PARLIER-DAVIS RESEARCH SYMPOSIUM  
June 12, 2012  

Table of Contents  

| Agenda                                      | 1 |
| Introduction                                | 2 |
| Crops Pathology and Genetics Research Unit  | 3 |
| National Clonal Germplasm Repository for Fruit and Nut Crops | 23 |
| National Arid Land Plant Genetic Resources  | 23 |
| Crop Diseases, Pests and Genetics Research Unit | 29 |
| Commodity Protection and Quality Research Unit | 53 |
| Water Management Research Unit              | 73 |
10 am Welcome and Introductions
   Dan Kluepfel

10:15 am Crop Diseases, Pests & Genetics:
   Elizabeth Rogers – Xylella fastidiosa: pathogen biology and plant responses
   Rodrigo Krugner – Biology, ecology, behavior, and transmission properties of
   Xylella fastidiosa vectors
   Craig Ledbetter – Current Prunus and Vitis breeding efforts at the SJVASC
   Ray Yokomi – Current research on citrus pathogens

11:15 am Break

11:30 am Water Management Research:
   Jim Ayars – irrigation water management
   Jim Gerik – Alternatives to methyl bromide for pre-plant applications

Noon Lunch catered by Uncle Harry’s, Reedley, CA

1:30 pm Commodity Protection & Quality/National Arid Land Plant Genetic Resource:
   Judy Johnson – Non-chemical postharvest alternatives to methyl bromide
   Spencer Walse – Chemical postharvest alternatives to methyl bromide
   Joe Smilanick – Maintaining quality and extending shelf and shipping life
   Gabriela Romano – NALPGR

2:30 pm Break

2:45 pm Crops Pathology and Genetics/National Clonal Germplasm Repository for Fruit
   and Nut Crops:
   Greg Browne – Etiology and biology of tree crops diseases
   Kendra Baumgartner – Sustainable Viticulture
   Cai-Zhong – Rice genetics/Sustainable floriculture
   Malli Aradhya – NCGR

3:45 – 4:30 pm Tour
   Lysimeter
   SEM/Confocal microscopes
   CPQ insectary/ insect-rearing room
   Fumigation area
INTRODUCTION

I welcome you to our first joint research symposium between the Davis and Parlier USDA-ARS locations. We share many research objectives in common, and communication between our locations can only strengthen our future efforts. Collectively, our locations represent an incredible breadth of expertise in numerous cropping systems and varied aspects of crop production. Today you will meet the SYs in each research unit at both locations, and the presenters will summarize the research programs in each lab supported under a common CRIS project. As science is becoming more and more team-oriented and trans-disciplinary, it is reassuring to know we have such a wealth of experience available in Davis and Parlier, which we can exploit to advance current projects and build future collaborations.

Dan Kluepfel
Research Leader, Crops Pathology and Genetics Research Unit
Acting Center Director, SJVASC
CROPS PATHOLOGY AND GENETICS RESEARCH UNIT

Mission: The mission of the CPGRU is to develop information on and solves issues involving: 1) etiology and biology of diseases affecting deciduous fruit/nut trees, grapevine, and development of improved disease management approaches that do not rely on methyl bromide or other pesticides; 2) rice genetics and germplasm enhancement for temperate environments; 3) sustainable management of grapevine diseases and weeds; and 4) development of sustainable floriculture production systems.

Unit Scientists:
Daniel Kluepfel  Research Leader
Kendra Baumgartner  Research plant pathologist
Greg Browne  Research plant pathologist
Cai-Zhong Jiang  Research plant physiologist
Takao Kasuga  Research geneticist
Andrew McElrhone  Research plant physiologist
Kerri Steenwerth  Research soil scientist
Mysore Sudarshana  Research geneticist
Thomas Tai  Research plant physiologist

Research Projects:
1. ARS Areawide Pest Management Program for Methyl Bromide Alternatives
2. Genetic Dissection of Seedling Cold Tolerance in Rice
3. Improving Postharvest Life of Potted Plants & Cut Flowers through use of Molecular and Applied Technologies
4. Sustainable Vineyard Production Systems
5. Integrated Strategies for Advanced Management of Fruit, Nut, and Oak Tree Diseases

Program overview: Research is focused on basic and applied research programs, which include the following: 1)determining the nature, biology, and pathogenic effects of bacteria, fungi, viruses, virus-like agents, and abiotic disorders that affect production of fruit/nut crops and developing alternative, environmentally sound disease management approaches; 2)identifying and characterizing rice genes affecting agronomically important traits (e.g. cold tolerance, disease resistance, competitiveness) and developing enhanced rice germplasm; 3)assessing and developing disease and weed management approaches for sustainable viticulture production; and 4)planning and implementing research on floriculture crops (i.e., cut flower and flowering potted plants) and production systems to improve the sustainability of greenhouse operations.
Daniel A. Kluepfel, Research Leader, CPG

Education:
1978  BA, University of Missouri, Major: Biology/Biochemistry
1984  PhD, University of Florida, Gainesville, Plant Pathology

Professional Work Experience:
1987-2003  Professor, Clemson University, Clemson, SC
2003-present  Research Leader, Crops Pathology and Genetics, USDA-ARS, Univ. California, Davis, Davis, CA

Accomplishments:
Dr Kluepfel has conducted research on the biology, ecology, population genetics, and rhizosphere ecology of plant associated prokaryotic microorganisms for more years than he cares to remember. His graduate studies involved a characterization of the mechanisms which controlled attachment of Agrobacterium tumefaciens to both biological and abiotic surfaces. This was followed by a postdoctoral Fulbright Fellowship which supported his postdoctoral work at Wageningen Agricultural University, The Netherlands where he worked on Rhizobium-legume interactions. This was followed by a postdoctoral position in the Department of Plant Pathology at the University of Hawaii in Honolulu where he work on characterizing the genes involved in toxin production by various Pseudomonas species. Dr Kluepfel then joined the faculty in the Dept of Plant Pathology at Clemson University in South Carolina where he served for 16 years rising through the ranks to Full Professor. In 2003 he joined the USDA-ARS as research leader for the Crops Pathology and Genetics Research Unit in Davis, CA.

Current Research:
Dr. Kluepfel’s current research currently focuses on the biology and ecology of Agrobacterium tumefaciens under both nursery and orchard production systems. In addition his lab is working in a collaborative effort to identify and characterize crown gall resistant Juglans and Prunus spp. This work involves examining both wild species of Juglans and Prunus along with the progeny of directed crosses of parental material exhibiting desirable phenotypes. This work is performed in an effort to develop commercially viable disease resistant rootstock material. The rootstock development project is a collaborative effort between three SYs in the Crops Pathology and Genetics Research unit, scientists at the USDA-ARS National Clonal Germplasm Repository in Davis and several key faculty at the University of California. To facilitate the crown gall resistance screening effort Kluepfel’s lab is examining the genetic diversity of A. tumefaciens isolates though out California. In addition they are also examining the diversity of such important A. tumefaciens phenotypes as agrocin 84 resistance, virulence, and host range.

Selected Publications:


Kendra Baumgartner, Plant Pathologist, CPG

Education
1996  MS, State University of New York, College of Environmental Science & Forestry
2000  PhD, Plant Pathology, University of California, Davis.

Professional work experience
2000-present  Research Plant Pathologist, USDA-ARS, Davis, CA

Accomplishments
Dr. Baumgartner has conducted research on the biology, population genetics, and pathogenesis of fungal pathogens of grapevine for 16 years. In her graduate studies on the root pathogen Armillaria mellea at the University of California, Davis, she linked the distribution of foliar symptoms to sources of below-ground inoculum, and to the forest types from which the inoculum originates. Since joining USDA-ARS, she developed genotype markers, a genetic transformation system, and a rapid infected assay, all of which have advanced research on Armillaria genetics and infection biology. Dr. Baumgartner identified and characterized Phomopsis viticola and other Phomopsis species that are wood-canker pathogens of grape, in grape-growing regions where P. viticola was previously known primarily as a fruit and foliar pathogen. As leader of a multi-national, collaborative project on Eutypa dieback, she found that populations of the wood-canker pathogen Eutypa lata were likely introduced to California, Australia, and South Africa from grape-growing regions of Europe.

Current research
Currently, Dr. Baumgartner’s research is focused on development of an assay that detects wood-canker infection in its early stages, before wood-canker diseases become widespread in the field and especially in the nursery. As such, she is working with Andrew McElrone (USDA-ARS, Davis, CA) to define the early stages of wood infection, using advanced imaging techniques (MRI, CT-scan) and RNAseq. In collaboration with diagnostic labs throughout California, she is developing a diagnostic tool that combines morphological descriptions with a searchable DNA-sequence database, to improve the accuracy of diagnosing trunk diseases of grape. In autumn 2012, Dr. Baumgartner will serve as a fellow of the Organization for Economic Cooperation and Development, at the Institut des Sciences de la Vigne et du Vin, Université de Bordeaux.

Selected Publications


Greg Browne, Research Plant Pathologist, CPG

**Education:**
1978  BS, Plant Science, University of California, Davis
1984  MS, Plant Pathology, University of California, Davis
1991  PhD, Plant Pathology University of California, Davis

**Professional Work Experience**
1995-PRES.  RESEARCH PLANT PATHOLOGIST, USDA-ARS, DAVIS, CA
1992-95  Farm Advisor, University of California, Bakersfield, CA
1986-92  Plant Pathologist, USDA-ARS, Davis, CA

**Research Accomplishments**
Determined effects of soil-water saturation and its duration on development of apple root and crown rots caused by three *Phytophthora* spp. Quantified underlying effects of flooded and nonflooded soil moisture conditions on disease development. Determined that resistance in apple rootstock germplasm to *P. cactorum*, *P. cambivora*, and *P. cryptogea* can vary according to the particular *Phytophthora* sp. Determined etiology of Perennial Phytophthora canker (PPC), a disease of almond scions that occurred at high incidence in what were some of the San Joaquin Valley’s most productive orchards. Developed integrated control strategies for PPC and Phytophthora crown and root rots on almond. Described Prunus replant disease (PRD) on almond and peach and developed new strategies to control it without MB. Established putative roles of fungi and oomycetes in PRD of almond and peach. Identified walnut rootstocks with superior resistance to *Phytophthora citricola* and *P. cinnamomi*. As program director for USDA-ARS Pacific Area-Wide Pest Management Program for Integrated Methyl Bromide Alternatives (PAW-MBA), designed and coordinated a research and demonstration program to facilitate stable transitions to MB alternatives.

**Current Research**
Main research objectives are: 1) Determine species of *Phytophthora* and *Pythium* contributing to root and crown rot diseases of cultivated *Prunus* and *Juglans* species, 2) Identify members of soil microbial communities that mediate *Prunus* replant disease, 3) Evaluate genetic resistance of almond and peach rootstock germplasm to *Phytophthora* species and the *Prunus* replant disease complex. Dr. Browne directs the Pacific Area-Wide Program for Methyl Bromide Alternatives.

**Selected Publications**


seed viability, weed densities, and time required for hand weeding. Weed Technology 22:267-274.


Gao, S., Hanson, B.D., Wang, D., Browne, G., Qin, R., Ajwa, H., Yates, S. Methods evaluated to minimize emissions from pre-plant soil fumigation. California Agric. Jan-Mar 2011 pp. 41-46; doi#10.3733/ca.v065n01p41


Cai-Zhong Jiang, Research Plant Physiologist, CPG

**Education:**
1982 BS, Agronomy, Guangxi Agricultural College, Guangxi, China
1986 MS, Crop Science, Tokyo University of Agriculture and Technology
1989 PhD, Crop Science, Tokyo University of Agriculture and Technology

**Professional work experience:**
2006-present Research Plant Physiologist, USDA-ARS, Davis, CA
2003-2005 Associate Project Scientist, Plant Sciences, University of California at Davis, CA
1997-2003 Senior Scientist, Group Leader of Molecular Biology, Mendel Biotechnology, Hayward, CA

**Current research:**
Dr. Jiang’s research project is on post-harvest biology and technology of floricultural/ornamental crops developing sustainable postharvest systems that enhance productivity while reducing loses due to post harvest disease, longevity issues. The project focuses on 1) To understand the molecular basis of plant senescence and abscission; and 2) To address how environmental factors such as water, temperature and diseases, effect on the performance of ornamental crops. One of the basic research programs is the exploitation of virus-induced gene silencing (VIGS) to identify which transcription and regulatory factors that control floral senescence, abscission and other important agronomic traits such as drought tolerance.

**Selected Publications:**


Patents awarded:
Takao Kasuga, Molecular Geneticist, CPG

Education
1986  B. Eng. Waseda University, Industrial Chemistry
1991  M. Eng. Waseda University, Applied Chemistry
1995  Ph.D. Aberdeen University, Genetics

Professional Work Experience
1995-1997  Postdoc in Plant Genetics, S. R. Noble Foundation, Ardmore, OK
1997-2001  Postdoc in Fungal Evolution Roche Molecular Systems
2002-2008  Associate Specialist, University of California, Berkeley, CA
2008-present  Research Molecular Geneticist, USDA ARS, Davis, CA

Accomplishments
Dr. Kasuga is expertise in evolutionary genetics and genomics of pathogenic microbes. He conducted pioneering work on phylogeography and estimation of gene evolutionary rates in fungi at the University of California, Berkeley. He also played a key role in the development of microarray transcriptomics for filamentous fungi. He has developed several new approaches for data mining, software for automation, and disseminated them to the scientific community. Since joining USDA-ARS, he has developed microarrays for two Phytophthora species, adapted the next-generation sequencing technology for the study of Sudden Oak Death pathogen, and initiated to investigate the involvements of circadian rhythm and epigenetics in oomycete pathogenesis.

