplete comparisons. Establishing a standardized set of molecular marker loci for many marker types and storing the resulting data in a curated database similar to a GenBank flat file would allow virtual diversity analyses without duplicating previous efforts. This would allow comparisons among accessions from selected geographical areas or climates, and result in cost savings among researchers world-wide. Marker data obtained from previous and current research will be used to examine formats for storage and retrieval of molecular marker information.

COMPUTER AND IT (G. Pentecost)

Activities

Computer Resources

USDA-ARS established agency-wide computer hardware and software standards during the past year. These requirements had been anticipated, so many of our computers were already in compliance. Nevertheless, upgrading the remaining computers remained a priority during 2003.

The hardware requirements addressed processor speed and memory. We optimized our resources through a combination of actions by purchasing a small number of new PCs, then reformatting and reconfiguring middle-aged PCs for continued use within the group. In addition, generous amounts of memory were added to all the new and older PCs.

The software requirements called for the latest Windows NT-based operating systems, as well as specific applications for editable and non-editable documents. Upgrading to the newer operating systems has already demonstrated its worth through the reduced numbers of system crashes, increased system stability, and better security features. The entire group now has the correct software to handle editable documents. Although the software for non-editable documents has not been deployed yet, we do have a convenient work-around application.

The oldest computers did not meet Agency requirements. However they did contain useful components. We deliberately retained items such as modems, serial cards, USB cards, zip drives and memory before sending the oldest PCs to surplus.

In 2003, we began using Pocket PCs for remote data collection. Our software applications allow the integration of GPS coordinates and text descriptions which are exportable to mapping and Office software and then downloadable into GRIN. The Pocket PCs are too small for easy viewing or typical computer operations, so they are used in conjunction with compact notebook PCs for more stable memory storage, the convenience of a larger screen and keyboard, and for additional viewing, processing and editing of files.

Space and compatibility continue play a role. We combined the functions formerly covered by two PC systems into a single PC. The computer is now used for GIS and image manipulation, as well as other assorted applications. During the transition, we expanded the system's capabilities with updated versions of Photoshop and ArcGIS. Flatbed scanner functions improved. We now have a single device for both paper and film media, with a faster, more intuitive software interface and a faster hardware interface. We also added a large format, photo-quality printer.

The demand continued to increase for digital images. Most curators and lab managers bought their own cameras to increase scheduling flexibility and meet their specialized image requirements. Many images of plant accessions were optimized for effective viewing on computer monitors as well as transmittal over modems, and then submitted to GRIN. Detailed images also documented research results for use on posters and other publications.

Until this year, Internet service at the Central Ferry farm depended on a problematic and slow modem connection. The network is now accessed through a fast, dependable satellite network connection.

Computer Security

Computer security continued to require constant attention, with an emphasis on providing background protection and minimizing the need for explicit actions by employees. We modified PC system settings to block widely exploited system vulnerabilities. Windows security updates now install themselves automatically, as do anti-virus definitions. We also implemented other security measures recommended by the USDA.

Because even the best computer security can be unintentionally undermined by problems transmitted over the Internet from off-site computers, we delivered security warnings to personnel for issues that campus PCs were already protected against, in order to increase the likelihood of better home computer security. Likewise, links to resources for identifying hoaxes, actual threats, and best practices were also distributed.

Safety Awareness

My Collateral Duty Safety Officer (CDSO) duties were transferred to William Luna in March, 2003. I organized my safety records as clearly and thoroughly as possible beforehand, so that minimal time would be required for William to get oriented. My 3 ½ years as CDSO impressed me with the planning, commitment and time a good safety program requires.

Talks and Presentations

I gave presentations on the most important security and computer-related issues at our Plant Introduction unit meetings.

Travel, Invitations, Special Awards and/or Assignments

Feb. 12-14	Attended Conflict Management seminar in Spokane, WA
Sep. 22-26	Studied DIVA GIS, presented by Robert Hijmans in Prosser, WA

Committees, Other Assignments, Activities and News

Washington State University Campus Trails Committee
Washington State University CAHE Safety Committee (early 2003)
ARS Pullman Location Safety Committee (early 2003)
Completed ARS training on Ethics, Civil Rights/ADA, and Security Awareness
Attended WSU Basic first Aid refresher class

Plans 2004

1. Spatial and Tabular Data Collection
   Expand the field use of Pocket PCs with GPS units and barcode scanners.
   Integrate the output into GIS applications, spreadsheets and documents.
2. Hardware and software
   Complete the distribution of Agency-standard software.
   Add another light notebook computer for travel needs.
   Upgrade computers as needed.
3. Security
   Develop group-wide back-up system.
   Emphasize security-related best practices.
   Continue hardening our systems.
4. Web site
   Develop the web site for the Parlier station.
   Update our Pullman site as necessary.
5. GIS
   Develop background maps for plant collection trips.
   Assist curators in their spatial data collection efforts.
   Assist farm managers with their acreage management.
   Maintain data in ArcGIS-compatible formats.

