# Parlier-Davis Research Symposium
# June 12, 2012
# SJVASC, Parlier CA

**PARLIER-DAVIS RESEARCH SYMPOSIUM**
**June 12, 2012**

## Table of Contents

**PARLIER-DAVIS RESEARCH SYMPOSIUM**
**JUNE 12, 2012**
**San Joaquin Valley Agricultural Sciences Center, 9611 South Riverbend Ave., Parlier, CA**

| | |
|---|---|
| 10 am | Welcome and Introductions<br>Dan Kluepfel |
| 10:15 am | Crop Diseases, Pests & Genetics:<br>Elizabeth Rogers – *Xylella fastidiosa*: pathogen biology and plant responses<br>Rodrigo Krugner – Biology, ecology, behavior, and transmission properties of *Xylella fastidiosa* vectors<br>Craig Ledbetter – Current *Prunus* and *Vitis* breeding efforts at the SJVASC<br>Ray Yokomi – Current research on citrus pathogens |
| 11:15 am | Break |
| 11:30 am | Water Management Research:<br>Jim Ayars – irrigation water management<br>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:<br>Judy Johnson – Non-chemical postharvest alternatives to methyl bromide<br>Spencer Walse – Chemical postharvest alternatives to methyl bromide<br>Joe Smilanick – Maintaining quality and extending shelf and shipping life<br>Gabriela Romano – NALPGR |
| 2:30 pm | Break |
| 2:45 pm | Crops Pathology and Genetics/National Clonal Germplasm Repository for Fruit and Nut Crops:<br>Greg Browne – Etiology and biology of tree crops diseases<br>Kendra Baumgartner – Sustainable Viticulture<br>Cai-Zhong – Rice genetics/Sustainable floriculture<br>Malli Aradhya – NCGR |
| 3:45 – 4:30 pm | Tour<br>Lysimeter<br>SEM/Confocal microscopes<br>CPQ insectary/ insect-rearing room<br>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 McElrone | 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:**
Wechter, P. Begum, D., Presting, G. Kim, J., Wing, R. **Kluepfel, D**. 2002. Physical mapping, BAC-end sequence analysis and marker tagging of the soil-borne nematicidal bacterium, *Pseudomonas synxantha* BG33R. OMICS, Journal of Integrative Biology 6 (1):11-21.

Wechter, P., Williamson, Robertson, **Kluepfel**, **D**. 2003. A rapid, cost-effective procedure for the extraction of microbial DNA from soil. World J. of Microbiol.and Biotech. 19(1):85-91.

Roberston, A.E., Wechter, W. P., Denny, T. P., Fortnum, B. A., **Kluepfel**, D. A., 2004. Relationship between Avirulence gene (avrA) diversity in *Ralstonia solanacearum* and bacterial wilt incidence. Molec. Plant-Microbe Interactions; 17: 1376-1384

Steenwerth. K.L., R.E. Drenovsky, J. -J. Lambert, **D.A. Kluepfel**, K.M. Scow, and D.R. Smart. 2007. Soil morphology, depth and grapevine root frequency influence microbial communities in a Pinot Noir vineyard. Soil Biology and Biochemistry, *special issue "Molecular Approaches", online.*

Ong, K. L., Fortnum, B. A., **Kluepfel, D. A**., and Riley, M. B. 2007. Winter cover crops reduce bacterial wilt of flue-cured tobacco. Online APS; Plant Health Progress doi:10.1094/PHP-2007-0522-01-RS. http://www.plantmanagementnetwork.org/sub/php/research/2007/tobacco/

*Gonzalez, E.,* Wechter, P., and **Kluepfel, D**. 2008. Global gene expression of *Pseudomonas putida* KT2440 during growth in the rhizosphere of *Arabidopsis thaliana*. Microbiology (in review)

*McClean, A. ,Sudarshana, P* and **Kluepfel, D.** 2008. Enhanced detection and isolation of the walnut pathogen *Brenneria rubrifaciens*, causal agent of deep bark canker. European. J. Plant Pathology 122:413-424

*McClean, A* and **Kluepfel, D.** 2009. Identification and characterization of the genetic loci mediating rubrifacine biosysnthesis in *Brenneria rubrifaciens*. Phytopathology 99:145-151**.**

Yakabi, L, Parker, S., and **Kluepfel, *D.* *2010.*** Effect of pre-plant soil fumigants on *Agrobacterium tumefaciens*, pythiaceous species, and subsequent soil recolonization by *A. tumefaciens*. Crop Protection 29:583-590

**Kluepfel**, Yakabi, Parker, McClean, Maccree. 2010. Detection and implication of early *Agrobacterium* infection of paradox seeds and seedlings. *Acta Horticulturae*. (ISHS) 861:497-500

McElrone, Grant, **Kluepfel**, 2010. Role of ethylene-induced tyloses in canopy hydraulic failure of mature walnut trees afflicted with apoplexy disorder. *Tree Physiology* 30(6):761-772.

Hasey, Lampinen, Anderson, Grant, Caprile, Beede, **Kluepfel**, 2010. Crown gall incidence: Seedling Paradox walnut rootstock versus own-rooted English walnut trees. *Acta Horticulturae* 861:453-456.

Yakabe, L, Parker, S., and **Kluepfel, *D.* *2012.*** Novel PCR primers for detection of genetically diverse virulent *Agrobacterium tumefaciens* biovar 1 strains. J. Gen. Plant Path. 78:121–126.

**Kluepfel**, Aradhya, Browne, McKenry, Leslie, McClean, Moersfelder, Velasco, and Baumgartner. 2012. The quest to identify disease resistance in the USDA-ARS

*Juglans* germplasm collection. *Acta Horticulturae* (In Press)

Yakabi, L, Parker, S., and **Kluepfel, *D.* *2012.*** Cationic Surfactants: Potential Surface

Disinfectants to Manage *Agrobacterium tumefaciens* Biovar 1 Contamination of Grafting Tools. Plant Disease 96:000-000 (In press)

McClean, A., Duerkop, B., Greenberg, E., and **Kluepfel**, **D.** 2012. AHL signals induce rubrifacine production in a *bru*l mutant of *Brenneria rubrifaciens*. Phytopathology 102:195-203.

**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**

**Baumgartner K,** Fujiyoshi PT, Travadon R, Castlebury LA, Wilcox WF, Rolshausen PE. In press. Characterization of *Phomopsis* species recovered from wood cankers in eastern North American vineyards. Plant Disease.

**Baumgartner K**, Baker, BB, Korhonen K, Zhao J, Hughes KW, Bruhn J, Bowman TS, Bergemann SE. 2012. Evidence of natural hybridization among homothallic members of the basidiomycete *Armillaria mellea sensu stricto*. Fungal Biology 116: 677-691.

Travadon R, Smith ME, Fujiyoshi P, Douhan GW, Rizzo DM, **Baumgartner K**. 2012. Inferring dispersal patterns of the generalist root fungus *Armillaria mellea*. New Phytologist 193: 959-969.

Travadon R, **Baumgartner K**, Rolshausen PE, Gubler WD, Sosnowski M, Lecomte P, Halleen F, Peros J-P. 2012. Genetic structure of the fungal grapevine pathogen *Eutypa lata* from four continents. Plant Pathology 61: 85-95.

**Baumgartner K,** Coetzee MPA, Hoffmeister D. 2011. Secrets of the subterranean pathosystem of *Armillaria*. Molecular Plant Pathology 12: 515-534.

Petit E, Barriault E, **Baumgartner K,** Wilcox W, Rolshausen PE. 2011. *Cylindrocarpon* species associated with black-foot of grapevine in the northeastern United States and southeastern Canada. American Journal of Enology and Viticulture 62: 177-183.

**Baumgartner K**, Fujiyoshi P, Foster GD, Bailey AM. 2010. *Agrobacterium*-mediated transformation for investigation of somatic recombination in the fungal pathogen *Armillaria*. Applied and Environmental Microbiology 76: 7990-7996.

**Baumgartner K**, Fujiyoshi P, Smith RF, Bettiga L. 2010. Weed flora and dormant-season cover crops have no effects on arbuscular mycorrhizae of grapevine. Weed Research 50:456-466.