Current Research
Currently our lab is focusing on two main projects. (1) rapid phenotypic diversification in invasive pathogens: We have recently demonstrated that phenotypic variation observed in the sudden oak death pathogen Phytophthora ramorum is associated with host species from which microbes are isolated but not with multilocus genotypes. This phenomenon, termed, host-induced phenotypic diversification, is likely governed by epigenetic alteration triggered by host environments. We are currently investigating molecular mechanism underlying this phenomenon. (2) Mode of action of phosphonate: the systemic fungicide, phosphonate, is effective in controlling oomycete diseases and is environmentally benign. The chemical has been used successfully as a trunk injection, or spray, to control P. ramorum in coast live oak and tanoak. Despite the value of phosphonates in oomycete disease control, their mode of action is poorly understood and rather controversial. Our group use Tomato and Phytophthora capsici as a model pathosystem to decipher the mode of action of phosphonate fungicide.

Selected Publications


PATENT

Andrew J. McElrone, Research Plant Physiologist, CPG

**Education:**
1996  BS, Biology/Environmental Science Millersville University
2001  PhD, Plant Biology University of Maryland

**Professional work experience:**
2006-present  Research Plant Physiologist, USDA-ARS, Davis, CA
2004-2006  Assistant Professor, Biology Dept, Saint Joseph's University, Philadelphia PA
2001-2004  Post Doctoral Research Associate

**ACCOMPLISHMENTS:**
Dr. McElrone has conducted research on water transport processes in plants for 15 years. His dissertation research, conducted at the University of Maryland at College Park, focused on the interactive effects of drought and bacterial leaf scorch disease (caused by *Xylella fastidiosa*) on xylem function in woody plants. As a Post-doctoral Research Associate in the Biology Department at Duke University, Dr. McElrone studied water uptake and transport physiology of deep tree roots (some as deep as 20m below ground) using cave systems in the Texas hill country- an area with a large concentration of eroded limestone caves and coincidently within the native range of *Vitis berlandieri*. As a post doc, he also studied the influence of elevated atmospheric carbon dioxide on plant diseases, and continued this work as an Assistant Professor in the Department of Biology at St. Joe’s University in Philadelphia. Since moving west and joining USDA-Agricultural Research Service in Davis CA, he has worked to improve water use efficiency in wine, juice, table and raisin grape vineyards through: 1) better understanding of drought resistance in *Vitis*; 2) evaluating water uptake (at the fine roots) and transport (in the xylem) physiology in grapevines and other woody plant species; 3) development of sensor technology to quantify water use; 4) identification of seasonal windows of water savings; and 5) evaluating the use of crop crops on vineyard water use and fruit production.

**Current Research:**
Currently, Dr. McElrone’s research program continues to focus on improved water use efficiency in grapevines through improved understanding of stress tolerance and better vineyard level water quantification. Some of his current work utilizes High resolution computed tomography (HRCT-a type of CAT scan) to visualized transport capacity in xylem of living grapevines. This work is being conducted at the Advanced Light Source at Lawrence Berkeley national Labs. In an expansion of this effort, he is working with Kendra Baumgartner (USDA-ARS, Davis, CA) to define the early stages of wood infection, using HRCT. McElrone is also collaborating with grapevine breeder, Dr. Andy Walker from UC Davis, to evaluate rootstock drought resistance with a focus on fine root hydraulic conductivity, hydraulic redistribution, and xylem cavitation resistance and embolism repair. To improve the quantification of vineyard water use at the vineyard scale, McElrone is co-advising a PhD student (Tom Shapland) with UC Davis biometeorologists Drs. Rick Snyder and K.T. Paw U in an effort to develop surface renewal as an inexpensive user friendly method for quantifying vineyard water flux.
**Selected Publications**

Brodersen CR, Choat B, Chatelet D, Shackel KA, Matthews MA, **McElrone AJ**. Peripheral xylem chains contribute to radial and tangential xylem connectivity in stems of two grapevine species (*Vitis vinifera* and *V. arizonica*). *American Journal of Botany* (in press)


Choat B, Drayton W, Brodersen C, Mattthews MA, Shackel KA, **McElrone AJ**. 2010. Vulnerability to cavitation in grapevines has been overestimated by the centrifuge technique *Plant Cell and Environment* 33:1502-1512


Kerri Steenwerth, Soil Scientist, CPG

**Education:**
1995  BS, Genetics and Plant Biology University of California, Berkeley
2003  PhD, Soil Science University of California, Davis

**Professional Work Experience:**
2003-2004 Post-doctoral Researcher, UC Davis
2004-present Research Soil Scientist, USDA-ARS, Davis, CA

**Accomplishments:**
Dr. Steenwerth has carried out innovative research for the study of microbial-plant interactions, nutrient cycling, greenhouse gas emissions, and plant management in Mediterranean soils. Dr. Steenwerth has integrated the study of soil processes and microbial communities across multiple spatial scales (i.e., region, landscape, field plot, and microcosms) in grasslands and agricultural ecosystems. Dr. Steenwerth has shown that soil microbial communities form a unique ‘fingerprint’ that corresponds to a given land use type at the landscape and regional scale (state of California). This finding represented a new perspective on factors controlling the spatial distribution of soil microorganisms. Dr. Steenwerth investigated vineyard cover crop and weed management practices with soil nitrogen dynamics and nitrous oxide emissions from vineyards to demonstrate that vineyards were neither strong emitters of greenhouse gases nor significant sources of nitrate leaching.

**Current Research:**
Dr. Steenwerth leads several studies focusing on the effects of vineyard floor management and soil landscapes influence biogeochemical cycles, weed and soil microbial communities, and winegrape production. Goals of the current research program are to minimize greenhouse gas emissions from vineyards, utilize biogeochemical models to predict how management and soil landscapes affect nitrogen and carbon cycling, and identify alternative weed control practices. Dr. Steenwerth and collaborators at U.C. Davis use Life Cycle Assessment to investigate how soil landscapes, management practices, and production goals interact to influence environmental impacts of winegrape production. Dr. Steenwerth also works with researchers at U.C. Davis and Monash University (AU) to address means to reuse winery wastewater for winegrape irrigation.

**Selected Publications:**


Mysore R. Sudarshana, Research Plant Pathologist, CPG

Education:
1995  PhD, Plant Science University of Idaho, Moscow, ID

Professional work experience:
2008-present  Research Biologist, USDA-ARS, Davis, CA
2004-2008  Assistant Researcher, Western Institute for Food Safety and Security, Univ. of California, Davis, CA
2002-2004  Staff Research Associate, Dept. of Plant Pathology, Univ. of California, Davis, CA
2001  Group Leader (Genomics), Avestha Gengraine Technology Pvt. Ltd, Bangalore, India
1995-2000  Post-doctoral Fellow, Dept. of Plant Pathology, Univ. of California, Davis, CA

Accomplishments:
Dr. Sudarshana has conducted research on the biology and molecular biology of plant viruses. He characterized the genome of a tobacco rattle virus isolate from the Pacific Northwest and obtained transgenic potato lines expressing virus coat protein during his graduate program. During his post-doctoral work he conducted studies on cell-to-cell and long distance transport of a plant DNA virus tagged with a green fluorescent protein gene in hosts and nonhosts. He also generated a chemically inducible cucumber mosaic virus amplicon to produce heterologous proteins in plants. In his present position, he has described a new graft union disorder in Pinot noir grapevines on 110 Richter rootstock. He has developed sensitive primers to screen backcross populations containing a genetic marker linked to Cherry leaf roll virus resistance in black walnuts and screened ~1300 trees. He has also determined the genome sequence of the virus strain that causes black line disease in walnuts.

Current research:
Dr. Sudarshana’s research is focused on determining the etiological agents associated with graft union disorders in grapevines and tree fruits and nut crops and developing sustainable management strategies to manage these diseases. He has detected DNA of a phytoplasma, related to Peach yellow leafroll phytoplasma, in almond trees affected by brown line disease. He is interested in developing an inoculation assay by agroinfiltration of an elicitor protein from Cherry leaf roll virus genome. He is developing genetically altered walnut interstocks resistant to Cherry leaf roll virus to prevent blackline development. He is also working on determining the etiological agent associated with grapevine red blotch disease in Napa Valley. To improve diagnosis of plant viruses in woody plants, Sudarshana is exploring new isothermal amplification protocols. He collaborates with UCD scientists Dr. Adib Rowhani, for detection and characterization of grapevine viruses, and Chuck Leslie on walnut related projects. He also collaborates with Dr. Yong-Biao Liu, USDA-ARS, Salinas on grapevine red blotch disease.

Selected Publications:


Thomas H. Tai, Research Geneticist, CPG

**Education:**
1990  BS, Biological Sciences Cornell University, Ithaca, NY
1995  PhD, Plant Biology University of California, Berkeley

**Professional Work Experience:**
2002-present - Research Geneticist, USDA-ARS, Davis, CA
1999-2002 - Research Plant Molecular Geneticist, USDA-ARS, Stuttgart, AR
1996-1997 - Postdoctoral Research Associate, The Sainsbury Laboratory, Norwich, UK

**Accomplishments:**
Dr. Tai has conducted plant genetics research for over 20 years and has authored/co-authored over 40 publications. As a graduate student, he used a positional cloning approach to isolate the Bs2 gene from pepper which confers resistance to bacterial spot disease of pepper and tomato. Following postdoctoral work on the tomato Cf4 and Cf9 resistance genes and QTL mapping in rice, Dr. Tai joined the newly opened USDA-ARS Dale Bumpers National Rice Research Center where he established a molecular genetics program to evaluate genetic diversity and population structure in rice germplasm using microsatellite markers. After transferring to Davis, Dr. Tai’s research focus has involved developing rice genomics resources and identifying genes affecting grain quality and agronomic performance. Accomplishments include cloning of the rice low phytic acid 1 (lpa1) gene, which is involved in the biosynthesis phytic acid in seeds, and the fine mapping of two major QTLs for seedling cold tolerance, qCTS4 and qCTS12. Along with colleagues at UC Davis, Dr. Tai also developed a public rice TILLING resource for reverse genetics.

**Current research:**
Currently, Dr. Tai’s research is focused on identifying and characterizing the genes underlying the qCTS4 and qCTS12 in order to determine how these QTL function in conferring seedling cold tolerance. Additional research projects include genetic dissection of rice milling yield and other grain quality traits. Dr. Tai continues to develop and evaluate populations of rice mutants for functional genomics and breeding applications, and more recently, has begun employing next-generation sequencing/genotyping strategies for genetic diversity studies, linkage mapping, and association analyses.

**Selected Publications:**


NATIONAL CLONAL GERMPLASM REPOSITORY FOR FRUIT AND NUT CROPS

Mission: As part of the US National Genetic Resources Program, our mission is to collect, preserve, evaluate, and distribute the genetic resources of *Vitis, Prunus, Juglans, Ficus, Olea, Pistacia, Punica, Diospyros, Actinidia*, and *Morus*. These resources are preserved by us to ensure that these species will be available for future generations, and to support research efforts in variety development and other areas of plant research.

Unit Scientists:
John Preece  Research Leader
Malli Aradhya  Research geneticist

Program overview: The main priority is to build and maintain the plant collections, but we are cooperators on a broad range of research projects, including: 1) breeding *Vitis* for resistance to Pierce’s disease, 2) identifying sources of resistance in the *Juglans* germplasm to soil-borne diseases, and 3) development of SNP markers for phenotypic characterization of *Vitis*.

NATIONAL ARID LAND PLANT GENETIC RESOURCE UNIT

Mission: The mission of the National Arid Land Plant Genetic Resource Unit (NALPGRU) is to provide a long-season regeneration site for National Plant Germplasm System (NPGS) accessions not adapted to their priority sites, and to be the priority site for the maintenance and distribution for selected genera with potential as new crops in arid environments.

Unit Scientists:
John Preece  Research Leader
Gabriela Romano  Supervisory Horticulturist

Research Projects:
1. Collection of descriptor data and images of the arid lands crops collections. Determination of viability of all accessions and annual increases of the crops preserved and distributed by NALPGRU. Incorporation of the information to the Germplasm Resources Information Network (GRIN) database.
2. Determination of best germination conditions for *Opuntia* (prickly pear), *Proboscidea* (devil’s claw) and other genera preserved at NALPGRU.