SEED STORAGE & GERMINATION LABORATORY (D. Stout, P. Lundt, E. Johnston)

Activities

Passport data entered
367 W6-numbers were assigned in 2003, 206 of these were from the Stoney Wright grass collection made in the Falkland Island and South Georgia. 428 accessions received PI numbers and of these 375 were W6-numbers conversions.

Accession evaluations:
36,587 observation data points were entered in GRIN for 7,623 accessions on 118 descriptors on 20 crops. Number of records by crop are: 36 ALFALFA, 9 ALLIUM-WILD, 20 ASTRAGALUS, 6188 CHICKPEA, 39 CLOVER, 25 FABABEAN, 2152 GRASS, 10 LATHYRUS, 550 LENTIL, 121 LETTUCE, 44 LUPIN, 18 MEDIC, 11540 PEA, 12052 PHASEOLUS, 1067 SAFFLOWER, 1442 SUGARBEET, 510 TREFOIL, 21 TRIGONELLA, 154 VETCH, 589 W6-MISC. 61% of the data came from the Pullman program and 39% came from cooperators.
Started linking pictures, Excel spreadsheets, and other documents to the evaluation environment anytime it was available to use.

Inventory management:
It is a goal to have every inventory container bar-coded and weighed. In 2003 we bar-coded most of the Cicer and Vicia faba collection. 18,563 inventories were weighed; of these 2,066 were newly increased seed. 4,564 inventories were sealed in waterproof containers and put in –10 degree Celsius storage; most of these were Cicer and Lens.

1847 accessions were sent to NCGRP for backup inventories.

Inventory germinations:
12,891 inventory viability records were entered in GRIN on 11,151-inventory lot of 11,803 accessions. 5,516 of these viability records were tested in 2003 consisting of 5,221 inventories on 4,964 accessions. 398 grass accessions were contracted out at $6.25 per lot to Tangent seed in Oregon. 1468 records came from backup samples sent to NCGRP. The remaining 3,650 germinations came the germination program in Pullman.
All the environments (GRIN field = ename) for germination records that were know to come from the Pullman program over the years and we knew the procedure used were changed to an environment to reflex the Association of Official Seed Analysts(AOSA) rules for seed testing handbook.

At years end we had 55,176 accessions available, 52% have viability records less than ten years old, 67% have viability records less than twenty years old, and 69% have a viability record.

Germplasm orders distributed

During the year, 11,881 accessions were distributed in 18,746 packets, 13,168(70%) packets in the USA and 5,578(30%) packets to foreign countries. There were 582 separate orders filled, 412 orders in the USA and 170 orders to foreign countries.

Talks and Presentations

None.

Travel, Invitations, Special Awards and/or Training

Jun. 7-10 Dave Stout, Paula Lundt and Ellen Johnston attended the annual meeting of the Association of
Official Seed Analysts and The Society of Commercial Seed Technology in Seattle, Washington.
They also toured the Prosser station on the return home.

Committees, Other Assignments, Activities and News

None.

Plans for 2004
1. Continue bar-coding storage containers.
2. Continue weighing storage containers.
3. Continue seal packaging inventories and storing in –10 Celsius

4. Funding available: Clean, paint, equip and remodel the headhouse lab into a germination lab.
5. Teach our personnel how to use GrinWin.
6. Transfer all Parlier accessions to Parlier.

PULLMAN FARM OPERATIONS (W. Olson, J. Cruver, A. Davis)

Overview for 2003

One thing continues year after year for the Pullman Plant Introduction Farm, that is change and advancement into newer and more advanced production and handling methods for our Researchers and Curators. It's been said that a thriving Unit or Corporation has new ideas, innovative changes, a fresh look at things for each upcoming year, differentiation from the norm, and commitment from senior management with clear goals and buy-in from the entire organization. Surviving is *status quo* operation, doing everything the way it always has been done, and coasting. Needless to say, with the direction and changes in 2003 the Pullman Farm and our associated Researchers and Curators are thriving.

Field Operation Changes and Research

In 2003 we moved into less aggressive tillage methods to conserve and build organic matter and increase soil conservation since most all of our fields are on slopes of some degree. After our wheat and barley rotational crops we plowed less stubble under this year and chose to chisel more in the fall of 2002 and 2003. We withheld the use of the rototiller within our fields and used less aggressive chisel points and sweeps on our cultivators for our summer weed control.

In our rotational field on Observatory Hill we looked at a new practice by planting a spring mustard crop in early summer and plowed it down as a green manure crop just as pods were forming. Reason for our interest is to look at possible Bio-fumigation properties, increase in biomass resulting in higher organic matter, and increasing fertility through organic recycling. This was only possibly since we have irrigation to that field.

One interesting observation to this plow-down of the spring mustard was that we planted our research plot for winter safflower adjacent to the spring mustard just before bloom of the mustard. In past years on this field, our seed rows in these safflower plots were ravaged by ravens and blackbirds to the point we had to net the production areas to retain any planted seed or seedlings. This year the safflower was neither netted, nor to Dr. Richard Johnson's emergence records and observation hardly, if at all, touched by the bird population residing at the adjacent University Composting station.