Steenwerth KL, **Baumgartner K**, Belina KM, Veilleux L. 2010. Vineyard weed seedbank composition responds to glyphosate and cultivation after three years. Weed Science 58:310-316.

Blaedow KE, **Baumgartner K**, Cox KD, Schnabel G. 2010. Natural infection of an herbaceous host by *Armillaria*: a case study on *Hemerocallis*. Canadian Journal of Plant Pathology 32:351-360.

**Baumgartner K**, Travadon R, Bruhn J, Bergemann S. 2010. Contrasting patterns of genetic diversity and population structure of *Armillaria mellea sensu stricto* in the eastern and western United States. Phytopathology 100:708-718.

**Baumgartner K**, Bhat R, Fujiyoshi P. 2010. A rapid infection assay for *Armillaria* and real-time PCR quantitation of the fungal biomass in planta. Fungal Biology 114:107-119.

Gadoury DM, Andrews J, **Baumgartner K**, Bjerkness M, Burr TJ, Kennelly MM, Lichens-Park A, MacDonald J, Savary S, Scherm H, Tally A, Wang G-L. 2009. Disciplinary, institutional, funding, and demographic trends in plant pathology: what does the future hold for the profession? Plant Disease 93:1228-1237.

**Baumgartner K**, Grubisha L, Fujiyoshi P, Garbelotto M, Bergemann SE. 2009. Microsatellite markers for the diploid Basidiomycete fungus, *Armillaria mellea*. Molecular Ecology Resources 9:943-946.

**Baumgartner K**, Bergemann SE, Fujiyoshi P, Rolshausen PE, Gubler WD. 2009. Microsatellite markers for the grapevine pathogen, *Eutypa lata*. Molecular Ecology Resources 9:222-224.

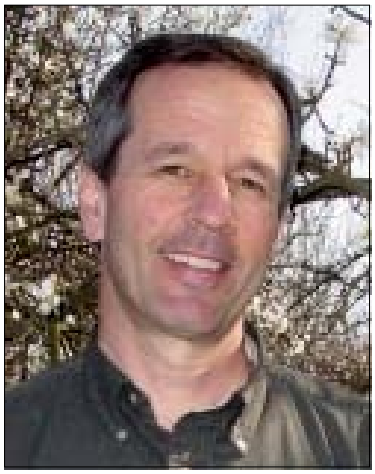
Smith RF, Bettiga L, Cahn M, **Baumgartner K**, Jackson L, Bensen T. 2008. Vineyard floor management effects on soil properties, soil moisture, sediment loss, plant nutrition and grape yield and quality. California Agriculture 62:184-190.

Cheng X, Euliss AC, **Baumgartner K.** 2008. Nitrogen capture by grapevine roots and arbuscular mycorrhizal fungi from legume cover-crop residues under low rates of mineral fertilization. Biology and Fertility of Soils 44:965-973.

**Baumgartner K**, Steenwerth KL, Veilleux L. 2008. Cover crop systems affect weed communities in a California vineyard. Weed Science 56:596-605.

**Baumgartner K**, Steenwerth KL, Veilleux L. 2007. Effects of organic and conventional practices on weed control in a perennial cropping system. Weed Science 55:352-358.

**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**

Bhat, R.G., **Browne, G.T.** 2007. Genetic diversity in populations of *Phytophthora citricola* associated with horticultural crops in California. Plant Disease 91:1556-1563.

Shaw, D.V., Hansen, J., **Browne, G.T.,** and Shaw, S.M. 2008. Components of genetic variation for resistance of strawberry to *Phytophthora cactorum* estimated using segregating seedling populations and their parent genotypes. Plant Pathology 57:210-215.

Klose, S. Ajwa, H.A., **Browne, G.T.,** Subbarao, K.V., Martin, F.N., Fennimore, S.A., Westerdahl, B.B. 2008. Dose response of weed seeds, plant-parasitic nematodes, and pathogens to twelve rates of metam sodium in a California soil. Plant Disease 92:1537-1546.

Shrestha, A**., Browne, G.T.,** Lampinen, B.D., Schneider, S.M., Simon, L., Trout, T.J. 2008. Perennial crop nurseries treated with methyl bromide and alternative fumigants: Effects on weed

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

Fennimore, S.A., Duniway, J.M., **Browne, G.T**., Martin, F.N., Westerdahl, B.B., Goodhue, R.E., Haar, M.J., Ajwa, H.A., Winterbottom, C.Q. Methyl bromide alternatives evaluated. California Agriculture 62 (2): 62-67. 2008.

Shrestha, A., **Browne, G.T.**, Lampinen, B.D., Schneider, S.M., and Trout, T.J. 2009. Weed community composition in tree fruit nurseries treated with methyl bromide and alternative fumigants. Intl. J. Fruit Sci., 9:78-91.

Wang, D. **Browne, G.,** Gao, S., Hanson, B., Gerik, J. Qin, R., and Tharayil, N. 2009. Spot fumigation: Fumigant dispersion and emission characteristics. Environ. Sci. and Tech. 43:5783-5789.

Hong, C., Gallegly, M., **Browne, G.T.,** Bhat, R., Richardson, P., Kong, P. 2009. The avocado subgroup of *Phytophthora citricola* constitutes a distinct species, *Phytophthora mengei* sp. nov. Mycologia 101:833-840.

Upadhyaya, S.,K., Udompetaikul, V., Shafii, M.S., and **Browne, G.T.** 2009. Design, development, and evaluation of a tree planting-site-specific fumigant applicator. Acta Hort. 824:281-288.

McGranahan, G., **Browne, G.,** Leslie, C, Hackett, W., and McKenna, J. 2010. Walnut rootstock 'RX1'. U.S. Plant Patent No. US PP20,649 P3. Date of patent: Jan. 19, 2010.

McGranahan, G., Leslie, C., Hackett, W., **Browne, G.,** McKenna, J., Buzo, T., Kaku, S., McKenry, M. 2010. Walnut Rootstock 'VX211'. US Plant Patent No. US PP21,179 P3. Date of patent: Aug. 3, 2010.

Bhat, R.G., **Browne, G.T.** 2010. Specific detection of *Phytophthora cactorum* in diseased strawberry plants using nested polymerase chain reaction. Plant Pathology: 59:121-129.

Wang, D., Gao, S., Qin, R., **Browne, G.** 2010. Lateral movement of soil fumigants 1,3-dichloropropene and chloropicrin from treated agricultural fields. Journal of Environmental Quality 39:1800-1806.

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

**Browne, G.T.,** Prichard, T.L., Schmidt, L.S., and Krueger, W.H. 2011. Evaluation of phosphonate treatments for control of Phytophthora crown rot of walnut. Plant Health Progress doi:10.1094/PHP-2011-0601-01-RS.

**Browne, G.T.,** Grant, J.A., Schmidt, L.S., Leslie, C.A., and McGranahan, G.M. 2011. Resistance to *Phytophthora* and graft compatibility with Persian walnut among selections of Chinese wingnut. Hortsci. 46:371-376.

Samtani, J.B., Ajwa, H.A., Weber, J.B., **Browne, G.T.,** Klose, S., Hunzie, J., Fennimore, S.A. 2011. Evaluation of non-fumigant alternatives to methyl bromide for weed control and crop yield in California strawberries (*Fragaria ananassa* L.). Crop Protection 30:45-51.

**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:**


Singh, A, Y.-C. Liang, P. Kumar, **C.-Z. Jiang** and M. S. Reid. (2012) Co-silencing of the *Mirabilis* antiviral protein (MAP) permits virus-induced gene silencing (VIGS) of other genes in Four O'Clock plants (*Mirabilis jalapa)*. ***Journal of Horticultural Science and Biotechnology*** (In press)

Reid, M. S. and **C.-Z. Jiang**. (2012) Postharvest biology and technology of cut flowers and potted plants. ***Horticultural Reviews*** (In press)

Reid, M. S. and **C.-Z. Jiang**. (2012) Postharvest-Cut flowers and potted plants. In ***Ornamental Geophytes: From Basic Science to Sustainable Production***. R. Kamenetsky and H. Okubo ed. (In press)

De Freitas, S. T., **C.-Z. Jiang** and E. J. Mitcham. (2012) Mechanisms involved in calcium deficiency development in tomato fruit in response to gibberellins. ***J of Plant Growth Regulation*** 31:221–234.