Program Overview: The goal of NALPGRU is to preserve and characterize the genetic diversity of the arid land crops and to collaborate with researchers from various disciplines to exploit these important resources to their fullest potential. To that end, NALPGRU provides seeds and vegetative material to researchers at universities, institutes, and private enterprises both domestic and international. Additionally we assist others seed banks in the regeneration of their germplasm.
John E. Preece, Research Leader, NCGRFNC/NALPGR

**Education:**
1980 PhD, Horticulture, University of Minnesota, St. Paul

**Professional Work Experience**

Supervisory Research Leader/ Research Horticulturist, National Clonal Germplasm Repository for Tree Fruits, Nut Crops, and Grapes, Davis, CA, and the National Arid Land Plant Genetic Resource Unit, Parlier, CA USDA-ARS

Emeritus Professor, Department of Plant, Soil and Agricultural Systems, Southern Illinois University Carbondale

Member Horticulture and Agronomy Graduate Group, University of California, Davis

**Accomplishments:**

Dr. Preece has expertise in clonal propagation of woody plants, plant tissue culture, juvenility and phase change, genebanks and germplasm, plant physiology, plant growth regulators and hormones, and horticultural practices. He has extensive international experience, including:

- Short-term consultant at Northeast Forestry University, Harbin, China, 15 July - 1 August, 2002. Delivered a graduate-level tree tissue culture course, helped students and researchers in the woody plant tissue culture laboratory of Dr. Hailong Shen.
- Short-term consultant at Northeast Forestry University, Harbin, China, August 1-17, 2009. Worked with graduate student on woody plant tissue culture.
- Foreign expert/consultant for the selection of three Permanent Associate Professors of Botany, University of the Punjab, Lahore, Pakistan, 10/2002 - 1/2003.
- Plant Collection Expedition, Albania, 9/2012

**Selected Publications:**


George, L.J.; Preece, J.E. 2009; Shoot forcing and rooting of Betula nigra L. Propagation of ornamental plants; 9: 181-184


Gabriela Romano, Supervisory Horticulturist, NALPGRU

**Education:**
1984 Lic. en Biología, Universidad Nacional de La Plata
1990 MS, University of Florida, Gainesville, FL
1999 PhD, University of Florida, Gainesville, FL

**Professional Work Experience:**
2002-2004 – Postdoctoral Scientist. Morphotek, Inc., Exton, PA
2004-2009 – Research plant geneticist, USDA-ARS, CG&PRU, Stoneville, MS
2009-present – Supervisory horticulturist, USDA-ARS, NALPGRU, Parlier, CA

**Accomplishments:**
In her previous position in ARS, Dr. Gabriela Romano worked with cotton breeding and molecular genetics. She worked on the mapping of markers associated with reniform nematode (*Rotylenchulus reniformis*) resistance in cotton hybrids. A tri-species hybrid, \(Gossypium arboreum \times (G. hirsutum \times G. aridum)^2\), was crossed with MD51ne (G. *hirsutum*) and progeny from the cross were used to identify and map SSR markers associated with reniform nematode resistance. The markers found in association to reniform nematode resistance are being used in marker-assisted selection to introduce reniform nematode resistance into commercial cotton cultivars, all of which lack any resistance to this pest. Dr. Gabriela Romano also worked on the development of low gossypol cotton lines. Gossypol provides protection against pests and perhaps pathogens but its toxicity decreases the value of cottonseed meal for feed, particularly for non-ruminants. The strategy adopted in this breeding program was to minimize gossypol content in seeds while still maintaining gossypol glands throughout other plant organs. The final line selections have low seed gossypol content (50 to 80% reduction from glanded parent), normal or nearly normal boll (fruit), stem and stigma glanding; and somewhat reduced gossypol in the leaves. The lines have good yields and fiber quality and good pest resistance. In her positions in the private sector Dr. Romano worked with plant molecular markers and soybean somatic embryogenesis at Pioneer Hi-Bred International Inc. and Morphotek, Inc.

**Current work:**
Dr. Gabriela Romano organizes and supervises the maintenance and regeneration of several genera with potential as crops in arid lands and the distribution of germplasm to researchers and businesses as well as services to other National Plant Germplasm System (NPGS) germplasm banks. Dr. Romano also provides information related to the accessions kept at this site to people interested in developing the use of these plants. NALPGRU collections include a multiple-use crop, *Opuntia* (prickly pear); oil seed crops, *Simmondsia chinensis* (jojoba); *Physaria* (bladderpod), *Limnanthes* (meadowfoam), and *Cucurbita foetidissima* (buffalo gourd); forage crops, *Atriplex* (saltbush) and *Bassia* (kochia) and a latex crop, *Parthenium* (guayule). Dr. Romano has initiated the regeneration of dozens of arid land accessions that had never been grown and increased the number of germplasm viability tests done at NALPGRU. Research is being conducted to improve regeneration of prickly pear and jojoba. NALPGRU continues to provide service to other germplasm banks by regenerating accessions that require a long growing season. Hundreds of cereal, garlic and sunflower accessions are regenerated every year for NPGS sites located in colder regions of the country.
Selected Publications:


J.A. Scheffler, G.B. Romano, and C.A. Blanco. 2012. Evaluating Host Plant Resistance in Cotton (Gossypium hirsutum L.) with varying gland densities to tobacco budworm (Heliothis virescens F.) and bollworm (Helicoverpa zea Boddie) in the field and laboratory. Agricultural Sciences, 3:14-23; doi:10.4236/as.2012.31004.


Mission: The mission of the Crop Diseases, Pests and Genetics Research Unit (CDPGRU) is to conduct innovative, multidisciplinary research to enhance production and minimize losses in Mediterranean and subtropical horticultural crops. CDPGRU research focuses on 1) citrus diseases transmitted by insects and caused by viruses or fastidious prokaryotes, 2) table grape, raisin, almond, and stone fruit improvement, and 3) invasive plant pathogens and insects, primarily Xylella fastidiosa (Xf) and glassy-winged sharpshooter (GWSS).

Unit Scientists:
Elaine A. Backus Research Entomologist
Jianchi Chen Research Molecular Biologist
Rodrigo Krugner Research Entomologist
Craig Ledbetter Research Geneticist
Hong Lin Research Plant Physiologist
David Ramming Research Horticulturist
Elizabeth E. Rogers Research Molecular Biologist
Mark S. Sisterson Research Entomologist
Drake C. Stenger Research Leader and Research Plant Pathologist
Christopher Wallis Research Plant Pathologist
Raymond Yokomi Research Plant Pathologist

Research Projects:
1. Improvement of Prunus and Vitis Scions for Fruit Quality and Pest Resistance (National Program-Plant Genetic Resources, Genomics, and Genetic Improvement).
2. Epidemiology and Management of Xylella fastidiosa and Other Exotic and Invasive Diseases and Insect Pests (National Program-Plant Diseases).

Program Overview: The CDPGRU is uniquely capable of rapidly addressing new and/or invasive pests and pathogens of high value perennial fruit and nut crops. CDPGRU research is conducted under three appropriated research projects listed above by 11 scientists and ~35 support personnel. Goals of basic and applied research are aimed at genetic improvement of horticultural crops and on reducing losses in these crops associated with diseases and pests. Classical breeding coupled with modern genetic tools are used to develop superior stone fruit, table grape, raisin, and almond selections to satisfy industry needs for high quality cultivars. Research conducted on diseases caused by Xylella fastidiosa (Xf) include, but are not limited to, Pierce’s disease of grapevine and almond leaf scorch. Xf research emphasizes pathogen genetics and biology, insect vector (including, but not limited to, glassy-winged sharpshooter [GWSS]) ecology and pathogen transmission, disease epidemiology, development of disease resistance through classical breeding assisted by molecular marker selection, and modeling of landscape-scale integrated disease management strategies. Research conducted on citrus diseases focuses on economically important pathogens established in California (Citrus tristeza virus and Spiroplasma citri) and on exotic pathogens (‘Candidatus Liberibacter’ species) associated with Huanglongbing and zebra chip disease. Primary areas of research on citrus diseases include pathogen detection, strain discrimination, and epidemiology.
Drake Stenger, Research Leader and Plant Pathologist, CDPG

**Education:**
1981 BS, Biology, California State College, Bakersfield
1983 MS, Plant Pathology, University of California, Berkeley
1987 PhD, Plant Pathology, University of California, Berkeley

**Professional Work Experience:**
1988–1989 – Postdoctoral Research Associate, USDA-ARS, Salinas, CA
1989–1992 – Postdoctoral Fellow, The Ohio State University, Columbus, OH
1992–1997 – Assistant Professor, Northern Illinois University, De Kalb, IL
2006–present – Research Leader, USDA-ARS, Parlier, CA

**Accomplishments:**
Dr. Stenger has conducted innovative research throughout his career as a plant pathologist. As a graduate student, he was among the first cadre of plant pathologists to adopt molecular biological tools. His thesis work characterized strawberry viruses and developed diagnostic hybridization assays, and he contributed to the first cloning of phytoplasma DNA. As a post-doc (ARS, Salinas, CA, 1988-1989), Dr. Stenger conducted the first molecular analysis of virus strains/species responsible for curly top disease. During his Fellowship, he demonstrated rolling-circle replication of geminivirus DNA and discovered curtovirus DI-DNAs. As an Assistant Professor (Northern Illinois University, 1992-1997), Dr. Stenger mapped geminivirus replication specificity determinants, identified a recombinant geminivirus, and defined curtovirus evolutionary history and diversity. Upon joining ARS, Dr. Stenger served as Lead Scientist (Lincoln, NE, 1997-2006) and revitalized the wheat virology project by focusing on Wheat streak mosaic virus (WSMV). Dr. Stenger led development of WSMV as a model system to investigate gene function, evolution, population biology, and eriophyid mite transmission. Most recently, Dr. Stenger assumed duties as Research Leader of the Crop Diseases, Pests and Genetics Research Unit (Parlier, CA, 2006-present) where he leads a multidisciplinary team studying the fastidious prokaryote *Xylella fastidiosa* and its invasive insect vector, the glassy-winged sharpshooter. In this ongoing research, Dr. Stenger discovered and characterized novel IncP-1 plasmids of *X. fastidiosa* and successfully adapted IncP-1 replication and toxin/antitoxin modules to construct a stable shuttle vector for delivery of DNA to *X. fastidiosa*. Concurrently, Dr. Stenger discovered *Homalodisca vitripennis* reovirus (HoVRV) infecting the glassy-winged sharpshooter and developed the novel approach of using HoVRV sequence polymorphism to reconstruct population biology/invasive history of the glassy-winged sharpshooter.

**Current Research:**
The role of toxin-antitoxin (TA) growth regulation systems encoded by the *X. fastidiosa* genome on pathogenicity/virulence is currently under investigation. Relevant mutants and complementing plasmids have been constructed and are being evaluated in functional assays, both in vitro and in vivo. A full-length cDNA clone of *Homalodisca coagulata* virus 1 has been constructed. In a collaborative effort with university scientists, additional current work is focused on demonstrating infectivity of the cDNA clone to GWSS cell cultures and whole insects, to be followed by modification of the viral genome to increase virulence for use as a biological control agent of GWSS.
Selected Publications:


Elaine Backus, Entomologist, CDPG

Education:
1978 BS, Zoology, Brigham Young University, Provo, UT
1983 PhD, Entomology, University of California, Davis, CA

Professional Work Experience:
1983–1984 – Postdoctoral Research Associate, University of California, Davis, CA
1984–1990 – Assistant Professor, University of Missouri, Columbia, MO
1990–2002 – Associate Professor, University of Missouri, Columbia, MO
2002 – Professor, University of Missouri, Columbia, MO
2003–present – Research Entomologist, USDA-ARS, Parlier, CA

Accomplishments:
Dr. Elaine Backus is a vector entomologist whose research focuses on feeding biology of hemipteran pest insects. She specializes in use of electrical penetration graph (EPG) technology, light, confocal and electron microscopy, as well as selected biochemical methods to study hemipteran feeding. While at the University of Missouri, Dr. Backus identified the fundamental feeding behaviors of Empoasca spp. leafhoppers and how that feeding causes crop injury (hopperburn). She developed an EPG-based Resistance Index for Empoasca that predicts degree of host plant resistance to hopperburn based on type of feeding performed. Dr. Backus also participated in team research to study the digestive/salivary physiology of Lygus hesperus. In addition, Dr. Backus collaborates with electrical engineers in the design of new EPG monitors, recently patented. Dr. Backus facilitates EPG technology transfer through hands-on workshops, hosting visiting scientists in her laboratory, and consulting on outside research projects that lead to publications. In earlier work, Dr. Backus also described functional anatomy of the precibarium and cibarium in sharpshooters, the foregut region housing the chemosensilla, valve, and pump that control feeding. Since joining ARS, she has correlated movements of the foregut valve and pump muscles, as well as salivation, with EPG waveforms recorded during feeding of GWSS. Through this correlation process, Dr. Backus identified and defined all EPG waveforms for GWSS feeding on grape, including the waveforms representing Xf acquisition, and likely Xf inoculation (the latter termed the X wave). Recent work developed the salivation-egestion model to explain the previously unknown inoculation mechanism of Xf by its vectors. Confocal microscopy studies of a time course of bacterial acquisition and discharge, as well as salivary immunocytochemistry studies support the hypothesis.