In preparation for Barbara Hellier's annual planting of the Garlic Collection, and in co-operation with her and her Technician Russ Staska, we continued applications of lime to raise the pH levels of our soils towards neutral from a pH of 5.3. We applied five ton per acre of lime in the form of Dolomite in June this year, three months earlier than last year. Our goal is to be liming one to two years ahead of garlic production in the near future to give time for pH adjustment. We also planted the whole field to winter canola in June, immediately after the lime application and incorporation. As soon as the canola fully germinated, we cultivated out strips five feet wide leaving "filter strips" for erosion control between the accession areas, and leaving enough area for the garlic so production would not be inhibited by the canola growth over winter. Mid September Barbara Hellier brought in pallets of Peat Moss which we put through a Bale Chopper and applied

to a six-inch depth in the production strips for the 2003 – 2004 garlic regeneration of the collection. This operation went smoothly after we switched from our standard shift tractor to Plant Material Center's hydrostatic tractor. After application of the Peat Moss, we used three passes of the rototiller for complete and uniform incorporation of the peat moss to a field depth of 7 inches. Garlic was planted on October 20th. We are annually monitoring fields limed through soil sampling looking for pH changes over time and nutrient availability in our Palouse silt loam soils.

In Dr. Clare Coyne's perennial legume accessions, in years past we would pick the mature seed by hand with every person of the farm crew every other day for 6 to 7 weeks. We initiated a system this year of using insect netting pinned tightly at the base of the plants (after much experimentation) and using a small portable bag sewing machine to enclose the accessions into long tubes of screen material. This seemed to work fairly well; but the real test will be the second year's seed production and retention in 2004 production.

In Dr. Richard Johnson's Tall Fescue research and Dr. Rich Hannan's Beet Field Regeneration studies we again used the small hand-held bag sewing machine. We cut strips of insect netting six feet wide and fifteen feet long, transferred the crop from the accession to the netting, and then pulled the sides together to form an enclosed tube when the open three sides were sewn closed with the small sewing machine powered by a small suit-case sized generator in the field. This process worked very well for transport and drying of each accession or crop for regeneration and research purposes.

For the general farming operation, some of the continuous hoeing of weeds was supplemented by the use of a new piece implement developed in Canada called a "Reggie". The "Reggie" with it's operator are mounted on the three-point behind our 2440 John Deere tractor. Stiff rotating tines on the "Reggie" do a very good job of loosening soils and removing weeds along side and between accession rows. From our observations, Swan-neck hoes and student still have to be used for final and technical cleanup of the accessions, but time and labor has been reduced.

Accessions grown on the Pullman Farm by Researcher / Curator

Dr. Richard Johnson
Technician – Connie Foiles
Tall Fescue Drought Efficiency Research – 21 Plots
Mountain Brome Research – 675 Research Lines
Winter Safflower Research – 54 Research Lines
Dr. Steve Clement
Technician – Leslie Elberson
Tall Fescue Endophyte Research – 2 Plots, 80 Lines each
Dr. Richard Hannan
Beet Collection Regeneration – 10 Accessions
Dr. Frank Dugan
Technician – Shari Lupien
Garlic Disease Research – 10 Accessions

Dr. Clarice Coyne
Technician – Mike Cashman
Cold Season Legume Regeneration & Research – 520 Accessions & Plots
Barbara Hellier
Technician – Russell Staska
Horticultural Accession Regeneration – 177 Accessions
Garlic Collection - 438
Vicki Bradley
Technician – Bob Guenthner
Grass Accession Regeneration, Second year – 278 Accessions
Grass Accession Regeneration, First year – 320 Accessions
Lolium Research – 220 Research lines

Total Production for 2003 for Pullman Farm was:
2,727 Accessions, Plots, and Lines

Accessions threshed and conditioned for seed storage
Plant Technician II – Jacqueline Cruver
Seed lines conditioned & delivered to seed storage in 2002 – 2,046 Accessions
Other seed lines threshed and conditioned for 2002 – Est. 357 Accessions
Total for 2002 - 2,403

Seed lines conditioned & delivered to seed storage in 2003 to date – 1,918 Accessions
(Will not be complete until approximately April 2004 when grasses are completed)
Other seed lines threshed and conditioned for 2003 to date – Est. 317 Accessions
Total for 2003 to date - 2,235

Talks and Presentations

Feb. 11 Wayne Olson, Scott McGee, Jacqueline Cruver participated in the University of Idaho
Career Fair, University of Idaho, Moscow, Idaho.
Feb.12 Wayne Olson participated in the Washington State University Career Fair, Washington
State University, Pullman, Washington.

Travel, Invitations, Special Awards and/or Training

Jan. 9-10 Wayne Olson and Scott McGee attended the Washington State Pesticide Recertification
Meetings held in Moscow, Idaho.
Mar. 2002 Scott McGee began his training for the Washington State University Leadership Development for Supervisors Series. This 50-hour course addresses the need and desire

for continuous improvement primarily in the areas of communication, ethics, diversity, and service through enhanced leadership skills and awareness.