Reid, Michael S. and **Cai-Zhong Jiang**. (2011) Florigen Unmasked: Exciting Prospects for Horticulture. ***Chronica Horticulturae*** 51: 7-9.

Meir, Sh., S. Philosoph-Hadas, S. Sundaresan, K.S. V. Selvaraj, S. Burd, R. Ophir, B. Kochanek, M. S. Reid, **C.-Z. Jiang** and A. Lers. (2011) Identification of defense-related genes newly-associated with tomato flower abscission. ***Plant Signaling & Behavior*** 6: 590-593.

**Jiang, C-Z**, J.C. Chen and MS Reid (2011) Virus-Induced Gene Silencing in Ornamental Plants. In ***Methods in Molecular Biology, RNAi and Plant Gene Function Analysis***. H. Kodama ed. Clifton, New Jersey, pp81-96.

Meir, Sh., S. Philosoph-Hadas, S. Sundaresan, K.S. V. Selvaraj, S. Burd, R. Ophir, B. Kochanek, M. S. Reid, **C.-Z. Jiang** and A. Lers. (2011) Microarray analysis of the abscission-related transcriptome in tomato flower abscission zone in response to auxin depletion. ***Plant Physiology*** 154:1926-1956.

Villalobos-Acuna, M G., W. V. Biasi, S. Flores, **C-Z Jiang**, M. S. Reid, N. H. Willits, E. J. Mitcham. (2011) Effect of maturity and cold storage on ethylene biosynthesis and ripening in 'Bartlett' pears treated after harvest with 1-MCP. ***Postharvest Biology & Technology*** 59: 1-9.

Macnish, A. J., K. L. Morris, A. de Theije, M. G.J. Mensink, H. A.M. Boerrigter, M. S. Reid, **Cai-Zhong Jiang**, E. J. Woltering. (2010) Sodium hypochlorite: Apromising agent for reducing Botrytis cinerea infection on rose flowers. ***Postharvest Biology & Technology*** 58: 262-267.

Macnish, A.J., **C-Z Jiang**, F. Negre-Zakharov and M.S. Reid. (2010). Physiological and molecular changes during opening and senescence of *Nicotiana mutabilis* flowers. ***Plant Science*** 179: 267-272.

Macnish, A.J., **C-Z Jiang** and M.S. Reid. (2010). Treatment with thidiazuron improves opening and vase life of iris flowers***. Postharvest Biology & Technology*** 56: 77-84.

**Patents awarded:**

Riechmann; J, O Ratcliffe, T Reuber, K Krolikowski, J Heard, O Pineda, **C-Z Jiang**, R Creelman, R Kumimoto, P Chomet. (2011) Plant tolerance to low water, low nitrogen and cold. US Patent #: 8,022,274

Ratcliffe; O, R Kumimoto, **C-Z Jiang**, J Libby, R Creelman, P Repetti, T Reuber, N Gutterson, G Kumar, B Karunanandaa, K Gabbert. (2011) Plants with improved yield and stress tolerance. US Patent #:7,939,715

**Jiang, C-Z**, JE Heard, O Ratcliffe, NI Gutterson, FD Hempel, RW Kumimoto, JS Keddie, BK Sherman, JM Libby, J Sun, KF Zobrist-Duff, J Wu, C Fu, SB Dotson, LL Lutfiyya. (2011) Transcriptional regulation of plant biomass and abiotic stress tolerance. US Patent #: 7,897,843.

**Jiang, C-Z**, JE Heard, O Ratcliffe, RA Creelman, TL Reuber, JL Riechmann. (2010) Polynucleotides and polypeptides in plants. US Patent #: 7,825,296.

Heard; J., JL Riechmann, R Creelman, O Ratcliffe, R Canales, N Gutterson, L Reuber, O Pineda, T Morrison; **C-Z Jiang**, K Century. (2010) Plant Transcriptional Regulators. US Patent #: 7,663,025.

Sherman; B. K., JL Riechmann, O Ratcliffe, **C-Z Jiang**, J Heard, V Haake, R Creelman, L Adam, L Reuber, J Keddie, A DuBell, O Pineda, P Repetti, K Century, N Gutterson, G-L Yu, P Broun, R Kumimoto and M Pilgrim. (2010) Polynucleotides and polypeptides in plants. US Patent #: 7,659,446.

Ratcliffe O, L Adam, J Heard, **C-Z Jiang**, L Reuber, R Creelman. (2009) Yield-related polynucleotides and polypeptides in plants. US Patent #: 7,635,800.

Reuber L, JL Riechmann, J Heard, **C-Z Jiang**, L Adam, A DuBell, O Ratcliffe, O Pineda, G-L Yu, P Broun. (2009) Stress-related polynucleotides and polypeptides in plants. US Patent #: 7,601,893.

Zhang J, M Fromm, J Heard, JL Riechmann, L Adam, P Broun, O Pineda, L Reuber, J Keddie, G-L Yu, **C-Z Jiang**, R Samaha, M Pilgrim, R Creelman, A DuBell, O Ratcliffe, R Kumimoto, B Sherman. (2008) Polynucleotides and polypeptides in plants. US Patent #: 7,345,217.

**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**

**Kasuga T**, Kozanitas M, Bui M, Hüberli D, Rizzo DM, Garbelotto M (2012) Phenotypic diversification is associated with host-induced transposon derepression in the Sudden Oak Death pathogen *Phytophthora ramorum*. PLoS ONE 7: e34728.

Fan Z, Wu W, Hildebrand A, **Kasuga T**, Zhang R, Xiong X (2012) A novel biochemical route for fuels and chemicals production from cellulosic biomass. PLoS One 7: e31693.

**Kasuga T,** Bui M (2011) Evaluation of automated cell disruptor methods for oomycetous and ascomycetous model organisms. Fungal Genetics Reports 58: *4-13*.

Gilbert LB, **Kasuga T**, Glass NL, Taylor JW (2011) Array CGH Phylogeny: How accurate are comparative genomic hybridization-based trees? BMC Genomics 12: 487-500.

Gilbert LB, Chae L, **Kasuga T**, Taylor JW (2011) Array comparative genomic hybridizations: assessing the ability to recapture evolutionary relationships using an in silico approach. BMC Genomics 12: 456-472.

Zhang R, Fan Z, **Kasuga T** (2010) Expression of cellobiose dehydrogenase from *Neurospora crassa* in *Pichia pastoris* and its purification and characterization. Protein Expr Purif 75: 63-69.

Greenwald CJ, **Kasuga T**, Glass NL, Shaw BD, Ebbole DJ, Wilkinson HH (2010) Temporal and spatial regulation of gene expression during asexual development of *Neurospora crassa*. Genetics 186: 1217-1230.

Addidle M, Pynn J, Skellern P, **Kasuga T**, Grimwade K (2010) Chronic disseminated histoplasmosis with prolonged latency. J Infect 61: 272-274.

**Kasuga T**, Mannhaupt G, Glass NL (2009) Relationship between phylogenetic distribution and genomic features in *Neurospora crassa*. PLoS ONE 4: e5286.

Videira A, **Kasuga T**, Tian CG, Lemos C, Castro A, Glass NL (2009) Transcriptional analysis of the response of Neurospora crassa to phytosphingosine reveals links to mitochondrial function. Microbiology-Sgm 155: 3134-3141.

**Kasuga T**, Glass NL (2008) Dissecting colony development of *Neurospora crassa* using mRNA profiling and comparative genomics approaches. Eukaryot Cell 7: 1549-1564.

Tian CG, **Kasuga T**, Sachs MS, Glass NL (2007) Transcriptional profiling of cross pathway control in *Neurospora crassa* and comparative analysis of the Gcn4 and CPC1 regulons. Eukaryot Cell 6: 1018-1029.