Current Research:
Dr. Backus’s present research is to conclusively demonstrate that the X wave represents the Xf inoculation behavior by the vector. Once this is proven, Backus plans to develop an EPG-based Resistance Index for performance of the inoculation behavior by GWSS. Recent research has shown that an Xf-resistant wild grape species, Vitis candicans, reduces a vector’s performance of the inoculation behavior compared with V. vitis ‘Chardonnay’. Future work for the new CRIS will use EPG to test whether inoculation behavior is reduced on two of Dr. Ramming’s grape accessions, and use that data to develop the Resistance Index.
**Selected Publications:**


Jianchi (JC) Chen, Molecular Biologist, CDPG

Education:
1982 BS, Plant Protection, South China Agricultural College
1988 MS, Plant Pathology, University of Georgia, Athens
1992 PhD, Plant Pathology, University of Georgia, Athens

Professional Work Experience:
1992–1994 – Postdoctoral Research Associate, University of Wisconsin, Madison, WI
1994–2002 – Assistant Professor, Florida A&M University, Tallahassee, FL
2002–2003 – Research Scientist, Florida Department of Citrus, Lake Alfred, FL
2003–present – Research Molecular Biologist, USDA-ARS, Parlier, CA

Accomplishments:
Research had been on the biological and epidemiological perspectives of exotic, emerging, re-emerging, and invasive pathogens. The main target was *Xylella fastidiosa*. Others were: “*Candidatus Liberibacter* spp.”, “Candidatus Phytoplasma asteris”, and *Spiroplasma citri*. For *X. fastidiosa*, the grape Pierce’s disease (PD) and almond leaf scorch disease pathotypes were the focus. Research discoveries included pathotype co-infection in almond, variation of PD strains from different hosts and locations, observation of unique colony morphology and surface motility, description of phages, and two whole genome sequences. A citrus Huanglongbing (HLB) research project was initiated through collaboration. Population difference of “Ca. L. asiaticus” strains from U.S. and China were determined.

Current Research:
Currently, whole genome sequence is being determined for at least ten representative strains of *X. fastidiosa*; the additional sequenced genomes will aid comparative genomic studies. A project on complexity and expression of small RNAs (sRNAs) of *Xylella fastidiosa* has been initiated. Efforts are also being made on population analyses of “Ca. L. asiaticus” and *S. citri*. As part of an in vitro cultivation project, “Ca. L. solanacearum”, the putative pathogen of potato zebra chip disease, has been successfully maintained *in planta* for biological characterization and analysis.

Selected Publications:
Wallis, C. M. and Chen J. 2012. Grapevine secondary metabolites in xylem sap and tissues are significantly altered during infection by *Xylella fastidiosa*. Phytopathology (in press)


Rodrigo Krugner, Entomologist, CDPG

**Education:**
2000  BS, Universidade de São Paulo, Piracicaba, SP, Brazil
2003  MS, California State University, Fresno, CA
2007  PhD, University of California, Riverside, CA

**Professional Work Experience:**
2000–2003 – Staff Research Associate, UC KARE, Parlier, CA
2007–present – Research Entomologist, USDA-ARS, Parlier, CA

**Accomplishments:**
Dr. Rodrigo Krugner has sixteen years of experience in entomology focused on the biology, behavior, and ecology of insect pests and associated natural enemies. He demonstrated that *Anagrus epos*, an imported egg parasitoid of glassy-winged sharpshooter (GWSS), has a wide host range in California that includes the blue-green sharpshooter, the most important vector of *Xylella fastidiosa* (*Xf*) in coastal CA. He developed an efficient method to mass produce *A. epos* using eggs of a factitious host. This work resulted in hastening adoption of *A. epos* mass rearing practices by the California Department of Food and Agriculture. He demonstrated that female *Gonatocerus ashmeadi*, the primary GWSS egg parasitoid, uses plant-derived chemical volatiles as cues to find GWSS egg masses and that successful parasitism of GWSS egg masses varies among host plants. He demonstrated the role of plant water stress on regulation of population dynamics of a xylem-fluid feeding insect. His research documented that, depending on duration and intensity of water stress (e.g., deficit irrigation), GWSS may be suppressed or favored by the irrigation regimes. He defined key environmental conditions affecting GWSS feeding activity; identified differences in the reproductive behavior of GWSS from populations in southern and central California; and showed that oviposition after summer months is a key mechanism regulating population growth of GWSS. He demonstrated that GWSS population origin, gender, and age do not affect transmission efficiency of *Xf* to grapevines, which indicates that primary and secondary pathogen spread are determined by local environmental characteristics such as host plant conditions that control insect vector behavior. He showed a seasonal susceptibility of almond nursery plants to *Xf* infection and the impact of rootstock variety in plant infection. He further documented high vector population densities and presence of *Xf* in naturally-occurring plants in commercial almond nurseries, which emphasizes the need for integration of vector control and removal of sources of inocula to prevent infection of nursery stock as a potential novel strategy for management of Almond Leaf Scorch disease.

**Current Research:**
Currently, Dr. Krugner is working on 1) the evaluation of biotic and abiotic factors affecting transmission efficiency of *Xf* to grapevines by GWSS, 2) the identification of chemical cues used in the host finding behavior of GWSS egg parasitoids, 3) the evaluation of almond rootstocks in almond leaf scorch disease incidence and severity, 4) the pathogenicity and characterization of *Xf* in olives, 5) describing the a potential role of olive plants in the spread of *Xf* by GWSS.

**Selected Publications:**

Krugner, R., Daane, K.M., Lawson, A.B., and Yokota, G.Y. Temperature-Dependent Development of *Macrocentrus iridescens* (Hymenoptera: Braconidae) as a Parasitoid of the
Obliquebanded Leafroller (Lepidoptera: Tortricidae): Implications for Field Synchrony of Parasitoid and Host. Biological Control 42(2): 110-118. 2007.


Craig Ledbetter, Geneticist, CDPG

Education:
1979 BS, Agronomy & Plant Genetics University of Arizona, Tucson
1981 MS, Agronomy & Plant Genetics University of Arizona, Tucson
1986 PhD, Agronomy & Plant Genetics University of Arizona, Tucson

Professional Work Experience:
1987–1988 – Postdoctoral Research Associate, USDA/ARS, Fresno, CA
1988–present – Research Geneticist, USDA/ARS, Parlier, CA

Accomplishments:
Dr. Ledbetter’s career began in Prunus rootstock development with over 200 diverse Prunus accessions being evaluated for rootstock potential by screening for root lesion nematode (Pratylenchus vulnus) resistance. Resistant accessions were then used in diverse rootstock hybridizations, and selections from those progenies are currently being evaluated for horticultural qualities. In the early 1990’s he began breeding almond varieties that were self-compatible and able to produce fruit without the use of pollinating insects. Presently, nine self-compatible almond accessions are in commercial trials to determine yield potential prior to variety release. Dr. Ledbetter has developed and introduced eight new fresh market and processing apricots for propagation and production: ‘Helena’ (1994), ‘Robada’ (1997), ‘Lorna’ (1998), ‘Apache’ (2001), ‘Nicole’ (2003), ‘Kettleman’ (2005), ‘Primarosa’ (2009) and ‘Bolaroja’ (2009). Several of these apricots are very popular among domestic and international growers. ‘Apache’ apricot acreage is increasing in California and the cultivar is currently the earliest ripening apricot available to growers. Dr. Ledbetter’s collaborative research with University of California pomologists led to the introduction of four new size-controlling clonal rootstocks (‘Controller 6’, ‘Controller 7’, ‘Controller 8’ and ‘Controller 9.5’) for stone fruits. These new rootstocks will allow stone fruit growers options in replanted orchards, offering resistance to root knot nematodes (Meloidogyne incognita and M. javanica) and reduced tree vigor without reductions in fruit size or yield. Dr. Ledbetter’s almond leaf scorch disease research began in 2006, and has focused on the variability of disease development in almond scions and rootstocks. During this time, his work has demonstrated differences in winter curing of Xylella fastidiosa infections among different almond hybrids, and the differential susceptibility of peach, peach x almond and almond rootstock germplasm to X. fastidiosa.

Current Research:
Current research focuses on Prunus breeding and evaluation; 1) selection and introduction of new apricot cultivars from hybridizations utilizing Central Asian germplasm, 2) development of high-yielding, self-compatible almond cultivars with acceptable kernel qualities, and 3) identifying new rootstock hybrids that resist or tolerate soilborne diseases. An Almond Board of California funded project utilizing granular activated carbon from almond shells to mitigate DBCP contaminated aquifers is currently in progress, and final results will determine whether or not the research will continue. Dr. Ledbetter envisions further research to characterize kernel shape and appearance variability within and between California almond marketing groups as a means of objectively placing newly developed almond cultivars into their appropriate groups.
**Selected Publications:**


Hong Lin, Plant Physiologist, CDPG

Education:
1982  BS, Forestry Science Nanjing Forestry University
1992  MS, Plant Biology University of California, Davis
1994  PhD, Plant Biology University of California, Davis

Professional Work Experience:
1994–1999 – Postdoctoral Researcher, University of California, Davis
1999–2002 – Senior Scientist, Celera Genomics, Inc., Davis, CA

Accomplishments:
Dr. Lin has broad knowledge of, and research experience in, plant physiology, plant biochemistry, genetics and molecular biology of plant responses to biotic and abiotic stresses. He is nationally and internationally known for contributions to the functional genomics and proteomics of grapevine responses to PD. Dr. Lin’s Ph.D. studies focused on systematical characterization of physiological and biochemical processes of plant responses to salt stress. His research demonstrated how changes in root membrane composition (lipid, fatty acids, phospholipids, membrane-bound proteins) influenced integrity of the plasma membrane under salt stress, and how these changes in turn affected plant nutrition and growth. Dr. Lin’s research utilized DNA based technologies and developed a molecular fingerprinting system for grape rootstock identification. This technique provided a very practical grape rootstock identification tool, which led to the critically important discovery of phylloxera-susceptible grape rootstocks in California vineyards. Since joining ARS, Dr. Lin has developed a holistic and strategic approach to research on a number of economically important crop diseases, including grape PD, citrus Hunaglongbing (HLB) and potato zebra chip (ZC) disorder. He constructed transcriptional and proteomic profiles from PD-resistant and -susceptible grapevines to identify host genes that were responsible for disease development and resistance response. Information derived from this study facilitated identification of PD resistant mechanisms. An online MySQL-php driven relational database “VitisExpDB” containing annotated EST data for grapes is publicly available. Dr. Lin employed bioinformatics approaches to identify and designed simple sequence repeat biomarkers among four Xylella fastidiosa (Xf) strains. This Xf genetic analysis system has been used for Xf population structure and genetic diversity studies. More recently, Dr. Lin has successfully sequenced and annotated the whole genome sequences of ‘Candidatus Liberibacter solanacearum’ and ‘Candidatus Liberibacter asiaticus’, bacteria associated with potato ZC and citrus HLB, respectively. The impact on this research is significant as genomic information derived from this study is critical in understanding the insights of genomic evolution, adaptation, and pathogenicity of the unculturable bacteria. Information derived from this study will facilitate development of effective strategies for controlling HLB and ZC diseases.

Current Research:
Dr. Lin’s current research focuses on the molecular basis of host defense response to diseases including but not limited to grape PD, citrus HLB and potato ZC using functional genomic and proteomic approaches. His research also involves identification of Xf virulence genes and elucidation of their roles in disease development. He is collaborating with scientists at Los Alamos National Laboratory on genome sequencing of ‘Candidatus Liberibacter africanus’ and ‘Candidatus Liberibacter americanus’, two species of bacteria that are also associated with citrus HLB. The additional Liberibacter genome sequence will permit a comprehensive analysis.
leading to successful signature identification and downstream virulence factor characterization. In addition, new genome information will facilitate the development of improved molecular diagnostic tools for early detection of HLB. This research project is currently supported by NSF Small Business Innovation Research Program. His research projects in genotyping and population genetic analyses of ‘Candidatus Liberibacter’ spp associated with citrus huanglongbing and potato zebra chip are supported by Florida Citrus Research & Development Foundation and USDA-NIFA-SCRI, respectively. More recently, he has developed a new project for the identification and functional determination of virulence genes responsible for pathogenicity of “Candidatus Liberibacter solanacearum” associated with Potato ZC, which had been funded by USDA-ARS Potato Research Program.

Selected Publications:


David Ramming, Horticulturist, CDPG

Education:
1968 BS, Horticulture, Oklahoma State University
1972 MS, Horticulture, Oklahoma State University
1976 PhD, Horticulture, Rutgers University

Professional Work Experience:
1975–present – Research Horticulturist, USDA-ARS, Parlier, CA

Accomplishments:
Dr. Ramming’s career includes 37 years of research experience in the area of grape and stone fruit breeding, embryo rescue, somatic embryogenesis, genetics and disease resistance breeding. Numerous cooperative projects have been developed as a result of his expertise. In the last 10 years he has released two plums: ‘Owen T’ and ‘Black Splendor’; one peach, ‘Galaxy’, a flat shape peach; five table grapes, ‘Sweet Scarlet’, ‘Thomcord’, ‘Scarlet Royal’, ‘Autumn King’ and ‘Valley Pearl’; two dwarfing Prunus rootstocks, ‘P130-35’ and ‘K146-43’; one grape rootstock ‘Demko 10-17A’; and cooperatively released one raisin grape cultivar, ‘Sunglo’. ‘Crimson Seedless’, released in 1989, has now become the most important table grape grown in California and has impacted the major table grape production areas around the world. ‘Selma Pete’ grape released in 2001 is being planted almost exclusively for mechanical harvest production of raisins. He has been engaged in a full time stone fruit and grape breeding program while directing basic research resulting in development of innovative breeding procedures and elucidation of trait inheritance. Dr. Ramming’s development and use of embryo rescue for seedless grapes in the breeding program allows seedless x seedless crosses to be attained. ‘Thomcord’, ‘Scarlet Royal’ and ‘Valley Pearl’ are the most recent table grapes produced from embryo rescue. The segregation of resistance to Phyloxera nodosity was controlled by two complimentary dominant genes in rootstock families. ‘Demko 10-17A’ grape rootstock provides resistance to most nematodes. Differences in raisin fruit drying rates and characteristics were determined. ‘Summer Muscat’ and ‘Diamond Muscat’ were identified as drying significantly faster than Thompson Seedless and therefore more suitable for mechanical harvest. Variability of antioxidant activity and phenolic content was observed in raisin cultivars and advanced selections, suggesting the possibility of breeding for increased health benefits.