Feb. 18 Wayne Olson received his Certificate of Achievement for completion of the Washington State University Leadership Development for Supervisors Series, which he has been working on for the last year and a half.

Nov. 18-20 Wayne Olson attended the Pacific Northwest Vegetable Grower's Conference in Pasco, Washington.

Committees, Other Assignments, Activities and News

None.

Plans for 2004

1. With successful changes in operation and expansion, come additional challenges. In the last four years we have acquired fields, PMC "2", PMC "2A", Tukey Farm, and Lower Whitlow. These fields have brought us up to 36 acres over four farms around the Washington State University Campus. In 2004 we will have research or regeneration crop on 32 of the 36 acres. Many of these crops we are regenerating are turning out to be perennial crops. The result is that we have little or no organic matter going back into the fields two of three years. This is resulting in dramatic drops in organic matter, increased erosion problems, and soil tilth problems.
2. During 2004 we are actively pursuing an additional 15 to 25 acres for the further expansion of the cropping area we need. These new acres will also be used for two years out of regeneration and research use, and into high lignin crops to bring organic matter and soil tilth into a better balance.
3. In April of 2004 we are looking forward to an increased building area for seed cleaning. Hopefully this year we can also increase our storage area for planting flats, tenting material, and related equipment that has grown exponentially in the last three years as we shift to new production methods and protocols.
4. I'm sure both changes and challenges will await the Pullman Plant Introduction Farm Support Group as we work our way through 2004. As always, our Farm Group looks forward to planning for and methodically working through these changes and challenges as they arise throughout the year.

CENTRAL FERRY FARM OPERATIONS (K. Tetrick, S. McGee)

It was another busy year for operations, improvements and maintenance of the Central Ferry farm. Although we had fewer germplasm lines to increase, our improvements and maintenance kept us very busy.

Activities and Improvements

Improvements
Expanded 40 acres:
After acquiring the adjacent 40 acres last year from WSU, we began improving that land for germplasm increase. In early December 2002 we began the installation of an eight-foot deer fence around the new property, then tied it into the current deer fence around the existing 60 acres. The 6,300-foot fence was completed in late January. We had a difficult time with this fence because of weather, many corners, and mud. However, in the end it was vast improvement compared to the old broken down fence we replaced.

We continued fallowing the ground and did any noxious weed control as necessary. During this past year Dr Hannan and I have been working on water issues and preparing to lay mainline for irrigation of that land. In November after marking the land for future roadways, I planted half to winter wheat to prevent erosion and to add organic material. Next spring we will plant the other half to a mustard blend for green manure cropping and the bio-fumigation qualities that mustard plants bring.

New sewer system for temp house
In July we had a backed up sewer system at the 'Temphouse.' After running a snake and many other attempts to unblock the system, I dug to the lid of the septic tank and it collapsed as I was running the backhoe. After I had the old tank pumped I found that the steel had rusted and didn't have baffles anymore. So we removed the old tank, replaced it with a concrete tank, hooked it back up, and covered it with dirt.

Equipment
Replacement
With the increase of labor and duties on the farm we found ourselves short handed when it came to transportation on the farm. We solved that problem with a utility vehicle (Polaris Ranger) that can transport people around the farm when other vehicles are in use.
This vehicle will probably become the primary work vehicle on the farm

We also replaced the 20-year-old primary tractor (50 horse power John Deere) for several reasons. I had found some large metal chunks in January while servicing the transmission leading me to understand why it was jumping out of gear and not staying in adjustment. This led to a cost of more than what the tractor was worth. Also with the expansion of land we needed a reliable piece of equipment that could handle the expanded workload. I recommended replacement of our current tractor to a 90-horse power tractor to stay in the same frame size and have a larger engine for the work being done. It was approved in July and the tractor was delivered in late December.

Minor equipment repairs:
Our push at the Central ferry farm is maintenance of our equipment to prevent major repairs but there was one minor repair we had this year mostly due to age.
Over the past two years I have slowly been improving our 1974 farm truck's performance. This past year I replaced the carburetor and installed a brakeless ignition kit. It vastly improved performance and gas mileage seems unaffected.

Equipment fabrication
In November we constructed a plastic mulch lifter. As we were designing the lifter I decided to make it a multi use tool. That way it can be used as a Chisel plow, ripper, and a mulch lifter by attaching and removing piece form the implement frame. Work was complete in two weeks at a cost of $553.26.

Curator and Plot Summary

Germplasm regeneration:

Vicki Bradley
154 accessions of 2003-2004 grass
176 accessions of 2002-2003 grass
216 accessions of Safflower increase

Barbara Hellier
Increase accessions of allium species
Broadleaf increase accessions

Molly Welsh
192 accessions greenhouse been increase

Germplasm research

Vicki Bradley
79 accessions of safflower ornamental research
Grass Identification

Clare Coyne
Chickpea seed quality
50 Irrigated
50 Non-irrigated

Barbara Hellier
Fly trial for 2004
Pollination study using a replicated caging with different insect pollinators

Dr. Richard C Johnson
Safflower winter hardiness study
A mountain brome, genetic variability, study for 2004-2005 in conjunction U.S. Forest Service genetic research.