## PATENT

Z. Fan, **T. Kasuga**, W. Wu, X. Xiong, R. Zhang (2010) A novel biochemical platform for fuels and chemicals production from cellulosic biomass (an international patent is currently pending).

**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*)

Manuck CM, Heller N, Battany M, Perry A, **McElrone AJ**. Evaluating the potential of well profiling technology to limit irrigation water salinity in California vineyards. *Applied Engineering in Agriculture* (*in press*)

Gambetta GA, Manuck CM, Drucker SD, Fort K, Matthews MA, Walker MA, **McElrone AJ**. Root

hydraulics and scion vigour across Vitis rootstocks. What role to aquaporins play? *Journal of Experimental Botany* (*in press*)

Shapland TM, **McElrone AJ**, Snyder RL, Paw U KT. Structure function analysis of two-scale scalar ramps. Part I: Theory and modeling. *Boundary Layer Meterology*; (*in press*)

Shapland TM, **McElrone AJ**, Snyder RL, Paw U KT. Structure function analysis of two-scale scalar ramps. Part II: Applications. *Boundary Layer Meterology* (*in press*)

**McElrone AJ**, Bleby TM. 2011. Sap flow: an overview of measurement approaches *PrometheusWiki*- invited review; Available at: http://www.publish.csiro.au/prometheuswiki

**McElrone AJ**, Gambetta GA, Choat B, Brodersen C. Water uptake and transport in vascular plants- invited review; *Nature Knowledge Project* (*in press*)

Brodersen C, Lee E, Choat B, Jansen S, Phillips R, Shackel K **McElrone AJ**, Matthews MA. Automated analysis of 3D xylem networks using high resolution computed tomography. *New Phytologist* 191: 1168–1179

Brodersen C, **McElrone AJ**, Matthews MA, Choat B, Shackel K. Dynamics of embolism repair in grapevine: in vivo visualizations using HRCT. *Plant Physiology* 154: 1088-1095

Eastburn D, **McElrone AJ**, Bilgin D. 2010. How elevated $CO_2$ and $O_3$ alter host-pathogen interactions: a review research over the last decade. *Plant Pathology* 60:54-69

**McElrone AJ**, Grant J, Kluepfel D. 2010. The role of ethylene-induced tyloses in canopy hydraulic failure of mature walnut trees afflicted with apoplexy disorder. *Tree Physiology* 30:761-772

Choat B, Drayton W, Broderson 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

Bleby T, **McElrone AJ**, Pockman WT, Jackson RB. 2010. Water uptake and hydraulic redistribution across large woody root systems to 20 m depth. *Plant Cell and Environment* 33:2132-2148

Gambetta GA, Shaghasi TH, Matthews MA, **McElrone AJ**, Castellarin SD. 2010. Sugar and ABA signaling orthologs are activated during grape berry ripening. *Planta* 232:219-234

Eastburn DM, DeGennaro MM, DeLucia EH, Dermody OC, **McElrone AJ**. 2009. Futuristic plant disease: How atmospheric change will impact diseases of soybeans. *Global Change Biology* 16:320-330

**McElrone AJ**, Hamilton JG, Krafnick AJ, Aldea M, DeLucia EH, Knepp RG. 2009. Combined effects of elevated CO2 and natural climatic variation on leaf spot diseases of redbud and sweet gum trees. *Environmental Pollution* 158:108-114

**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 landcapes, 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:**

Baumgartner, K., **Steenwerth**, **K. L.** and Veilleux, L. Effects of organic and conventional practices on weed control in a perennial cropping system. Weed Sci. 55: 352-358. 2007.

Jackson, L. E., Potthoff, M., **Steenwerth**, **K. L.**, O'Geen, A. T., Stromberg, M. R. and Scow, K. M. Soil Biology and Carbon Sequestration in Grasslands. 107-118 pp. In M.R. Stromberg, J.D. Corbin, and C.M. D'Antonio (eds.) California Grasslands. UC Press, Berkeley. 408 pp. 2007.

Baumgartner, K., **Steenwerth**, **K. L.** and Veilleux, L. The influence of dormant season cover crops on weed community structure and diversity in a California vineyard. Weed Science. 56: 596-605. 2008.

**Steenwerth. K. L.**, Drenovsky, R. E., Lambert, J. -J., Kluepfel, D. A., Scow, K. M., and Smart, D. R. Soil morphology, depth and grapevine root frequency influence microbial communities in a Pinot Noir vineyard. Soil Biol. Biochem. 40: 1330-1340. 2008.

**Steenwerth, K. L.**, and Belina, K. M. Cover crops and cultivation: Impacts on soil N dynamics and microbiological function in a Mediterranean vineyard agroecosystems. Appl. Soil Ecol. 40: 370-380. 2008.

**Steenwerth, K. L.**, and Belina, K. M. Cover crops enhance soil organic matter microbiological function in a vineyard agroecosystem. Appl. Soil Ecol. 40: 359-369. 2008.

**Steenwerth, K. L.**, and Belina, K. M. Vineyard weed management practices influence nitrate leaching and nitrous oxide emissions. Agric. Ecosys. Environ. 138: 127–131. 2010.

**Steenwerth, K. L.**, Pierce, D. L. Spencer, R. G., Carlisle, E. A., and Smart, D. R. A vineyard agroecosystem: Disturbance and precipitation affects soil respiration under Mediterranean conditions. Soil Sci. Soc. of Am. J. 74: 231-239. 2010.

Drenovsky, R. E., **Steenwerth, K. L.**, Jackson, L. E., and Scow, K. M. Land use and climatic factors structure regional patterns in soil microbial communities. Global Ecol. Biogeog. 19: 27-39. 2010.

**Steenwerth, K. L.**, Baumgartner, K., and Belina, K. M. Vineyard weed seedbank composition responds to glyphosate and cultivation after three years. Weed Sci. 58: 310-316. 2010.

Smukler, S. M., Sanchez-Moreno, S., Fonte, S. J., Ferris, H., Klonsky, K., O'Geen, A. T., Scow, K. M., **Steenwerth, K. L.**, and Jackson, L. E. Biodiversity and multiple ecosystem functions in an organic farmscape. Agric. Ecosys. Environ. 139: 80-97. 2011.

Alcorta, M., Fidelibus, M.W., **Steenwerth, K.L.**, and Shrestha, A. Effect of Vineyard Row Orientation on Growth and Phenology of Glyphosate-Resistant and Glyphosate-Susceptible Horseweed (Conyza canadensis). Weed Sci. 59: 55-60. 2011.

Lee, J., and **Steenwerth, K. L.** Rootstock and vineyard floor management influence on 'Cabernet Sauvignon' grape yeast assimilable nitrogen (YAN). Food Chem. 127:926-933. 2011.

Sharma, S. K., Ramesh, A., Sharma, M. P., Joshi, O. M., Govaerts, B., **Steenwerth, K. L.**, and Karlen, D. L. Microbial community structure and diversity as indicators for evaluating soil quality. In E. Lichthouse (ed.) Biodiversity, Biofuels, Agroforestry and Conservation Agriculture. Sustainable Agriculture Reviews. 5: 317-358. 2011.

Alcorta, M., Fidelibus, M., **Steenwerth, K. L.**, and Shrestha, A. Competitive effects of glyphosate-resistant and glyphosate-susceptible Conyza canadensis on young grapevines (Vitis vinifera L.). Weed Sci. 59: 489-494. 2011.

Williams, J. N., Hollander, A., O'Geen, A. T., Thrupp, A., Hanifin, R., **Steenwerth, K. L.**, and Jackson, L. E. Quantification of carbon stocks and woody plant diversity across a vineyard-woodland landscape. Carbon Balance and Management. 9 November 2011. doi:10:1186/1750-0680-6-11

Guerra, B., and **Steenwerth, K. L.** Influence of floor management technique on grapevine growth, disease pressure, and juice and wine composition: A review. Am. J. Enol. Vitic. 11 November 2011. doi:10.5344/ajev.2011.10001

Halvorson, A. D., **Steenwerth, K. L.**, Suddick, E. C., Liebig, M. A., Smith, J., Bronson, K. F., and Collins, H. P. Management to reduce greenhouse gas emissions in Western U.S. croplands. (eds.) In: Managing Agricultural Greenhouse Gases. Elsevier. In press.