Current Research:
Dr. Ramming also has conducted research on introgressing Pierce’s disease (PD) and powdery mildew resistance into high quality table and raisin grapes. The fifth generation of PD resistant table and raisin grape germplasm with high fruit quality has been developed. Advanced table and raisin grapes with PD resistance have been propagated into initial production trials. Molecular markers have been used successfully to preselect PD resistant seedlings while they are still in the embryo culture test tubes. A single dominant gene for powdery mildew resistance, ren4, has been identified in a wild Chinese grape species, Vitis romanetii. This resistance has been used to produce third generation mildew resistant table and raisin grape germplasm. Table and raisin selections have been put into advanced production trials.

Selected Publications:


Elizabeth Rogers, Molecular Biologist, CDPG

**Education:**
1990  BA, Haverford College, Haverford, PA
1997  PhD, Harvard University, Cambridge, MA

**Professional Work Experience:**
1997–2001 – Postdoctoral Researcher, Dartmouth College, Hanover, NH
2001–2008 – Assistant Professor, University of Missouri, Columbia, MO
2008–present – Research Molecular Biologist (Plants), USDA-ARS, Parlier, CA

**Accomplishments:**
Dr. Rogers has conducted research on the molecular biology, genetics and biochemistry of plant responses to biotic and abiotic stresses for 20 years. As a graduate student at Harvard University, Dr. Rogers was among the first to utilize the genetic power of *Arabidopsis thaliana* as a model system to identify plant defense responses effective at limiting the growth of invading bacterial pathogens. As a post-doc at Dartmouth College, Dr. Rogers applied her skills in plant molecular genetics and biochemistry to define mechanisms of iron uptake and homeostasis in plants. She continued work on iron transport in her own laboratory at the University of Missouri, Columbia. Starting from an Arabidopsis mutant with an intriguing but complex phenotype, Dr. Rogers defined biochemical functions of the mutated gene, explaining all of the complicated phenotypes of the original mutant and further defining the pathway of iron movement within the plant. She has applied knowledge gained in the Arabidopsis model plant system to define iron transport and homeostasis in an agronomically important crop species, soybean (*Glycine max*). Since joining ARS, Dr. Rogers has developed Arabidopsis as a model experimental host for *Xylella fastidiosa* and worked to identify novel bacterial virulence factors. She has collaborated with ARS Project scientists to both define the susceptibility of peach-almond hybrids to *X. fastidiosa* and characterize an *X. fastidiosa* plasmid.

**Current Research:**
Dr. Rogers’ current work focuses on identifying and characterizing novel secreted pathogenicity factors from both *Xylella fastidiosa* and *Candidatus* Liberibacter species. She is collaborating with other SYs in CDPG to look at the role of toxin-anti-toxin systems in *Xylella fastidiosa* virulence, genetics of susceptibility to almond leaf scorch disease in peach-almond hybrids, effect of grapevine root stock on scion susceptibility to Pierce’s disease, and transmission mechanisms of glassy wing sharpshooter.

**Selected Publications:**


Mark Sisterson, Entomologist, CDPG

**Education:**
1995  BS, Zoology, Colorado State University
1997  MS, Entomology, North Carolina State University
2001  PhD, Entomology, University of Massachusetts

**Professional Work Experience:**
2001–2004 – PERT Postdoctoral Fellow, University of Arizona
2004–2005 – Assistant Research Scientist, University of Arizona
2005–present – Research Entomologist USDA-ARS, Parlier, CA

**Research Background and Current Interests:**
Dr. Sisterson is an insect ecologist whose methodology includes field studies, controlled laboratory experiments, and modeling. To assess risk of Pierce’s disease in different regions of California, he analyzed 12 years of data on insecticide use in citrus, a key habitat of the glassy-winged sharpshooter. In conjunction, Geographic Information Systems maps on the concurrent distribution of citrus and grapes in California were analyzed. Results indicated that the most vulnerable region of California for Pierce’s disease epidemics was Riverside County due to proximity of vineyards to citrus groves that received few insecticide applications. Due to Pierce’s disease epidemics in the late 1990’s, there was concern about rising incidence of almond leaf scorch disease, a disease caused by *X. fastidiosa*. Dr. Sisterson’s research demonstrated that contrary to previous reports, almond leaf scorch affected trees do not typically die and produce a useable yield. Using this information, Dr. Sisterson developed a simple economic model that indicated that growers could maximize economic returns by removing infected trees from young orchards, but keeping infected trees in older orchards.

**Current Research:**
Current empirical projects focus on understanding host selection by female glassy-winged sharpshooters. Specifically, factors affecting the nutritional quality of host plants for egg maturation by the glassy-winged sharpshooter are under investigation. Current modeling projects focus on using spatially-explicit simulation models to evaluate plant disease management strategies.

**Selected Publications:**


Daane, K. M., C. M. Wistrom, E. B. Shapland, & **M. S. Sisterson**. 2011. Seasonal abundance of


Chris Wallis, Plant Pathologist, CDPG

**Education:**
2001   BS, Biochemistry and Biology, Mount Saint Mary University  
2004   MS, Plant Pathology, Pennsylvania State University  
2007   Ph.D. Plant Pathology, The Ohio State University

**Professional Work Experience:**
2000-2001 – Student Internship, National Cancer Institute, Ft. Detrick, MD  
2002-2004 – Graduate Research Assistant, Pennsylvania State University  
2004-2007 – Graduate Research Assistant, Ohio State University  
2008-2009 – Postdoctoral Fellow, University of Northern British Columbia  
2009-Present – Research Plant Pathologist USDA-ARS, Parlier, CA

**Accomplishments:**
Dr. Wallis is a broadly-trained plant pathologist with experience in a variety of fields including plant virology, epidemiology, molecular genetics, ornamental pathology, forest pathology, and chemical ecology. He determined which aphid species vector plum pox virus (PPV) in Pennsylvania peach orchards, and identified specific mutations in PPV are associated with successful infection of a new host. More recently, Dr. Wallis has developed expertise in chemical ecology, in particular examining the role that secondary metabolites, predominately phenolic and terpenoid compounds, play in host resistance to a variety of diseases and insect pests. Dr. Wallis participated in a landmark tripartite study that examined what occurs when a host, Austrian pine, is attacked in short succession by either the same or two different pest organisms (the fungal pathogen *Diplodia pinea* or the defoliating insect *Neodiprion sertifer*). Dr. Wallis characterized multiple compounds that, when induced by fungal infection, likely play roles in systemic induced resistance to combat a second fungal infection. As part of that project, he examined how nutrient availability could alter secondary metabolites levels. Dr. Wallis demonstrated, through use of multivariate statistics, that phenolic and terpenoid pathways are under independent regulation and, in some cases, compete for available plant resources. This has led other researchers to expand the number of compound classes they analyze in their respective pathosystems. Dr. Wallis has also addressed a long-standing hypothesis regarding the evolution of secondary metabolites, which states higher disease pressures would select for increased constitutive levels of secondary metabolites. When lodgepole pine from different locations are planted at the same location, Dr. Wallis showed that those originating from stands with frequent disease outbreaks possessed greater foliar levels of phenolics and terpenoids, as well as greater resistance to foliar diseases, than those originating from relatively disease-free stands.

**Current Research:**
Dr. Wallis now has begun studies examining the role of grapevine secondary metabolites in host resistance to *Xylella fastidiosa* and glassy-winged sharpshooter.

**Selected Publications:**


Raymond K. Yokomi, Research Plant Pathologist, CDPG

Education:
1969  BS, Entomology, Univ. California, Davis
1979  PhD, Entomology, Univ. California, Davis

Professional Work Experience:
1979–81 – Postdoctoral Research Associate, University of California, Riverside
1981–82 – Assistant Research Scientist, University of Florida, CREC, Lake Alfred, FL
1982–1996 – Research Entomologist, USDA, ARS, Orlando, FL
1997–present – Research Plant Pathologist, USDA, ARS, Parlier, CA

Accomplishments:
Ray Yokomi’s research at Parlier focuses on pathogens of citrus transmitted by insect vectors. His specialty is Citrus tristeza virus (CTV), a semipersistent, aphid-borne closterovirus, and Spiroplasma citri, a bacterium transmitted by leafhoppers in a persistent and circulative manner that is the causal agent of citrus stubborn disease. His research examines genetic diversity and epidemiology of CTV and citrus stubborn disease and detection of these pathogens. Dr. Yokomi developed rapid PCR-based methods for detection and genetic differentiation of CTV and determined the genetic diversity of CTV populations in California. This research has led to genotype-specific CTV detection for suppression/eradication purposes. He also developed rapid PCR-based methods to detect S. citri and is documenting epidemiology of stubborn disease in California.

Current Research:
Dr. Yokomi is now determining if gene silencing induced by small RNAs has potential to control CTV disease through cross protection. Future research will profile small RNAs from pathogen inoculated versus mock (healthy) inoculated plants to study the relationship of citrus small RNAs and natural host response to CTV and S. citri infection. Micro RNAs and small interfering RNAs will be identified and their specificity determined. Results should help select mild CTV strains for cross-protection. In addition, a panel of specific host microRNAs that can be used as biomarkers for early pathogen infection will be developed. Early diagnostic tools for citrus pathogens will improve management of these diseases.

Selected Publications:


COMMODITY PROTECTION AND QUALITY RESEARCH UNIT

Mission: The mission of the CPQRU is to develop alternative chemical and non-chemical treatments to replace methyl bromide use on horticultural stored products to meet quarantine needs, preserve or extend domestic and export markets, ensure quality maintenance of U.S.-grown horticultural commodities, extend storage life, and reduce postharvest losses caused by senescence, decay, pathogens, insect pests and postharvest treatments.

Unit Scientists:
Charles Burks  Research Entomologist
Judy Johnson  Research Entomologist
Lodewyk Kuenen  Research Entomologist
David Obenland  Research Plant Physiologist
Joel Siegel  Research Entomologist
Joseph Smilanick  Research Plant Pathologist
Spencer Walse  Research Chemist
Victoria Yokoyama  Research Entomologist
Research Leader  Vacant

Research Projects:
1. An Areawide Control Program for Navel Orangeworm (National Program-Crop Protection and Quarantine)
2. New Chemically based Methods Which Reduce the Use or Emissions of Chemicals as Alternatives to Methyl Bromide for Quarantine and Postharvest Pests (National Program-Methyl Bromide Alternatives)
3. Biological, Behavioral, and Physical Control as Alternatives for Stored Product and Quarantine Pests of Fresh/Dried Fruits and Nuts (National Program-Crop Protection and Quarantine and Methyl Bromide Alternatives)
4. Maintaining Quality and Extending Shelf and Shipping Life of Fresh Fruit with no or Minimal Synthetic Pesticide Inputs (National Program-Quality and Utilization of Agricultural Products)

Program overview: Research is focused on basic and reproductive biology, phenology, and host preferences of stored product and quarantine pests. Key pests include codling moth, tropical fruit flies, olive fruit fly, navel orangeworm, stored product pests, and quarantine pests of hay. Research includes development of heat and cold treatments; methyl bromide trapping technology; alternative chemicals for insect disinfestations; and insect pathogens and beneficial insects as stored product insect control agents. Research also includes: combining controlled atmosphere with high temperatures and/or fumigants; physiological and insect-plant interaction studies; physical and chemical detection systems; use of behavior governing chemicals to control and/or detect insect infestations; and basic biology and integrated pest management systems combining control methods developed in approaches listed above. Research also focuses on preserving quality and reducing postharvest losses caused by senescence, pathogens, and insect pests; on injuries caused by quarantine treatments; and on identifying physiological, biochemical and nutritional causes of postharvest changes in horticultural crops.
Chang-Lin Xiao, Supervisory Research Plant Pathologist and Research Leader, CPQ

**Education:**
1985  BS, Plant Protection, HuaZhong Agricultural University
1988  MS, Plant Pathology, China Agricultural University
1991  PhD, Plant Pathology, China Agricultural University

**Professional Work Experience:**
2000–2011 – Assistant, Associate Professor, Washington State University
1998–2000 – Postdoctoral Researcher/Biologist, University of Florida
1994–1998 – Visiting Postdoctoral Scholar, UC Davis
1991–1994 – Assistant Professor/Lecturer, China Agricultural University

**Accomplishments:**
Dr. Xiao’s research led to the discovery of three new, economically important postharvest diseases of pome fruits in the United States: Phacidopycnis rot caused by *Phacidopycnis piri*, Sphaeropsis rot caused by *S. pyriputrescens* and speck rot caused by *Phacidopycnis washingtonensis*. The latter two diseases were the first reports in the world and their causal agents were described as new fungal species. Dr. Xiao established that these three pathogens are resident in the orchard where they incite canker diseases on fruit trees and have the ability to incite latent infections of the fruit in the orchard, leading to fruit rots during storage. Using lab mutants of *Penicillium expansum*, Dr. Xiao documented that a fitness cost is associated with fludioxonil resistance but not pyrimethanil resistance, that pyrimethanil-resistant phenotypes can also extend resistance to fludioxonil, and that a higher risk exists for the development of resistance to pyrimethanil than fludioxonil in *P. expansum*. Dr. Xiao’s research documented that two major point mutations (H272R/Y) in the *SdhB* gene confer boscalid resistance in *B. cinerea* and that among the boscalid-resistant phenotypes, levels of resistance to boscalid are not associated with particular types of point mutations in the *SdhB* gene in *B. cinerea*. Dr. Xiao established that boscalid resistance and pyraclostrobin resistance are stable and that resistance to these two fungicides does not impair fitness components in resistant isolates, but resistant isolates have disadvantage in competing with wild-type strains on apple fruit.