Non-WRPIS research:

Dr. Kim Campbell
USDA Wheat genetics
2 acres

Dr. Steve Jones
WSU Wheat Breeding
3 acres

Dr, David Bragg
WSU Garfield County Extension
Pesticide research on winter wheat and Canola
1 acre

In conclusion we had a smaller but very busy year with maintenance and improvements. As in anything there is always improvement needed. I intend to improve our weed control, build our soil tilth and fertility, and to work hard on building and grounds maintenance.

Travel, Invitations, Special Awards and/or Training

Feb. 24-28 Kurt made one trip to Parlier, California and delivered two threshers, studied the farming practices
at that location, and returned to Pullman with germplasm increase seed.
Jan. 8-9 Annual Washington State pesticide re-certification classes for two days in Moscow, Idaho

Plans for 2004

In 2004 we will be working on:

1. Non-legume, green manure cropping to improve soil tilth and biology.
2. Expanding irrigation into the new property.
3. Seed the roadways on the new property.
4. Build another lath house to harden the transplants coming in from Pullman.

5. Build a drying shed/seed cleaning room to relieve the pressure to the drying shed at Pullman.

GREENHOUSE OPERATIONS AND SAFETY (W. Luna)

Activities

During 2003 the WRPIS greenhouse program continued with effective pest control, maintaining greenhouse supply inventory, and understanding the maintenance of greenhouse environmental control systems .

The Greenhouse Operations and Logistics Facility (GOLF) (aka the potting shed) has been in operation for just over a year. It continues to be well suited to meet the needs of the station. The centralized location has greatly simplified access to greenhouse supplies. Maintaining supply inventory has also improved because now everything has a place making it much easier to see when restocking is needed.

Continued effort was made to understand the maintenance aspect of greenhouse systems. The technician enrolled in a fall semester horticulture class (Hort 334: Controlled Environments). The class provided an overview of environmental factors of horticultural production in controlled environments. Class material covered greenhouse facilities, designs, and control systems. It also included design calculations for environmental control systems as well as management of those systems to approach optimal environmental control. The technician now has a better understanding of greenhouse equipment, the relationships between heating, cooling, and lighting systems and how one system affects the other two, proper equipment selection and equipment placement to help improve the greenhouse system and deal with any problems that might occur.

A new area of responsibility appointed to the greenhouse technician last year was maintaining the ARGUS control system. This is a computer controlled greenhouse environmental control system. It has been most effective in giving the technician and curators a means of monitoring the individual greenhouses. To reduce the possibility of things going wrong only the greenhouse technician can access the program controlling the greenhouse settings. Presently only one greenhouse has enough power assisted equipment to exploit the ARGUS systems' many control functions. Understanding the full potential of the ARGUS systems' and its' functions and interactions has continued. The ARGUS representative who installed the system has made himself available for consultation and on more than one occasion has helped walk the technician through the complex menu settings. More time needs to be invested in learning the system to fully appreciate the vast amount of controls that it can affect.

The greenhouse technician attended the 2003 Association of Education and Research Greenhouse Curators (AERGC) meeting held in St. Louis, MO., on the campus of George Washington University. This meeting increased the technician's knowledge of greenhouse related topics, allowed for visiting a state of the art greenhouse and plant research facility, and the chance to network with other greenhouse technicians and industry representatives.

Travel, Invitations, Special Awards and/or Training

Jul. 9–11 Bill Luna, St. Louis, MO. Attended the Association of Education and Research Greenhouse Curators (AERGC) Meeting.

Oct. Jul. 22 Bill Luna, Spokane, WA. Hort 334 Field Trip. Visited four plant production greenhouses.

Committees, Other Assignments, Activities and News

Feb. 4-5 Bill Luna, Pullman, WA, Training session from Argus representative on the ARGUS control system.

Aug. 26–Dec. 16 Bill Luna, Pullman, WA. WSU course – Horticulture 334: Controlled Environments.

Plans for 2004

1. Supervise and maintain the unit greenhouse chemical inventory.
2. Continue to maintain and organize the inventory stored in the potting shed. Coordinate pot washing to the needs of the technicians and curators.
3. Continue to develop the greenhouse and pest monitoring programs.
4. Attend WSU Plant Growth Facilities Committee meetings.
5. Continue role as Collateral Duty Safety Officer for WRPIS.
6. Attend the AERCG meeting.
7. Continue to enroll in courses at WSU.

NATIONAL TEMPERATE FORAGE LEGUME GERMPLASM RESOURCES UNIT, PROSSER, WA
(S. Greene, A. Bell, M. Cervantes)

Activities

Our unit is involved in maintaining, acquiring, evaluating and distributing the NPGS temperate forage legume germplasm collections which contain over 12,000 accessions representing current and obsolete cultivars, landraces, wild species and genetic stocks. In 2003, we regenerated 403 accessions of which 129 were *Lotus*, 115 were *Medicago* and 159 were *Trifolium*. Forty accessions were planted in the Fall of 2002; 68 accessions were over- wintered in our 2002 field, and 11 over wintered in the greenhouse; 281 accessions were started in the greenhouse in the spring of 2003 and three accessions were increased from cuttings and put out into the 2003 field. We had 152 special care accessions: 20 accessions were handled as seed rescues (i.e. sterile germination) and 132 accessions were wild species, mainly *Trifolium* started in special soil mixes. Taxonomy was verified on all accessions grown out this summer.