Suddick, E. C., **Steenwerth, K. L.**, Garland, G. M., Smart, D., and Six, J. Discerning agricultural management effects on nitrous oxide emissions from conventional and alternative cropping systems: A California case study. 203-226 pp. In G. Luo (ed.) Greenhouse Gas Emissions in Agriculture, American Chemical Society, Washington, DC USA. 532 pp. DOI: 10.1021/bk-2011-1072.ch012.

**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**:

Al Rwahnih, M., Rowhani, A.,Smith, R.J., Uyemoto, J.K., and **M.R. Sudarshana.** 2012. Grapevine necrotic union, a newly recognized disease of unknown etiology in Grapevines Grafted on 110 Richter rootstock in California. Journal of Plant Pathology (In Press).

Moyne, A.L., **Sudarshana, M.R.,** Blessington, T., Koike, S.T., Cahn, M.D., Harris, L.J. 2011. Fate of Escherichia coli O157:H7 in field-inoculated lettuce. Food Microbiol. 28:1417-25.

Al Rwahnih, M., Osman, F., **Sudarshana, M.R.,** Uyemoto, J., Minafra, A., Saldarelli, P., Martelli, G., Rowhani, A. 2010. Detection of Grapevine leafroll-associated birus 7 using real time qRT-PCR and conventional RT-PCR. Journal of Virological Methods doi:10.1016/j.jviromet.2011.11.026

Reddy, D.V.R., **Sudarshana, M.R.,** Fuchs, M.., Rao, N.C., Thottappilly 2009. Genetically engineered virus-resistant plants in developing countries: Current status and future prospects. Advances in Virus Research, 75: 185-220.

Stewart, L., Medina, V., **Sudarshana, M.R.,** and Falk, B.W. 2009. Lettuce infectious yellows virus-encoded P26 induces plasmalemma deposit cytopathology. Virology 388:212-220.

Hagen, C. Rojas M.R., **Sudarshana, M.R.,** Xoconostle-Cazares, B., Natwick, E.T.. Turini, T.A and Gilbertson, R.L. 2008. Biology and molecular characterization of Cucurbit leaf crumple virus, an emergent cucurbit-infecting Begomovirus in the Imperial Valley of California. Plant Disease 92:781-793.

Zhou, Y.-C., Garrido-Ramirez, E.R., **Sudarshana, M.R.,** Yendluri, S., and Gilbertson, R.L. 2007. The N-terminus of the Begomovirus nuclear shuttle protein (BV1) determines virulence or avirulence in Phaseolus vulgaris. Molecular Plant-Microbe Interactions 20:1523-1534.

**Sudarshana, M.R.,** Roy, G., and Falk, B.W. 2006. Methods for engineering resistance to plant viruses. In: Plant-Pathogen Interactions, Methods and Protocols (Ronald, P.C. ed) Methods in Molecular biology 354: 183-196.

Roy, G., **Sudarshana, M.R.,** Ullman, D.E., Ding, S.-W., Dandekar, A.M., and Falk, B.W. 2006. Chimeric cDNA Sequences from Citrus tristeza virus confer RNA silencing-mediated resistance in transgenic Nicotiana benthamiana plants. Phytopathology 96:819-827.

**Sudarshana, M.R.,** Plesha, M.A., Uratsu, S.L., Falk, B.W., Dandekar, A.M., Huang, T.K., and McDonald, K.A. 2006. A chemically inducible Cucumber mosaic virus amplicon system for expression of heterologous proteins in plant tissues. Plant Biotechnology Journal. 4:551-559.

**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
1997-1999 - Research Associate II, Dept. Plant Breeding, Cornell University, Ithaca, NY
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 (*lpa*1) 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:**

Till, B., Cooper, J., **Tai, T.H.**, Colowit, P., Greene, E.A., Henikoff, S., and Comai, L. (2007) Discovery of chemically induced mutations in rice by TILLING. BMC Plant Biol. 7:19.

Yan, W., Rutger, J.N., Bryant, R.J., Bockelman, H.E., Fjellstrom, R.G., Chen, M.H., **Tai, T.H.**, and McClung, A. (2007) Development and evaluation of a core subset of the USDA rice germplasm collection. Crop Sci 47:869-878.

Andaya, V.C. and **Tai, T.H.** (2007) Fine mapping of the *qCTS4* locus associated with seedling cold tolerance in rice (*Oryza sativa* L.). Mol Breeding 20:349-358.

Kim S.I., Andaya C.B., Goyal S.S., and **Tai, T.H.** (2008) The rice *OsLpa1* gene encodes a novel protein involved in phytic acid metabolism. Theor Appl Genet 117: 769-779

Kim S.I., Andaya C.B., Newman J.W., Goyal S.S., and **Tai, T.H.** (2008) Isolation and characterization of a low phytic acid rice mutant reveals a mutation in the rice orthologue of maize MIK. Theor Appl Genet 117: 1291-1301

Kim, S.I., McKenzie, K.S., and **Tai, T.H.** (2009) A molecular survey of *SD1* alleles used in U.S. rice cultivars. SABRAO J. 41: 25-40

Kim, S.I., and **Tai, T. H.** (2010) Genetic analysis of two *OsLpa1*-like genes in *Arabidopsis* reveals that only one is required for wild-type seed phytic acid levels. Planta 232: 1241-1250

Kim, S.I. and **Tai, T.H.** (2011) Evaluation of seedling cold tolerance in rice cultivars: a comparison of visual ratings and quantitative indicators of physiological changes. Euphytica, 178:437-447

Kim, S.I., Andaya, V.C., and **Tai, T.H.** (2011) Cold sensitivity in rice (Oryza sativa L.) is strongly correlated with a naturally occurring I99V mutation in the multifunctional glutathione transferase isoenzyme GSTZ2. Biochem J 435: 373-380

Tsai, H., Howell, T., Nitcher, R., Missirian, V., Watson, B., Ngo, K., Lieberman, M., Fass, J., Uauy, C., Tran, R., Khan, A.A., **Tai, T.**, Dubcovsky, J., and Comai, L. (2011) Discovery of rare mutations in populations: TILLING by sequencing. Plant Physiol 156:1257-1268

Kim, S.I. and **Tai, T.H.** (2011) Identification of genes necessary for wild-type levels of seed phytic acid in Arabidopsis thaliana using a reverse genetics approach. Mol Genet Genomics 286:119-133

Monson-Miller, J., Sanchez-Mendez, D.C., Fass, J., Henry, I.M., **Tai, T.H.**, and Comai, L. (2012) Reference genome-independent assessment of mutation density using restriction enzyme-phased sequencing. BMC Genomics 13:72

Kim, S.I., Kim, D.M., and **Tai, T.H.** (2012) Evaluation of rice seedling tolerance to constant and intermittent low temperature stress. Rice Sci (in press).

## 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**:

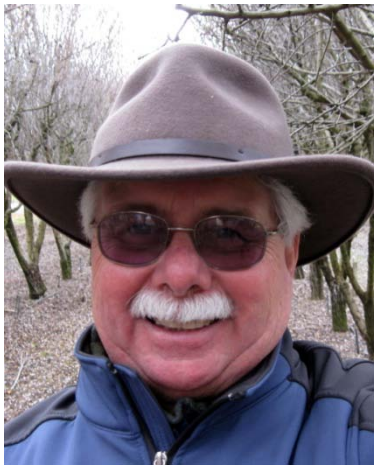
| | |
|---|---|
| John Preece | Research Leader |
| Gabriela Romano | Supervisory Horticulturist |

**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.
3. Determination of best vegetative propagation methods for *Simmondsia chinensis* (jojoba).

**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:**

Kong, D.M., **J.E. Preece**, H.L. Shen. 2012. Somatic embryogenesis in immature cotyledons of Manchurian ash (Fraxinus mandshurica Rupr.). Plant Cell Tiss. Organ Cult. 108: 485-492.