**Current research:**
Dr. Xiao’s current research focuses on the biology, epidemiology, and management of diseases of fruit crops with an emphasis on postharvest diseases; biology of plant pathogenic fungi; and molecular mechanisms, biological and ecological characterization, and management of fungicide resistance.

**Selected Publications:**


Charles S. Burks, Research Entomologist, CPQ

Education:
1982 BS, Entomology, Iowa State University
1987 MS, Entomology and Zoology, Iowa State University
1991 PhD, Entomology, University of Missouri, Columbia

Professional Work Experience
1997–present – Research Entomologist, USDA, ARS, SJVASC, Commodity Protection and Quality Research Unit, Parlier, CA
1995–1997 – Postdoctoral Research Entomologist, USDA, ARS, Grain Marketing and Production Research Center, Manhattan, KS
1993–1995 – Postdoctoral Research Associate, Miami University, Oxford, OH
1991–1993 – Postdoctoral Research Associate, Notre Dame University, South Bend, IN

Accomplishments:
Dr. Burks has, over the last 20 years, conducted research using a broad range of approaches to elucidate the interaction of insects with their environment, and determine how to manipulate this interaction for management of insect pests. As a doctoral student at the University of Missouri, Dr. Burks characterized hemolymph lipoproteins involved in diapause and overwintering of the southwestern corn borer. As a post-doc at the University of Notre Dame, he characterized a hemolymph protein involved in the immune response of the yellow fever mosquito. As a post-doc at Miami University of Ohio, he investigated how changes in resistance to chill and freeze injury in three tick species and the monarch butterfly related to the geographical range and overwintering strategies of these species. As a USDA-ARS postdoctoral researcher at the Manhattan, Kansas location, Dr. Burks discovered that the face fly, a cattle pest overwintering in grain elevators, had greater cold hardening than previously known. He also used an innovative protocol to determine the capacity for rapid cold hardening in eight beetle pests of stored grain. Also at Manhattan, he also determined how either chilling or freezing injury could be used to kill rice weevil larvae while allowing a parasitic wasp to live, thereby facilitating release into grain storage. Since coming to the Crop Protection and Quality Unit in Parlier, Dr. Burks has investigated monitoring and pest management of insect pest of tree horticultural crops, with an emphasis on applications for semiochemicals.

Current Research:
Dr. Burks’ current research projects include: 1) characterization of the area over which aerosol mating disruption dispensers suppress male response and female fertility of navel orangeworm; 2) the association of navel orangeworm pheromone and egg trap counts with subsequent damage to almonds in the absence of insecticide treatment; 3) the relative role and importance of navel orangeworm and codling moth in lepidopteran infestation of walnuts in the northern and southern Central Valley; and 4) the impact of different mating disruption formulations on Indianmeal moth population, and monitoring for Indianmeal moth in the presence of mating disruption.

Selected Publications:


Judy A. Johnson; Research Entomologist, CPQ

**Education:**
1976  BS, Entomology, University of California, Davis.
1982  PhD., Entomology, University of California, Riverside

**Professional Work Experience:**
1985-present – Research Entomologist, USDA, ARS, SJVASC, Commodity Protection and Quality Research Unit, Parlier, CA
1984-1985 – Postdoctoral Research Entomologist, University of California, Fresno, CA
1983-1984 – Postdoctoral Research Entomologist, University of California, Riverside, CA

**Accomplishments:**
Dr. Johnson has worked with the USDA-ARS for more than 26 years, specializing in the development of non-chemical treatments for postharvest dried fruits, nuts, and other durables. In that time, she helped to develop the scientific rational in support of the successful case brought before the World Trade Organization against the requirement by the Japanese for extensive testing of individual varieties in the development of quarantine commodity treatments. She determined the occurrence and seasonality of parasitoids of dried fruit insects in a culled fig warehouse, documented the winter activity of *Habrobracon hebetor*, and described the biology of a previously undescribed chalcid parasitoid. Dr. Johnson determined that bean bins exposed to commercial cold storage environments for 2 weeks were successfully disinfested of the most tolerant stage of the cowpea weevil. She participated in a project demonstrating the utility of integrating short-term non-chemical treatment methods to disinfest incoming product of field pests with long-term treatments designed to protect product from reinfestation. She participated with collaborators to develop radio-frequency heat treatments for control of postharvest walnut pests, determining thermal death kinetics of Indianmeal moth and red flour beetle, and assisting with commercial scale testing of the method. Dr. Johnson showed that California sweet cherries are essentially non-hosts for codling moth by pheromone trapping and extensive fruit sampling in cherry orchards adjacent to good codling moth hosts, contributing to the development of a systems approach for cherry exports to Japan. As author or co-author, Dr. Johnson has published more than 40 peer reviewed articles, 7 book chapters, 65 other publications, and made more than 90 oral presentations.

**Current Research:**
Dr. Johnson continues to develop non-chemical treatments for postharvest commodities, particularly dried fruits, tree nuts and dried legumes. This work seeks to identify alternatives to environmentally damaging chemical fumigants, particularly methyl bromide. She is developing vacuum as a disinfestation treatment for tree nuts and fresh fruits, and a high temperature-high CO₂ treatment to disinfest inshell walnuts of diapausing codling moth. She continues her collaboration with Washington State in designing radio frequency heat treatments for dried legumes. She is also determining the efficacy of cold storage as a disinfestation treatment for spotted winged drosophila in table grapes.

**Selected Publications:**


**Johnson, J. A.** Effect of relative humidity and product moisture on response of diapausing and nondiapausing Indianmeal moth (Lepidoptera: Pyralidae) larvae to low pressure treatments. J. Econ. Entomol. 103: 612-618. 2010


Wang, S., **Johnson, J. A.**, Hansen, J. D. and Tang, J. Determining thermotolerance of fifth-instar Cydia pomonella(L.) (Lepidoptera: Tortricidae) and Amyelois transitella(Walker) (Lepidoptera: Pyralidae) by three different methods. J. Stored Products Res. 45: 184-189. 2009

**Johnson, J. A.**, and Hansen, J. D. Evidence for the non-pest status of codling moth on commercial fresh sweet cherries intended for export. Crop Protection. 27: 1415-1420. 2008

**Johnson, J. A.** Survival of Indianmeal moth and navel orangeworm (Lepidoptera: Pyralidae) at low temperatures. J. Econ. Entomol. 100: 1482-1488. 2007


Lodewyk P. S. Kuenen, Research Entomologist, CPQ

**Education:**
- 1978 MS, Entomology, University of California, Riverside.
- 1982 PhD, Entomology, University of California, Riverside.

**Professional Work Experience:**
- 1996 - 1998 – Research Associate, Cornell University, Entomology Department.
- 1994 - 1996 – Associate Research Entomologist, USDA, ARS, Bee Research Laboratory, Beltsville, MD.
- 1989 - 1993 – Research Associate, University of Massachusetts, Amherst, Entomology Department.

**Accomplishments:**
Dr. Kuenen has conducted research on chemical ecology and analyses of insect and mite behavior for 32 years. Beginning in graduate school Dr. Kuenen helped decipher the stimuli and mechanisms employed by insects and mites to follow odor plumes to mates or food sources. He is author and co-author on the identification of several insect pheromone blends, developed and used new bioassay approaches plus video analyses (with software development) to analyze male moth flights to pheromone sources and he was the first to demonstrate positive anemotaxis to clean and odor-laden air in a free-walking mite species. Dr. Kuenen was the first to elucidate the location of female pheromone release (hind wings) in a primitive moth family, Hepialidae (ghost moths). Since joining ARS, Dr. Kuenen has elucidated critical sex pheromone components of the navel orangeworm (NOW) and various aspects of its development and field biology and has collaborated on better understanding the mechanisms mating disruption of the Indian mealmoth in enclosed spaces.

**Current Research:**
Dr. Kuenen has been with USDA, ARS, CPQ since 1998. His research focuses primarily on the elucidation of chemically mediated insect behavioral repertoires that can lead to development of controls for insects of tree nuts and postharvest durable commodities, particularly as alternatives to fumigation. The navel orangeworm, a primary pest of the multi-billion dollar California nut industries has been a special focus of Dr. Kuenen’s work. In collaboration with the University of California, he identified its sex pheromone and is currently developing formulations for field use. Another area of investigation is attraction of adult moths to host crops plus the influence of visual cues on flight behavior and trap capture. In the laboratory, a large flight tunnel with multiple video options are employed and field collaborations continue to follow up lab leads. As author or co-author Dr. Kuenen has published 42 peer reviewed articles, 1 patent, 3 book chapters, 66 other publications, and made scores of oral presentations.
Selected Publications:


David M. Obenland, Plant Physiologist, CPQ

**Education:**
1984  BS, Biology, Washington State University.
1986  MS, Plant Breeding and Cytogenetics, Iowa State University.
1989  PhD, Plant Physiology, Iowa State University.

**Professional Work Experience:**
1997-present – Research Plant Physiologist, USDA, ARS, SJVASC, Commodity Protection and Quality Research Unit, Parlier, CA.
1990-1992 – Postdoctoral Research Associate, Botanical Institute, Basel, Switzerland.
1986-1989 – Graduate Research Assistant, Plant Physiology, Iowa State University, Ames, IA.
1984-1986 – Graduate Research Assistant, Plant Breeding and Cytogenetics, Iowa State University, Ames, IA.

**Accomplishments:**
Dr. Obenland has 25 years of experience in plant physiology and postharvest fruit and vegetable quality research. In his postdoctoral work at the University of Basel, he studied the regulation of fructan accumulation in barley and demonstrated the mode of regulation of the key biosynthetic enzyme. His work on plant carbohydrates continued at the Kennedy Space Center where his research showed the effects of microgravity on starch metabolism in wheat. After beginning work with ARS, he confirmed that off-odor associated with packed broccoli was due to the formation of sulfur gases that were triggered by the low oxygen present in the packaging and identified the responsible enzyme. His work on alternatives to methyl bromide fumigation led to the demonstration of the feasibility of high temperature forced air combined with controlled atmosphere as a new non-chemical means for quarantine disinfection of stone fruit. His research on the effects of quarantine treatments on fruit quality has provided new information on the causes of quarantine-induced phytotoxicity and given means to help protect fruit from this injury. In collaborative work with colleagues at the University of California he has identified factors that are keys to determining flavor in navel oranges and mandarins and provided an understanding of the effects of postharvest conditions on flavor in these commodities. Based upon this research a new standard that governs when navel oranges can be harvested in California recently became law. His work with flavor was also recently extended to avocados where he demonstrated the involvement of aroma volatiles in the development of flavor during maturation and ripening.

**Current Research:**
Dr. Obenland’s current emphasis is on determining the causes of genotypic variation in coating-induced off-odor formation in mandarins to aid in the development of cultivars that are less susceptible to this flavor disorder. He also is continuing his work to better understand the impact of volatiles on avocado flavor. Research is ongoing to determine the effects of various chemical fumigation treatments on fresh fruit quality and to determine means to lessen treatment-induced injury.
Selected Publications:


Joel P. Siegel, Research Entomologist, CPQ

Education:
1974 BA, Biology, State University of New York at Binghamton.
1985 PhD., Entomology, University of Illinois at Urbana-Champaign.
1990 MS, College of Veterinary Medicine, University of Illinois at Urbana-Champaign.

Professional Work Experience:
1997-present – Research Entomologist, USDA, ARS, SJVASC, Commodity Protection and Quality Research Unit, Parlier, CA.
1988-1990 – Graduate Student and Statistical Consultant, University of Illinois at Urbana-Champaign, Dept. of Veterinary Pathobiology, College of Veterinary Medicine, Urbana, IL.
1985-1988 – Postdoctoral Research Associate, University of Illinois at Urbana-Champaign, Dept. of Veterinary Pathobiology, College of Veterinary Medicine, Urbana, IL.

Accomplishments:
Dr. Siegel’s breadth of expertise reflects 30 years of experience in entomological and epizootiological research in corn and tree nut production systems in Illinois and California, medical entomology and safety testing. He determined the threshold for transmission of the pathogen *Nosema pyrausta* for field populations of the European corn borer and developed a life table of the pest. He developed protocols for mammalian safety testing for the World Health Organization and is an authority on the mammalian safety of *Bacillus thuringiensis*. Dr. Siegel evaluated the persistence of microbial insecticides and their efficacy against mosquitoes, with an emphasis on assessing the efficacy of Vectobac and Vectolex for control of the vectors of Saint Louis Encephalitis and West Nile Virus. Dr. Siegel joined the Agricultural Research Service in 1997 and his research shifted focus to solving production problems in almonds and pistachios by implementing changes in management practices that increase commodity quality and boost their export. He is finishing his service as coordinator of an areawide program to control navel orangeworm (NOW) in tree nuts and serves as a member of four University of California Special Working Groups on almonds, pistachios, walnuts and spray coverage.