We received year-end money from National Program Staff, and purchased a water-curtain germinator, supplies, and have set up space in our in vitro lab to carry out our own germination testing. Estela began germination testing 2002 seed lots. We have successfully implemented a bar-coded data acquisition protocol. Key to the success was purchasing a Pocket PC/Scanner with a Palm operating system, which allowed us to make use of already developed software. Our previous Pocket PC operated under Windows CE. Besides being unstable, it had no commercially available barcode-reading software so was cumbersome to use. Our field labeling and bar coding innovations were shared with Clare Coyne and David Ianson, who are looking to adapt it in their own programs.

Acquisitions in 2003 included almost 100 accessions (mainly *Medicago*) from Turkmenistan, collected by R. Hannan in 2002. This acquisition helps us to fill collection gaps for Central Asian countries. We led efforts to develop a proposal in collaboration with Berry Botanical Garden, to collect wild legumes in Washington, Oregon and Idaho. This proposal was successfully funded, and we will be collecting seed in 2004. A total of 1,130 accessions were backed up at NCGRP in Fort Collins. We have almost completed the seed count inventory of all original seed of Medicago. In 2003 we distributed 40 packets of *Lotus* seed, 222 packets of T*rifolium* seed and 4,588 packets of *Medicago* seed, including 2,360 packets of *Medicago truncatula*.

Research Activities

Evaluation of the NPGS *Medicago truncatula* collection. An extensive morphological evaluation of the entire M. truncatula collection (313 accessions) was carried out in 2003. We started 40 plants/accession in the greenhouse, and field transplanted into a randomized complete block design having 3 reps, 10 plants/rep. We have collected 39 morphological traits. We also collected leaf samples and have isolated DNA from approximately 1/3 of accessions to date. We plan to complete the isolations and run microsatellites on the material in 2004. We will then analyze the data and develop a core subset.

Development of a GIS-based Interactive Agricultural Atlas to Promote Food Security in the Former Soviet Union. This project began in January of 2003. The grant provides $ 349,000 over three years to develop an interactive GIS atlas consisting of maps, narrative text, associated metadata and GIS exploratory software. The grant supports over 50 scientists from three Russian institutes (St. Petersburg State University, All Russian Institute of Plant Protection and Vavilov Institute), who will develop a web-based and CD-ROM Atlas that displays the distribution of major and minor crops cultivated in the FSU, and the incidence of disease, insect and weed pests of these crops. Maps representing the distribution of wild crop relatives and agro ecological maps of major climatic parameters that influence agricultural production will also be developed. This information is being compiled from an extensive array of historical literature sources, and from herbarium and germplasm collection. Over the course of the year I helped developed standard procedures for the project, developed the metadata scheme for the English version of the Atlas, wrote the English version of the web site (http://www.agroatlas.spb.ru/index_en.htm), and edited English translations of Atlas objects

Research on Kazakhstan germplasm collected in 2000. A paper entitled "Collecting wild crop relatives in northwestern Kazakhstan" was accepted in the *Plant Genetic Resources Newsletter* and is in press. We examined winter survival data at Prosser to confirm the statistically significant occurrence of tetraploid *M. sativa* subsp. *falcata* with cold temperatures, but the data set was too incomplete to use. We will be continuing the winter survival research project in 2004 (See 2004 plans). In collaboration with Ted Kisha, we carried out micro satellite analysis on the same 6 populations we did AFLP's on in 2002. The gels are ready to be scored. Our intention is to examine introgression between wild populations and Russian cultivars, comparing the two marker systems.

Research on Caucasus red clover germplasm collected in 1995. A paper entitled "Relating morphological and RAPD marker variation to collection site environment in wild populations of red clover" was accepted by *Genetic Resources and Crop Evolution* and is in press with no publication date yet set. A paper entitled "Isozyme diversity in wild red clovers from the Caucasus" was accepted by *Crop Science*, and will be published in March 2004. The lead author is Dr. Jorge Mosjidis, Auburn University. Research on the Caucasus red clover germplasm concludes with the publication of these two papers.

Research on Alfalfa cultivars: implications of seed increase and putative duplication. We completed collecting morphological data on 16 attributes for three alfalfa cultivars represented by multiple seed lots, and accession numbers. We plan on analyzing the data and preparing a paper in 2004.

Development of Germplasm Explore and Map GIS (GEM-GIS) software. Continued to lead efforts to promote adoption of GIS tools in the NPGS. As Chair of the PGOC GIS subcommittee, led efforts to define a prototype web-based GIS application that can be used with GRIN. Worked with Dr. Toshi Minoura to develop an NPGS prototype (GEM-GIS), using data from the Medicago and Trifolium collections. Dr. Jeff Steiner demonstrated the prototype at the 2003

PGOC meetings. A working group was organized to explore the specifics of implementing such a system across the NPGS.