Osman, F.; Al Rwahnih, M.; Golino, D.; Pitman, T.; Cordero, F.; **Preece, J.E.;** Rowhani, A. 2012. Evaluation of the phytosanitary status of the *Prunus* species in the National Clonal Germplasm Repository in California: survey of viruses and viroids. Journal of Plant Pathology 94: 249-253

**Preece, J.E.** 2010. Micropropagation in stationary liquid media. Propagation of Ornamental Plants 10: 183-187

De Klerk, G.; **Preece, J.E.** 2010. Special issue "New Methods of in vitro plant propagation" PREFACE Propagation of Ornamental Plants 10: 168

Baldwin, B.S.; Cirtain, M.; Horton, D.S.; Ouellette, J.; Franklin, S.B.; **Preece, J.E.** 2009. Propagation methods for rivercane [*Arundinaria gigantea* L. (Walter) Muhl.]. Castanea; 74: 300-316

Ashley, J.A.; **Preece, J.E.** 2009. Seed cutting treatments stimulate germination and elucidate a dormancy gradient in dormant *Fraxinus americana* L. and *Fraxinus pennsylvanica* Marsh. Propagation of Ornamental Plants 9: 122-128

West, T.P.; **Preece, J.E.** 2009. Bulk alginate encapsulation of *Hibiscus moscheutos* nodal segments. Plant Cell, Tissue and Organ Culture 97: 345-351

**Preece, J.E.;** West, T.P.; Romano, A. 2009. Microshoot encapsulation for cold storage, acclimatization, and clean up from arthropod infestations. Acta Horticulturae 812: 83-90

Mansouri, K.; **Preece, J.E.** 2009. The influence of plant growth regulators on explant performance, bud break, and shoot growth from large stem segments of *Acer saccharinum* L. Plant Cell, Tissue and Organ Culture 99: 313-318

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

**Preece, J.E**. 2008. Stock Plant Physiological Factors Affecting Growth and Morphogenesis. pp. 403-422. In: George, E.F., M.A. Hall, and G.-J. de Klerk (eds.) Plant Propagation by Tissue Culture, 3rd Ed., Volume 1. The Background. Springer, Dordrecht, The Netherlands.

Geyer, W.A.; Barden, C**.; Preece, J.E.** 2008. Biomass and wood properties of young silver maple clones. Wood and Fiber Science 40: 23-28

Crum, M.L.; Zaczek, J.J.; **Preece, J.E.;** Baer, S.G.; Buchheit, J.K.; Buckley, D.S.; Clatterbuck, W.K. 2007. The impact of thinning and fertilization treatments on sugar concentration, volume, and total sugar of silver maple sap. General Technical Report - Southern Research Station, USDA Forest Service; (SRS-101); 269-275

Van Sambeek, J.W.; **Preece, J.E.** 2007. In vitro propagation of *Fraxinus* species. Protocols for micropropagation of woody trees and fruits / edited by S. Mohan Jain and H. Häggman, 179-192

**Preece, J.E.** and T.P. West. 2006. Greenhouse growth and acclimatization of encapsulated *Hibiscus moscheutos* nodal segments. Plant Cell Tiss. Organ Cult. 87:127-138

**Preece, J.E**. and P.E. Read. 2005. The Biology of Horticulture : An Introductory Textbook 2nd Ed., John Wiley and Sons, New York 514 pp.

**Preece, J.E.** 2003. A century of progress with vegetative plant propagation. HortScience 38: 1015-1025.

**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* × (*G. hirsutum* × *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 chinensi*s (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 and **G.B. Romano.** 2012. Registration of GVS1, GVS2 and GVS3 upland cotton lines with varying gland densities and two near isogenic lines, GVS4 and GVS5. Journal of Plant Registrations 6:190–194; doi: 10.3198/jpr2011.10.0567crg.

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 (*Heliocoverpa* zea Boddie) in the field and laboratory. Agricultural Sciences, 3:14-23; doi:10.4236/as.2012.31004.

Cruz, M.V., **G.B. Romano**, and D.A. Dierig. 2012. Effects of after-ripening and storage regimens on seed-germination behavior of seven species of *Physaria.* Industrial Crops and Products 35:185-191; doi:10.1016/j.indcrop.2011.06.034.

**G.B. Romano**, E. Taliercio, R.B. Turley, and J.A. Scheffler. 2011. Fiber Initiation in 18 Cultivars and Experimental Lines of Three *Gossypium* Species. Journal of Cotton Science 15:61–72; doi:10.1186/1471-2229-9-11 .

**G.B. Romano**, E.J. Sacks, S.R. Stetina, D. Fang, O.A. Gutierrez, and J.A. Scheffler. 2009. Identification and genomic location of a reniform nematode (*Rotylenchulus reniformis*) resistance locus (*Ren*$^{ari}$) introgressed from *Gossypium aridum* into upland cotton (*G. hirsutum*). TAG 120:139-50. Epub 2009 Oct 14.

E. Taliercio, **G.B. Romano**, J.A. Scheffler, and B. Ayre. 2009. Expression of genes associated with carbohydrate metabolism in cotton stems and roots. BMC Plant Biology 9:11 (doi:10.1186/1471-2229-9-11).

**G.B. Romano** and J.A. Scheffler. 2008. Lowering seed gossypol content in glanded upland cotton lines. Plant Breeding 127:619-624 (doi: 10.1111/j.1439-0523.2008.01545.x).

J.A. Scheffler and **G.B. Romano**. 2008. Modifying gossypol in cotton (*Gossypium hirsutum* L.): A cost effective method for small seed samples. Journal of Cotton Science 12:202-209.

## CROP DISEASES, PESTS AND GENETICS RESEARCH UNIT

**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. CPDGRU 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:**

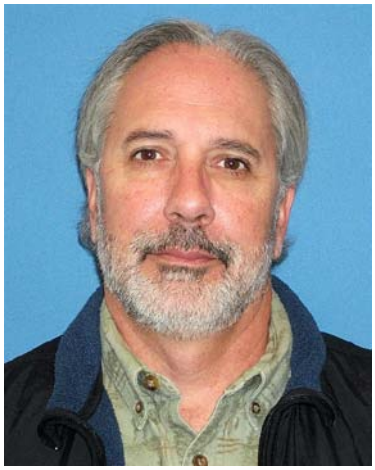
| | |
|---|---|
| Elaine A. Backus | Research Entomologist |
| Jianchi Chen | Research Molecular Biologist |
| Rodrigo Krugner | Research Entomologist |
| Craig Ledbetter | Research Geneticist |
| Hong Lin | Research Plant Physiologist |
| David Ramming | Research Horticulturist |
| Elizabeth E. Rogers | 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).
3. Characterization and Epidemiology of Citrus Tristeza Virus and Other Invasive and Emerging Graft-transmissible Diseases of Citrus in California (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
1997–2006 – Research Plant Pathologist, USDA-ARS, Lincoln, NE
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:**


Lee, M. W., Rogers, E. E., and **Stenger, D. C.** 2012. *Xylella fastidiosa* plasmid-encoded PemK toxin is an endoribonuclease. *Phytopathology* 102:32-40.

Spear, A., Sisterson, M. S., and **Stenger, D. C.** 2012. Reovirus genomes from plant-feeding insects represent a newly discovered lineage within the family *Reoviridae*. *Virus Research*: 163:503-511.

Young, B. A., **Stenger, D. C.,** Qu, F., Morris, T. J., Tatineni, S., and French, R. 2012. Tritimovirus P1 functions as a suppressor of RNA silencing and an enhancer of disease symptoms. *Virus Research*: 163:672-677.

**Stenger, D. C.** and Lee, M. W. 2011. Phylogeny of replication initiator protein TrfA reveals a highly divergent clade of incompatibility group P1 plasmids. Applied and Environmental Microbiology 77:2522-2526.

Lee, M. W., Rogers, E. E., and **Stenger, D. C.** 2010. Functional characterization of replication and stability factors of an incompatibility group P-1 plasmid from *Xylella fastidiosa*. Applied and Environmental Microbiology 76:7734-7740.

**Stenger, D. C.**, Sisterson, M. S., and French, R. 2010. Population genetics of *Homalodisca vitripennis* reovirus validates timing and limited introduction to California of its invasive insect host, the glassy-winged sharpshooter. Virology 407:53-59.