Current Research:
Dr. Siegel expanded his interest in complex population dynamics to include the relationship between NOW and its nut hosts, as well as between NOW population levels and successful chemical and nonchemical control of this pest. He was the first to demonstrate the efficacy of the commercially produced entomopathogenic nematode *Steinernema carpocapsae* for control of overwintering NOW in pistachios and devised novel strategies for dissemination of the nematode. Dr. Siegel and his collaborators were also the first to use industry databases to elucidate the relationships between proximity to pistachios and damage to the most common almond variety (Nonpareil) as well as between pistachio shell integrity and NOW damage. He developed novel bioassays to determine the ovicidal/larvicidal effects, duration of control, and extent of coverage of chemical insecticides in almonds and pistachios. As an authority on the biology and control of NOW, Dr. Siegel’s studies produced a fundamental change in the understanding of the relationship between nut quality and the rate of development of NOW, which in turn affects the proper timing of insecticide applications. His research also demonstrated the ovicidal activity of narrow spectrum insecticides used to control NOW and he is considered an authority on insecticide coverage in almonds and pistachios.
Selected Publications:


Joseph L. Smilanick, Research Plant Pathologist CPQ

Education:
1978 B.Sc. UC Davis
1980 M.Sc. Colorado State University
1984 Ph.D. UC Riverside

Professional Work Experience:
1983-1986 Postdoctoral Research Associate, USDA-ARS Logan, UT
1986-present Research Plant Pathologist, USDA-ARS, Parlier, CA

Accomplishments:
Dr. Smilanick’s research has lead to several common commercial practices in the grape and citrus industries. In the early 1990s, he introduced and verified the concentration x time concept and colorimetric dosimeters to control sulfur dioxide fumigation of grapes to control gray mold of table grapes, these technologies made fumigation reliable while reducing chemical use by 75% or more and were adopted industry-wide. He demonstrated the value of integrated thermal treatments for citrus fruit to control postharvest decay while reducing chemical use and improving fruit quality; these are common commercial practices in California and elsewhere. He evaluated ozone use to control postharvest decay of fresh citrus fruit and table grapes, including aqueous and gaseous applications in several modes of application. Low constant ozone concentration use in citrus storage became a ubiquitous practice as a consequence of this work.

Current research:
The emphasis of Dr. Smilanick program is primarily research on the biology and control of postharvest fungal diseases of fresh fruit, primarily table grapes and citrus fruit. The approaches employed to manage these diseases minimize or avoid completely the use of synthetic conventional fungicides, and include biological control, thermal treatments, natural products, or cultural practices done before harvest. Current projects include the control of the postharvest decay of table grapes by the use of ozone gas during storage and vineyard management practices applied before harvest. Current projects include the control of the postharvest decay of citrus fruit by the use of thermal treatments applied after harvest and grove management practices applied before harvest. Dr. Smilanick has also participated in many other plant pathology research projects with other pathogen-host combinations, such as Dutch elm disease, grape powdery mildew, coffee rust, and several diseases of wheat caused by the Tilletia spp.

Selected Publications:


Spencer Walse, Research Chemist, CPQ

**Education:**
1998  BS, Chemistry, University of Illinois, Urbana-Champaign
2003  PhD, Environmental Analytical/Organic Chemistry, University of South Carolina, Columbia,

**Professional Work Experience:**
2008-present – Research Chemist, USDA, ARS, SJVSC, Commodity Protection and Quality Research Unit, Parlier, CA
2007-2009 – Faculty Research Associate, Department of Chemical Engineering, Environmental Engineering Program, Yale University, New Haven, CT

**Accomplishments:**
Dr. Walse developed and applied novel systems-based approaches and methyl bromide fumigation treatments to control quarantine insect pests in postharvest channels that threaten domestic transportation and/or international trade of specialty crops. He also developed a kinetic model of methyl bromide sorption for USDA-APHIS and industry to facilitate comparison of insecticidal efficacy data obtained across a variety of different fruit and packaging types with varying load factors. His research critically supports USDA-Animal Plant Health Inspection Service (APHIS) negotiations with foreign governments regarding insect- and residue-related phytosanitary issues that have the potential to serve as trade barriers for US-grown agricultural commodities. Dr. Walse discovered an evolutionary basis for pheromone production and the environmental basis for pheromone release within the *Anastrepha*, the genus of Tephritidae that contains eight economically important fruit fly pests. He demonstrated that physicochemical-based inter-organism communication strategies are common among insects and mechanistically linked to the abiotic environmental processing of chemical signals. Dr. Walse also demonstrated the insecticidal efficacy of sulfuryl fluoride and “Horn” phosphine, the primary alternatives to methyl bromide for postharvest disinfections of perishable and durable commodities, toward species endemic to California. Dr. Walse’s research on agriculturally, economically, and environmentally sound postharvest replacements for methyl bromide is the basis for technical interaction between US industry, the USEPA, and the United Nations Environmental Program (UNEP) Methyl Bromide Technical Options Committee (MBTOC) and Technical and Economic Assessment Panel (TEAP), and as such critically supports the United States government’s compliance with international regulation under the Montreal Protocol.

**Current Research:**
The overall goal of Dr. Walse’s research is to ensure the protection and quality of foodstuffs in global distribution channels. The results of this research directly enhance production, distribution, and safety of foodstuffs, promote and retain access of United States-grown crops to domestic and foreign markets, and protect the United States and trading partners from the agricultural, ecological and economic threat posed by quarantine and invasive pests. In general, Dr. Walse develops chemical and non-chemical techniques to rapidly disinfect raw products of field pests, control storage pests in processed products amenable to re-infestation and microbial infection, reduce reliance on fumigation as a stand-alone measure for postharvest disinfestations and disinfections, and minimize the environmental and ecological impact of postharvest processing. The research involves a multidisciplinary approach to the development and integration of predictive chemical kinetics, modeling strategies, and *in situ* results as they
relate to quantitatively understanding how the biological activity of molecules is affected by interaction with surrounding environments. Lastly, Dr. Walse has obtained extramural grant funds totaling over $4,000,000 and in-kind support totaling over $1,750,000 from stakeholder, research, and regulatory entities. Dr. Walse is a postharvest consultant for > 25 commodity groups located in regions that span the U.S. and has been an invited speaker at 10 international as well as approximately 40 other academic, government, and industry venues.

**Selected Publications:**

**Walse, S.S;** Bellamy, D.E., Krugner, R.; Tebbets, J.S.; Postharvest treatment of California USA strawberries with methyl bromide to eliminate the spotted wing drosophila, Drosophila suzukii, in exports to Australia. J. Asian-Pac. Entomol. *In press*


Victoria Y. Yokoyama, Research Entomologist, CPQ

**Education:**
1967  BS, Entomology, University of California, Davis
1968  Graduate Program; Entomology and Tropical Horticulture, University of Hawaii, Honolulu
1972  MS, Entomology, University of California, Berkeley
1974  PhD, Entomology, University of California, Berkeley

**Professional Work Experience:**
1984-present – Research Entomologist, USDA, ARS, SJVASC, Commodity Protection and Quality Research Unit, Parlier, California.
1975-1984 – Assistant-Associate Professor, Department of Biology, California State University, Long Beach, CA.

**Accomplishments:**
Dr. Yokoyama has developed quarantine treatments and strategies to control regulatory pests during her 27-year research program at the USDA, ARS in Fresno and later Parlier. Her work has been documented through over 130 publications including first and co-authored papers in peer-reviewed journals, proceedings papers, technical reports, reports to U.S. and foreign regulatory agencies, and over 200 presentations. Dr. Yokoyama was distinguished as a 2006 Fellow of the Entomological Society of America (ESA) for outstanding contributions to entomology, and was the recipient of the 2004 C. W. Woodworth Award, ESA Pacific Branch for outstanding accomplishments in entomology within the region over the past 10 years. She has elucidated the biology of olive fruit fly in relation to climatic conditions in different olive growing regions, and developed trapping techniques and cultural practices such as orchard sanitation to mitigate existing pest populations after the exotic pest was first discovered in California. She developed brine and cold storage quarantine treatments, investigated systems approaches for pest control, and was the first to initiate a statewide biological control program to mitigate olive fruit fly infestations. She developed unique quarantine treatments using bale compression in modern compressors and fumigation to control Hessian fly and cereal leaf beetle that was implemented by regulatory agencies for interstate and foreign shipments of hay to Asia-Pacific countries. She developed a multiple phase quarantine treatment for large-size, polypropylene fabric-wrapped hay bales to control Hessian fly in U.S. exports to Japan. The work was used by The National Hay Association and APHIS-PPQ to support access to new markets for US hay in South Korea, South Vietnam, and PR China. She developed the unique concept of a walnut husk fly pest-free period in stone fruit, and demonstrated the poor host status of peaches and nectarines, and the non-host status of plums and fresh prunes for the indigenous pest. The data was approved by New Zealand, Brazil, Colombia, and Ecuador in 1995-1997, Argentina in 2001, and Chile in 2003 allowing stone fruit to be imported from the San Joaquin Valley of California. A new market for California nectarines in Japan was based on her development of a new in-carton fumigation, the first of its kind approved by Japan for fresh fruit from the western U.S. She developed a new low temperature treatment for oriental fruit moth and a novel combination treatment using low temperature storage and slow-release sulfur dioxide pads for table grapes for certain insects and mites, and formulated a laboratory diet to mass rear oriental fruit moth, a quarantine pest in stone fruits exported to British Columbia and Mexico.
Current Research:
Final phase of developing a multiple quarantine treatment using bale compression and a 3-d PH3 fumigation for hay exported to Japan. Evaluating bale compression and field drying as a systems approach to control Hessian fly in hay exports. Developing a yellow corrugated plastic pan trap sprayed with GF-120 for control of olive fruit fly.

Selected Publications:


Yokoyama, V. Y. 2011. Approved quarantine treatment for Hessian fly (Diptera: Cecidomyiidae) in large-size hay bales and Hessian fly and cereal leaf beetle (Coleoptera: Chrysomelidae) control by bale compression. J. Econ. Entomol. 104: 792-798.


Yokoyama, V. Y. 2012. Mobility of olive fruit fly (Diptera: Tephritidae) late third instars and teneral adults. Environ. Entomol. (Accepted)
WATER MANAGEMENT RESEARCH UNIT

Mission: The mission of the Water Management Research Unit (WMRU) is to develop effective, practical, sustainable, and environmentally acceptable solutions for meeting on-farm water requirements and for controlling soil-borne pests of horticultural crops. WMRU research focuses on 1) crop coefficients and deficit irrigation strategies of high value and emerging specialty crops, 2) production and value-added products of drought and salt tolerant crops that can grow on marginal lands, 3) methyl bromide alternatives for pre-plant soil fumigation in strawberries, grapes/orchards replant, perennial field nurseries, and ornamental crops, and 4) emission reduction techniques of methyl bromide alternative compounds.

Unit Scientists:
James Ayars  Research Agricultural Engineer
Gary Banuelos Research Plant and Soil Scientist
Suduan Gao  Research Soil Scientist
James Gerik  Research Plant Pathologist
Dong Wang  Research Soil Scientist and Research Leader
Ray Anderson  Research Hydrologist

Research Projects
1. Water Management to Improve Productivity and Protect Water Quality (National Program: Water Availability and Water Management)
2. Alternatives to Methyl Bromide for California Cropping Systems (National Program: Methyl Bromide Alternatives)

Program Overview: The WMRU is unique in its multidisciplinary and interdisciplinary expertise in water management and pre-plant soil fumigation research. WMRU conducts research under two appropriated projects and a number of extramurally funded projects supporting the main objectives of the two appropriated projects. Project 1 and its affiliated extramural projects focus on determination of water requirements and improvement of management strategies of peaches, grapes, pomegranates, and on assessment of Brassica, cactus, and hybrid poplar as alternative crops for selenium management in the Westside of the San Joaquin Valley of California. Project 2 and its affiliated extramural projects focus on evaluation of pest control efficacy and crop response of methyl bromide alternative fumigants for wine, table, and raisin grapes, cut flower, ornamental, and perennial field nursery crops, and on non-chemical based soilless substrates for strawberries. Field and laboratory research is also conducted to evaluate emission reduction techniques of methyl bromide alternative fumigants using low permeability plastic films and associated pest control efficacy versus duration of film cover.
Dong Wang, Supervisory Research Soil Scientist and Research Leader, WM

Education:
1984 BEng, Beijing Ag Engineering Univ., Beijing, China
1989 MS, University of Idaho, Moscow, ID
1993 PhD, University of Wisconsin, Madison, WI

Professional Work Experience:
2000-2007 – Professor; University of Minnesota – Twin Cities, St. Paul, MN.
2007-Present – Supervisory Soil Scientist and Research Leader, USDA-ARS, Parlier, CA.