Talks and Presentations

Jan. 10 Presented an invited paper at the First International Workshop on "Agrobiodiversity, Pilot Conservation
Projects and the Taxonomy Gap" in Hanoi. The paper was entitled: Conserving alfalfa in Kazakahstan.
May 2 Presented a lecture on the GRIN database to students in Computer Science 540, Database Management Systems, at Oregon State University.
Sep. 23-26 Organized a weeklong “Use of GIS for the analysis of biodiversity data”, DIVA-GIS training workshop
for NPGS personnel, which was held in Prosser on September 23-26, 2003. This workshop was filled
to capacity, and received favorable feedback.
Nov. 4 Presented annual report to Clover and Special Purpose Legume Crop Germplasm Committee,
Denver, Colorado.

Travel, Invitations, Special Awards and Training

Jan. 9-16 Stephanie Greene went on an all-expenses paid trip to Vietnam to present paper at the First
International Workshop on "Agrobiodiversity, Pilot Conservation Projects and the Taxonomy Gap"
and to conduct training on the use of GPS, GIS software, and data management to support the
UNDP project entitled "In situ conservation of native landraces and their wild relatives in Vietnam.
Feb. 6 Stephanie Greene received an award for her excellence in management and research efforts at the
National Forage Legume Genetic Resources Unit.
Apr. Stephanie Greene visited the Desert Legume Program at the University of Arizona, in Tuscon,
Arizona, while in Tucson on annual leave.
May 1-2 Traveled to Corvallis Oregon to meet with Dr. Toshi Minoura, his graduate students, and Jeff
Steiner. We outlined the structure and functionality of GEM-GIS.
Jun. 10-12 Stephanie Greene attended the PGOC meetings in Miami, Florida. Visited Berry Botanical Garden,
Portland, Oregon.
Aug. 6 Andrew Bell and Estela Cervantes received merit awards for their work in field management of
M*edicago Truncatula* evaluation in addition to regeneration activities.

Sep. 6-17 Stephanie Greene went to St. Petersburg to meet with scientists and institute directors, to foster collaboration among the three Russian institutes.
Sep. 14-19 Estela was sent to Pullman for germination training in September.
Sep. 23-26 Organized a weeklong "Use of GIS for the analysis of biodiversity data", DIVA-GIS training workshop for NPGS personnel, which was held in Prosser on September 23-26, 2003. This workshop was filled to capacity, and received favorable feedback.

Committees, Other Assignments, Activities and News

Ex-officio member- Alfalfa CGC and Clover and Special Purpose Legumes CGC
Chair, PGOC subcommittee on GIS
Chair, C-8 division of the Crop Science Society of America
Continued to serve on the Crop Science Registration Subcommittee "Other legumes", chaired by Dr. Fred Muehlbauer. Reviewed 37 registration manuscripts in 2003.
Was asked to serve on the Technical Advisory Board for the Desert Legume project, in Tucson, Arizona.
Reviewed ~ 4-6 manuscripts for ARS scientists and Crop Science

Plans for 2004

The unit is planning to increase between 400 accessions, focusing predominately on new acquisitions collected in Turkmenistan in 2002, and Tajikistan in 2003. We will also continue increasing original seed lots of *Trifolium* and *Lotus* accessions that have only open-pollinated distribution seed. We will continue our seed rescue work and develop regeneration protocols for wild species. In March, I will be returning to St. Petersburg to finalize the English versions of maps and descriptions that have been completed to date. This summer I am collaborating with Dr. JoAnn lamb, to evaluate the winterhardiness of the 2000 Kazakhstan germplasm in three different locations (2 in Minnesota, 1 in Canada). We will also be running cool temperature germination and seed vigor tests at Prosser. I will be participating in a domestic collecting trip to Washington, Oregon and Idaho to collect wild and rare legume species. We will also survey extant populations of Trifolium thompsonii in June, and collect seed in August. This work is in collaboration with Berry Botanical Garden. In July, I will be attending the joint North American Alfalfa Improvement Conference/International Trifolium Conference in Quebec, Canada. In August, in collaboration with Marina Roumiantseva, Research Institute for Agricultural Microbiology, St. Petersburg, will submit a proposal entitled: "Exploring gene pool diversity responsible for effective Alfalfa-*Sinorhizobium* symbioses in drought, heat and salt stress environments". In conjunction with this, I will develop an NPGS exploration proposal to survey and collect alfalfa germplasm in Kazakhstan in 2005.