Cheng, D. W., Lin, H., Takahashi, Y., Walker, M. A., Civerolo E. L., and **Stenger, D. C.** 2010. Transcriptional regulation of the grape cytochrome P450 monooxygenase gene CYP736B expression in response to *Xylella fastidiosa* infection. BMC Plant Biology 10:135, pages 1-14.

Spear, A., Sisterson, M. S., Yokomi, R., and **Stenger, D. C.** 2010. Plant-feeding insects harbor double-stranded RNA viruses encoding a novel proline-alanine rich protein and a polymerase distantly related to that of fungal viruses. Virology 404:304-311.

**Stenger, D. C**., Lee, M. W., Rogers, E. E., and Chen, J. 2010. Plasmids of *Xylella fastidiosa* mulberry-infecting strains share extensive sequence identity and gene complement with pVEIS01 from the earthworm symbiont *Verminephrobacter eiseniae*. Physiological and Molecular Plant Pathology 74:238-245.

Cheng, D. W., Hong, L., Walker, A. M., **Stenger, D. C.**, and Civerolo, E. L. 2009. Effects of grape xylem sap and cell wall constituents on *in vitro* growth, biofilm formation and cellular aggregation of *Xylella fastidiosa.* European Journal of Plant Pathology 125:213-222.
**Stenger, D. C**., Sisterson, M. S., Krugner, R., Backus, E. A., and Hunter, W. B. 2009. A new *Phytoreovirus* infecting the glassy-winged sharpshooter (*Homalodisca vitripennis*). Virology 386:469-477.

Lin, H., Doddapaneni, H., Munyaneza, J. E., Civerolo, E. L., Sengoda, V. G., Buchman, J. L., and **Stenger, D. C.** 2009. Molecular characterization and phylogenetic analysis of 16S rRNA from a new "*Candidatus* Liberibacter" strain associated with zebra chip disease of potato (*Solanum tuberosum* L.) and the potato psyllid (*Bactericera cockerelli* Sulc). Journal of Plant Pathology 91:215-219.

**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:**


Son, Y., **E. A. Backus**, M. Johnson and R. L. Groves. 2012. Pattern of stylet penetration activity by *Homalodisca vitripennis* (Hemiptera: Cicadellidae) adults in relation to environmental temperature and light conditions. Environ. Entomol. *In press*.

Serikawa, R. H., M. E. Rogers, **E. A. Backus.** 2012. Effects of soil-applied imidacloprid on Asian citrus psyllid (Hemiptera: Psyllidae) feeding behavior. J. Economic Entomology. *In press.*

**Backus, E. A.**, K. B. Andrews, H. J. Shugart, L. C. Greve, J. M. Labavitch, and H. Alhaddad. 2012. Saliva containing β-1,4-glucanase is injected into xylem by a vector of a xylem-limited bacterial plant pathogen. J Insect Physiology. http://dx.doi.org/10.1016/j.jinsphys.2012.04.011.

**Backus, E. A.** and W. B. Bennett. 2012. System and method for synchronizing waveform data with an associated video. Patent application no. 122/45,022. Federal Register, July 25, 2012. Patent no. 8,169,483.

**Backus, E. A.** and W. B. Bennett. 2011. Electrical penetration graph system. Patent application no. 122/56,168. Federal Register, Aug. 23, 2011. Patent no. 8,004,292.

Youn, Y., **E. A. Backus**, R. H. Serikawa, and L. L. Stelinski. 2011. Correlation of an electrical penetration graph waveform with walking by Asian citrus psyllid, *Diaphorina citri* Kuwayama. Florida Entomologist. 94: 1084-1087.

**Backus, E. A.** and Morgan, D. 2011. Spatiotemporal colonization of *Xylella fastidiosa* in its vector supports two types of egestion in the inoculation mechanism of foregut-borne plant pathogens. Phytopathology 101: 912-922.

Alhaddad, H., Coudron, T. A., **Backus E. A.,** and Schreiber, F. 2011. Comparative behavioral and protein study of salivary secretions in *Homalodisca* spp. sharpshooters (Hemiptera: Auchenorrhyncha: Cicadellidae). Annals of the Entomological Soc. of America. 104: 543-552.

**Backus, E. A.,** Holmes, W. J., Schreiber, F., Reardon B. J., and Walker, G. P. 2009. Sharpshooter X wave: correlation of an electrical penetration graph waveform with xylem penetration supports a hypothesized mechanism for *Xylella fastidiosa* inoculation. Annals of the Entomological Society of America 102: 847-867.

**Backus, E. A.** and Bennett, W. H. 2009. The AC-DC Correlation Monitor: new EPG design with flexible input resistors to detect both R and emf components for any piercing-sucking hemipteran. Journal of Insect Physiology 55:869-884.

Stenger, D. C., M. S. Sisterson, R. Krugner, **E. A. Backus** and W. B. Hunter. 2009. A new phytoreovirus infecting the glassy-winged sharpshooter (*Homalodisca vitripennis*). Virology 386: 469-477.

Dugravot, S, **Backus, E. A.,** Reardon, B. R., and Miller, T. A. 2008. Correlations of cibarial muscle activities of *Homalodisca* spp. sharpshooters (Hemiptera: Cicadellidae) with EPG waveforms and excretion. Journal of Insect Physiology 54:1467-1478.

Sandanayaka, W. R. M. and **Backus, E. A.** 2008. Quantitative comparison of stylet penetration behaviors of glassy-winged sharpshooter on selected hosts. J Econ Entomol 101:1183-1197.

**Backus, E. A**., A. R. Cline, M. S. Serrano and M. R. Ellersieck. 2007. *Lygus hesperus* (Knight) Hemiptera: Miridae) feeding on cotton: new methods and parameters for analysis of non-sequential EPG data. Ann. Entomol. Soc. Am. 100 (2): 296-310.

**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)

Sisterson, M. S., Ledbetter, C. A., Higbee, B., Groves, R., **Chen, J.**, and Daane, K. 2012. Management of almond leaf scorch disease: long term data on yield, tree vitality, and disease progress. Plant Disease (in press).

Krugner, R., Ledbetter, C. A., **Chen, J.**, and Shrestha, A. 2012. Phenology of *Xylella fastidiosa* and its vector, *Draeculacephala minerva*, around California almond nurseries: an assessment of plant vulnerability to almond leaf scorch disease. Plant Disease (in press).

Wallis, C. M., **Chen, J.**, and Civerolo, E. L. 2012. Zebra chip-diseased potato tubers are characterized by increased levels of host secondary metabloites, amino acids, and defense-related proteins. Physiological and Molecular Plant Pathology (in press).

Wang, X., Zhou, C., Deng, X., Su, H., and Chen, J. 2012. Molecular characterization of a mosaic locus in the genome of '*Candidatus* Liberibacter asiaticus'. BMC Microbiology 12:18.

Deng, X., Gao, Y., **Chen, J.**, Pu, X., Kong, W., Li, H. 2012. Current situation of "*Candidatus* Liberibacter asiaticus" in Guangdong, P. R. China, where citrus Huanglongbing was first described. Journal of Integrative Agriculture 11: 424-429.

Liu, R., Zhang, P., Pu, X., Xing, X., **Chen, J.**, and Deng, X. 2011. Analysis of a prophage gene frequency revealed population variation of '*Candidatus* Liberibacter asiaticus' from two citrus-growing provinces in China. Plant Disease 95:431-435.

**Chen, J.**, Xie, G., Han, S., Chertkov, O., Sims, D., and Civerolo, E. L. 2010. Two whole genome sequences of *Xylella fastidiosa* (strains M12 and M23) causing almond leaf scorch disease in California. Journal of Bacteriology 192:4534.

**Chen, J.**, Deng, X., Sun, X., Jones, D., Irey, M., and Civerolo, E. 2010. Guangdong and Florida populations of '*Candidatus* Liberibacter asiaticus' distinguished by a genomic locus with short tandem repeats. Phytopathology 100:567-572.