Accomplishments:
Dr. Wang has conducted scientific research for over 27 years, in appointments ranging from Graduate Research Assistant to Supervisory Research Soil Scientist and Research Leader in the Water Management Research Unit at the San Joaquin Valley Agricultural Sciences Center. He is author of over 200 publications (senior or corresponding author of 130) including 78 refereed journal articles and 12 invited book chapters. He is nationally and internationally recognized as an authority on pre-plant soil fumigation with methyl bromide alternatives. He is also recognized as an expert on the characterization and measurement of soil hydraulic properties and applications of remote sensing in agriculture. His scientific accomplishments are acknowledged through invitations to speak, chair conference programs, write book chapters, serve on journal editorial boards (Journal of Environmental Quality and Vadose Zone Journal), and U.S. EPA, NSF, and USDA-NRI panels, and he was elected Fellow of American Society of Agronomy. His achievement is also demonstrated by $8 million extramural funding ($5M in current position), and mentoring younger scientists (seven of his former graduate students and postdocs are now independent research scientists and university professors).

Current research:
Dr. Wang’s current projects include 1) developing sustainable and environmentally sound methyl bromide alternatives for pre-plant soil fumigation, 2) developing water management strategies for peaches, pomegranates, grapes, 3) assessing water and carbon fluxes and budgets of sugarcane production as biofuel feedstock

Selected Publications:
Gao, S., R. Qin, B. Hanson, N. Tharayil, T. Trout, D. Wang, and J. Gerik. Effects of manure and water applications on 1,3-dichloropropene and chloropicrin emissions in a field trial. Journal of Agricultural and Food Chemistry 57:5428–5434. 2009.


James E. Ayars, Agricultural Engineer, WMR

**Education:**
- 1965 BS, Cornell University, Ithaca, New York
- 1973 MS, Colorado State University, Fort Collins, Colorado
- 1976 PhD, Colorado State University, Fort Collins, CO

**Professional Work Experience:**
- 1976–1980 – Assistant Professor, University of Maryland, Dept. of Agricultural Engineering, College Park, MD
- 1980–1994 – Agricultural Engineer USDA-ARS, SJVASC, Water Management Research Unit, Fresno, CA
- 1995–2005 – Agricultural Engineer, USDA-ARS, SJVASC, Water Management Research Unit, Fresno, CA
- 2006–Feb 2007 – Acting Research Leader, USDA-ARS, SJVASC, Water Management Research Unit, Fresno, CA
- 2007–2010 – Agricultural Engineer, USDA-ARS, SJVASC, Water Management Research Unit, Fresno, CA
- 2010–Present – Acting Research Leader, USDA-ARS, SJVASC, Water Management Research Unit, Fresno, CA

**Accomplishments:**
Dr. Ayars has worked for ARS for 32 years in the area of integrated management of irrigation and drainage systems. His initial studies focused on the reuse of drainage water for supplemental irrigation, disposal of saline drainage water through cyclic reuse of drainage water, and the characterization of irrigation efficiencies in irrigation districts. These studies resulted in the development of new criteria for the design and operation of subsurface drainage systems. Recent studies have focused on the characterization of water requirements for horticultural crops including, peaches, peppers, garlic and broccoli and the development of crop coefficients for use in irrigation scheduling.

**Current Research:**
Dr. Ayars is currently investigating the water and fertilizer requirements for young pomegranate. This is being done on field sites located on the Kearney Agricultural Center and the San Joaquin Valley Agricultural Sciences Center. His other studies include research to determine the effect of limited and impaired water supplies on table, raisin, wine, and juice grape yield and quality. This an SCRI-NIFA funded project with cooperators from the University of California, 2 ARS Locations, Washington State University and the UC Department of Agricultural and Natural Resources. Dr Ayars is looking at the water requirements for raisin grapes, early and late season table grapes and wine grapes.

**Selected Publications:**


Vaughan, P.J. T.J. Trout, and J.E. Ayars. 2007. A processing method for weighing lysimeter data and comparison to micrometeorological Eto predictions. 88(1-3):141-146.


Gary Bañuelos, Plant and Soil Scientist, WMR

**Education:**
1987  PhD, Agriculture-Plant Nutrition, Hohenheim University
1984  MS, Agriculture, California Polytechnical State University
1981  BS, Crop Science, California Polytechnical State University; Plant Biology (Diploma level), Tubingen University
1979  BA, German, California State University

**Professional Work Experience:**
1990-present – Plant/Soil Scientist, USDA-ARS, Parlier, CA
2000-present – Adjunct Professor, CSU Fresno, Fresno CA
2010-present – Honorary Visiting Professor, Anhui University, Hefei, China

**Accomplishments:**
Dr. Bañuelos has more than 25 years of research experience, focusing on developing phytoremediation strategies for saline soils and waters. He has produced over 120 peer-reviewed publications and co-edited four books, including one which was translated into Chinese and is widely referenced within Chinese Universities. He identified salt-and B-tolerant crops, including saline tolerant poplar tree clones useful in water reuse strategies with poor quality waters of the western California Central Valley. He was first to show that canola in crop rotation with sunflower, mustard, and alfalfa successfully removed Se from soils irrigated with Se-laden effluent. He demonstrated that Se-enriched canola inhibits feeding by an insect pest and the biotransfer possibilities of plant Se to other biological systems. Dr. Bañuelos demonstrated that Se-enriched canola can be safely used as a diet supplement for enhancing biological Se levels in livestock. He was first to demonstrate under field conditions that transgenetic mustard plants successfully accumulated two to five times more Se than untransformed plants. He has successfully produced BD 20 biofuels from oil-producing crops in unproductive soils, and developed Se-enriched animal feed and effective biofumigants from Brassica seed meals after oil extraction. He has identified new salt and B-tolerant cultivars of prickly-pear cactus for planting in fallowed soils of the westside of the California Central Valley, and discovered that the fruit and cladode organs accumulate unique bioavailable forms of Se and volatilize Se. Most recently, he has successfully developed first of its kind comprehensive Se speciation analytical techniques, for analyzing the newly-produced Se-biofortified products.

**Current research:**
The ultimate product of his research is the development of an integrative “systems” approach for the sustainability phytomanagement of Se, and other trace elements which includes such agronomic factors as; plant identification, water management, water recycling, insect monitoring, product development, i.e., biofuel, biofortified food crops, biofumigants, and grower and public acceptance. The methodology to be used by the incumbent utilizes vegetation management (phytoremediation) with salt and B tolerant trace element accumulator plants in conjunction with irrigation and water management practices to minimize soluble Se, B and other salts from entering both the drainage effluent and groundwater in agricultural regions.

**Selected Publications:**


**Bañuelos, G.S.** Phytoremediation of selenium-contaminated soil and water produces biofortified products and new agricultural byproducts. In: Biofortification and development of new


Suduan Gao, Research Soil Scientist, WMR

**Education:**
1992 PhD, Soil Sci., Univ. Calif. Davis
1985 MS, Soil Sci., Chinese Academy Agric. Sci. Beijing, China
1982 BS, Agric. Chem. Hebei Agric. Univ., Baoding, China

**Professional Work Experience:**
2004–present – Research Soil Scientist, USDA-ARS, Parlier
1997–2003 – Assistant Research Soil/Water Scientist. Univ. of Calif., Davis
1992–1997 – Postdoctoral Research Associate. Department of Land, Air and Water Resources, Univ. of Calif., Davis, CA
1987–1992 – Research Assistant. Univ. of Calif., Davis, CA

**Accomplishments:**
Suduan Gao has been conducting research to address environmental issues associated with agricultural activities for 25 years. Her research focuses on the processes and mechanisms affecting the fate of nutrients, toxic trace elements, and air pollutants, and strategies to minimize the negative impact of agriculture. Dr. Gao studied intensively the major pathways for arsenic and selenium transformation in soil and ground water. She examined the pros and cons of using flow-through wetlands to remediate selenium -laden water in the San Joaquin Valley. Dr. Gao was the first to apply the oxidative capacity and terminal electron accepting processes to describe redox chemistry in paddy soils and evaluated the impact of straw return, and mobility of trace elements and dissolved organic carbon (affecting drinking water quality) in soil, surface and shallow ground waters. Since joining USDA-ARS in 2004, in addition to continue trace element research related to agricultural drainage, Dr. Gao has conducted a number of research projects on emission reduction from soil fumigation while maximizing efficacy. Dr. Gao has determined most methods on their emission reduction potential under field conditions, collected data to assist in regulatory decision making, and identified the most effective method with low permeability tarp (TIF) that can reduce emission, increase fumigant use efficiency, and promote using reduced rates. Dr. Gao’s research has provided knowledge on field practices for emission reduction and increase efficacy in pre-plant soil fumigation for strawberry, perennial nursery, and orchard/vineyard growers as well as data or information for regulatory considerations.

**Current research:**
Dr. Gao is conducting research under two CRIS projects: NP211 Water Availability & Watershed Management, and NP308 Methyl Bromide Alternatives. Under 211, Dr. Gao has initiated new research to address issues related to N fertilizer applications by evaluating greenhouse gas N₂O emission and NO₃⁻ leaching in orchard from different irrigation and fertilization methods. The goal is to increase N use efficiency and minimize losses. Under 308, Dr. Gao also has three extramural funded projects from Almond Board, NIFA Methyl Bromide Transition Program, and CDFA Specialty Crop Block Grants Program. These projects are developing fumigation methods that maximize fumigant efficiency on soil-born-pest control with less chemical input low permeability tarp and/or carbonation of fumigations.

**Selected Publications:**


Hanson, B.D., Gao, S., Gerik, J.S., Shrestha, A, Qin, R., McDonald, J.A. 2011. Effects of emission reduction surface seal treatments on pest control with shank-injected 1,3-dichloropropene and chloropicrin. Crop Production. 30:203–207.


James S. Gerik, Research Plant Pathologist, WMR

Education:
1977 BS, Plant and Soil Science, Texas A & M University,
1979 MS, Plant Pathology, Texas A & M University,
1984 PhD, Plant Pathology, University of California,

Professional Work Experience:
Unit, USDA-ARS, Salinas, CA.
1991-2001 – Research Plant Pathologist, Holly Sugar Inc., Tracy,
California
2001-present – Research Plant Pathologist, Water Management
Research Unit, USDA-ARS, Parlier, CA.

Accomplishments:
Dr. Gerik has worked for 28 years mostly studying soilborne pathogens and root diseases. His
research has included ecological and epidemiological studies of Polymyxa betae and beet
necrotic yellow vein virus. Etiological studies have included tomato plant decline in the Imperial
Valley caused by tomato bushy stunt virus and vascular wilt disease of lettuce in Fresno County
caused by Fusarium oxysporum. Dr. Gerik spent 10 years conducting disease control research
and advising growers of disease control practices in 13 factory districts in 10 states for Holly
Sugar Corporation. Dr. Gerik demonstrated that alternative fumigants and other chemicals are
efficacious for disease and weed control in cut flower crops including calla lily, snapdragon,
Liatris, Dutch Iris, Freesia, myrtle, stock, Rhamnus, and Gypsophila. Dr. Gerik demonstrated
that drip applied methyl bromide alternatives for the production of rhizomes in calla lily nurseries
provide superior disease control compared to the standard application of methyl bromide /
chloropicrin applied by shank application.

Current Research:
Dr. Gerik continue to study alternative fumigants and other chemicals for the control of
diseases, weeds and other pest in cut flower and ornamental bulb production, concentrating on
using low permeability tarps and low rates of product. Other research involves the
characterization of post fumigation microbial communities over time and development of
pathogen quantification methods to help determine the necessary for fumigation.

Selected Publications:
Efficacy of four soil treatments against Fusarium oxysporum f. sp. vasinfectum Race 4 on

Cabrera, J.A., B.D. Hanson, M.J.M. Abit, J.S. Gerik, S. Gao, R. Qin, and D. Wang, 2012. Pre-
plant soil fumigation with reduced rates under low permeable films for tree nursery production,
orchard and vineyard replanting Calif. Agric. submitted.

system to control nematodes and pathogens in strawberry production Calif. Agric. submitted.


Hanson, B.D., S. Gao, J.S. Gerik, A. Shrestha, R. Qui, and J.A. McDonnald, 2010. Effects of emission reduction surface seal treatments on pest control with shank-injected 1,3-dichloropropene and chloropicrin. Crop Prot. 30:203-207.


Donald Makus, Biologist / Horticulturist, WMR

**Education:**
1965  BS, Delaware Valley College  
1966  MS, Michigan State University  
1972  PhD, North Carolina State University

**Professional Work Experience:**
1972–1973 – Special Lecturer, post-doc, NCSU  
1973–1979 – Assistant Professor, Seed Physiology, University, Idaho  
1979–1980 – Research Associate, Institute Molecular Biology, WSU  
1994–2011 – Research Agronomist, USDA-ARS, Weslaco, TX  
2012–present – Research Biologist, USDA-ARS, Parlier, CA

**Accomplishments:**
Dr. Makus’ career spans 9 years in academia and 32 years with ARS. He has experience in developmental seed biology, abiotic and biotic plant stress studies in multiple cropping systems. He has developed agronomic protocols for reduced tillage vegetable systems (sweet corn, broccoli, watermelon); evaluated no-till vs. conventional cropping systems for WUE, yield and crop quality attributes; developed fertility protocols for vegetable amaranth and gypsum application rates for improved sulfur nutrition in spinach and broccoli; developed a white asparagus production system based on opaque row covers and studied low temperature events (ice nucleation) in asparagus; evaluated calcium delivery systems for strawberries; done multi-species blueberry evaluations for yield, nutrient, fruit characteristics, sensory and post-harvest attributes; evaporative cooling in raspberries; and explored the use of synthetic barriers for weed control in blackberries and studied canopy shading effects on blackberry, green beans, and other vegetables.

**Selected Publications:**