NATIONAL ARID LAND PLANT GENETIC RESOURCE UNIT, PARLIER, CA

(M.M. Jenderek, J. Serimian, G. Smith)

Germplasm Conservation

In 2003, the NALPGRU processed 2,586 different accessions (40 different genera and 156 different species); 1,943 (75.1%) for other NPGS sites (Aberdeen, Ames, Corvallis, Griffin and Pullman) and 634 (24.9%) assigned to the Parlier site; this is a 39.3% more accessions than in the previous year. A total of 1000 accessions were regenerated. Regeneration of 163 annual accessions was done under cages or screen tents. 131 new perennial plant accessions (*Bassia, Cucurbita, Helianthus, Opuntia, Parthenium, Peponopis,* and *Simmondsia*) were established in the perennial nursery. 200 different *Hordeum* accessions were sampled for ELISA testing. 72 accessions (50 *Lesquerella* and 22 *Limnanthes* accessions) were characterized according to descriptors. A final list of descriptors for *Parthenium* was submitted for an entry to GRIN. Seed viability was established for 29 *Lesquerella* and 33 *Limnanthes* accessions. 137 new germplasm accessions (*Bassia, Hylocereus,* and *Opuntia*) were added to NALPGRU's genetic resources. A proposal for *Parthenium* plant exploration in Mexico was submitted.

Research Activities

Variation in seed production and phenological characteristics in selected accessions of the USDA *Limnanthes* germplasm collection. Ten different *Limnanthes* accessions were evaluated in a replicated trial for several descriptors. Results were presented on the 2003 AAIC meeting (poster). This project will be continued in 2004-2005. In addition to the 10 accessions, 24 accessions (all *L. alba* accessions in the USDA collection) will be evaluated. This study aims providing information for meadowfoam germplasm development.

Development of isolation structures for regeneration of wind pollinated plant species. A 3rd year of observations was completed to determine the most effective pollen isolation material for production of small seed quantities. For the 3rd time, lexan structures with cooled air flow have proven to be the best. The data is computerized and ready for analysis. The results have practical value to our program and may be of interest for other curators working on preservation of wind pollinated plant species.

Testing of pollen barriers (structures without a roof). Preliminary observations on using 6 and 4 feet high canvas cages without a roof as pollen barriers for wind pollinated plant species, with male sterile *Beta vulgaris* plants (model plant) inside the cages, and male fertile plants outside the cage, showed no seed development on the male sterile plants (inside the cages). However, the number of sterile plants used was low (14/cage, two replications). The testing will be repeated in 2004 and 2005, if a sufficient number of stecklings is available. In the past, we had difficulties to produce a sufficient number of stecklings for both sterile and fertile lines. This study attempts to develop economic isolation barriers for regeneration of *Bassia* sp. germplasm collection and possible for the *Atriplex* collection.

Evaluation of a half-sib garlic family. Selected economic traits were evaluated in two locations

(Parlier and Pullman) and compared to the maternal plant (first year completed). The evaluation will be carried out in 2004 and completed in 2005. This type of study is the first known for *Allium sativum*. It will provide information on garlic genetics to garlic breeders and researchers, and may result in germplasm release.

Evaluation of S_1 families in garlic. A second year of observations of morphological traits and invitro pollen germination was carried out to support current genomic studies (USDA-IFAFS grant) of Asparagales. A part of the results was already published ("Development of the first linkage map in garlic", abstract accepted for the 2004 Plant and Animal Genome meeting in San Diego, CA).

Talks and Presentations

M.M. Jenderek and R.M. Hannan. "Variation of reproductive characteristics of open pollinated garlic progenies. Hort. Science 38(5):673. 2003 ASHS, Providence, RI. Abstract and Oral presentation.

Travel, Invitations, Special Awards, Training, and/or Assignments

Filimon Ramirez, received a quality step increase.
Lourdes Vera, 130-day appointment was completed on September 6, 2003.
Shannan Stockton completed eight weeks of High School Summer Research Apprenticeship.
Required ethics training was completed by Jerry.
Gary completed First aid training.
Jerry, Gary Lee, Lourdes and Filimon were recognized with spot awards.
Johnatan and Ruben volunteered to prepare the USDA, ARS local parade exhibition.
Johnatan was recognized with a spot award.

May 13-15 Jerry Serminian, Maria Jenderek and Gary Smith all traveled to the USDA, ARS, Maricopa, AZ, collection of *Parthenium* and *Simmondsia*.
Jun. 10-12 Maria Jenderek attended the PGOC, USDA, ARS, Miami, FL.
Aug. 28-28 Maria Jenderek attended USDA, ARS, Beltsville, MD, GRIN training.
Sep. 2-4 Gary Smith traveled to the USDA, ARS, Ames, IA, field operations and pollination techniques.
Sep. 8-9 Maria Jenderek traveled to the USDA, ARS, Fort Collins, CO, seed viability testing and storage.
Sep.9-11 Jerry Serminian traveled to the USDA, ARS, WRPIS, Pullman, WA, harvest and post harvest operations.
Sep. 22-25 Maria Jenderek traveled to the USDA, ARS, Prosser, WA, for GIS training .
Oct. 2-5 Maria Jenderek attended the ASHS, Providence, RI.
Oct. 12-14 Maria Jenderek attended the AAIC, Portland, OR.

Committees, Other Assignments, Activities and News

American Society of Horticultural Science, member
Association for the Advancement of Industrial Crops, member
California Native Plant Society, member
International Society for Horticultural Science, member
New Crops CGC, ex-officio member
Leafy Vegetable CGC, member
Root and Bulb Vegetable CGC, member
PGOC