Livingston, S., **Chen, J.**, and Civerolo, E. L. 2010. Seasonal Behavior of *Xylella fastidiosa* causing almond leaf scorch disease under field conditions and improved detection of the bacteria by means of array-PCR. Journal of Phytopathology 158:40-45.

**Chen, J.**, Pu, X., Deng, X., Liu, S., Li, H., and Civerolo, E. 2009. A phytoplasma related to '*Candidatus* Phytoplasma asteris' detected in citrus showing huanglongbing (yellow shoot disease) symptoms in Guangdong, P. R. China. Phytopathology 99:236-242.

de Mello, A., Souza, R.C., Nakaya, H.I., de Lima, W.C., Paula de Almeida, L.G., Kitajima, E.W., **Chen, J.**, Civerolo, E., Vasconcelos, A.T., and Van Sluys, M.A. 2008. Origins of the *Xylella fastidiosa* prophage-like regions and their impact in genome differentiation. PLoS One 3:e4059.

Deng, X., **Chen, J.**, and Li, H. 2008. Sequestering from host and characterization of sequence of a ribosomal RNA operon (*rrn*) from '*Candidatus* Liberibacter asiaticus' Molecular and Cellular Probes 22:338-340.

**Chen, J.**, and Civerolo, E. L. 2008. Morphological evidence for phages in *Xylella fastidiosa*. Virology Journal 5:75.

**Chen, J.**, Civerolo, E., Tubajika, K., Livingston, S. and Higbee, B. 2008. Hyper-variations of a protease-encoding gene, PD0218 (pspB), in *Xylella fastidiosa* strains causing almond leaf scorch and Pierce's disease in California. Applied and Environmental Microbiology 74:3652-3657.

**Chen, J.**, Groves, R., Zheng, Y., Civerolo, E. L., Viveros, M., Freeman, M. 2007. Colony morphology of *Xylella fastidiosa* almond leaf scorch strains. Canadian Journal of Plant Pathology 29:225-231.

**Chen, J.**, Groves, R. L., Civerolo, E. L. and Livingston, S. 2007. Surface motility of *Xylella fastidiosa* visualized by oblique illumination. Canadian Journal of Microbiology 53:435-439.

**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.

**Krugner, R.**, Johnson, M.W., Groves, R.L, and Morse, J.G. Host Specificity of *Anagrus epos*: A Potential Biological Control Agent of *Homalodisca vitripennis*. BioControl 53(3): 439-449. 2008.

Siegel, J.P., Kuenen, L.P.S, Higbee, B., Noble, P., Gill, R., Yokota, G.Y., **Krugner, R.**, and Daane. K.M. Postharvest Survival of Navel Orangeworm Assessed in Pistachios. California Agriculture 62(1): 30-35. 2008.

**Krugner, R.**, Johnson, M.W., Daane, K.M., and Morse, J.G. Olfactory Responses of the Egg Parasitoid *Gonatocerus ashmeadi* Girault (Hymenoptera: Mymaridae) to Host Plants Infested by *Homalodisca vitripennis* (Germar) (Hemiptera: Cicadellidae). Biological Control 47: 8-15. 2008.

**Krugner, R.**, Groves, R.L., Johnson, M.W., Flores, A.P., Hagler, J.R., and Morse, J.G. Seasonal Population Dynamics of *Homalodisca vitripennis* (Hemiptera:Cicadellidae) in Sweet Orange Trees Maintained under Continuous Deficit Irrigation. Journal of Economic Entomology 102(3): 960-973. 2009.

Stenger, D.C., Sisterson, M.S., **Krugner, R.**, Backus, E.A., and Hunter, W.B. A New Phytoreovirus Infecting the Glassy-Winged Sharpshooter (Homalodisca vitripennis). Virology 386: 469-477. 2009.

**Krugner, R.**, Johnson, M.W., Morgan, D.J.W., and Morse, J.G. Production of *Anagrus epos* Girault (Hymenoptera: Mymaridae) on *Homalodisca vitripennis* (Germar) (Hemiptera: Cicadellidae) eggs. Biological Control 51(1): 122-129. 2009.

Son, Y., Groves, R.L., Daane, K.M., Morgan, D.J.W., **Krugner, R.**, and Johnson, M.W. Estimation of Feeding Threshold for *Homalodisca vitripennis* (Hemiptera: Cicadellidae) and Its Application to Prediction of Overwintering Mortality. Environmental Entomology 39(4): 1264-1275. 2010.

**Krugner, R.** Differential Reproductive Maturity between Geographically Separated Populations of *Homalodisca vitripennis* (Hemiptera: Cicadellidae) in California. Crop Protection 29 (12): 1521-1528. 2010.

Wang, X.G, Johnson, M.W., Opp, S.B., **Krugner, R.**, Daane, K.M. Honeydew and Insecticide-Bait as Competing Food Resources for a Fruit Fly and Common Parasitoids. Entomologia Experimentalis et Applicata 139: 128–137. 2011.

**Krugner, R.**, Sisterson, M.S., Lin, H. Effects of Gender, Origin and Age on Transmission of *Xylella fastidiosa* to Grapevines by *Homalodisca vitripennis* (Hemiptera: Cicadellidae). Annals of the Entomological Society of America 105: 280-286. 2012.

Walse, S.S., **Krugner, R.**, Tebbets, J.S. Postharvest Treatment of Strawberries with Methyl Bromide to Control Spotted Wing Drosophila, *Drosophila suzukii*, Journal of Asia-Pacific Entomology (2012), doi: 10.1016/j.aspen.2012.05.003.

**Krugner, R.**, Ledbetter, C.A., Chen, J., Shrestha, A. Phenology of *Xylella fastidiosa* and its Vector, *Draeculacephala minerva*, around California Almond Nurseries: An Assessment of Plant Vulnerability to Almond Leaf Scorch Disease. Plant Disease (In press).

**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:**


Sisterson, M.S., **Ledbetter, C.A.**, Higbee, B., Groves, R., Chen, J.C. and K.M. Daane. Management of almond leaf scorch disease: long term data on yield, tree vitality, and disease progress. Plant Disease (in press).

Krugner, R., **Ledbetter, C.A.**, Chen, J. and A. Shrestha. Phenology of *Xylella fastidiosa* and its vector, *Draeculacephala minerva*, around California almond nurseries: An assessment of plant vulnerability to almond leaf scorch disease. Plant Disease (in press).

**Ledbetter, C. A.**, and Sisterson, M. S. 2010. Carpological variability of almond (*Prunus dulcis* [Mill.] D.A. Webb cv Nonpareil) in a single orchard during seven consecutive harvests. HortScience 45:1788-1792.

**Ledbetter, C.A.** 2010. 'Bolaroja' and 'Primarosa': Two new mid-season apricots for the fresh market. HortScience 45(3):441–442.

Siegel, J. P., Kuenen, L. P. S., and **Ledbetter, C. A.** 2010. Variable development rate and survival of Navel Orangeworm (*Amyelois transitella*, Lepidoptera: Pyralidae) on wheat bran diet and almonds. Journal of Economic Entomology 103:1250-1257.

**Ledbetter, C. A**. 2010. Almond breeding and evaluation activities in Central California: Past and future. Options Méditerranéennes 94:255-260.

Klasson, K., **Ledbetter, C. A.**, Wartelle, L., and Lingle, S. 2010. Feasibility of dibromochloropropane (DBCP) and trichloroethylene (TCE) adsorption onto activated carbons made from nut shells of different almond varieties. Industrial Crops and Products 31:261-265.

**Ledbetter, C. A.** 2009. Using Central Asian germplasm to improve fruit quality and increase diversity in California adapted apricots. Acta Horticulturae 814:77-80.

**Ledbetter, C. A.,** and Rogers, E. E. 2009. Differential susceptibility of *Prunus* germplasm (Subgenus Amygdalus) to a California isolate of *Xylella fastidiosa*. HortScience 44:1928-1931.

**Ledbetter, C. A.**, Chen, J. C., Livingston, S., and Groves, R. L. 2009. Wintercuring of *Prunus dulcis* cv 'Butte,' *P. webbii* and their interspecific hybrid in response to *Xylella fastidiosa* infections. Euphytica 169:113-122.

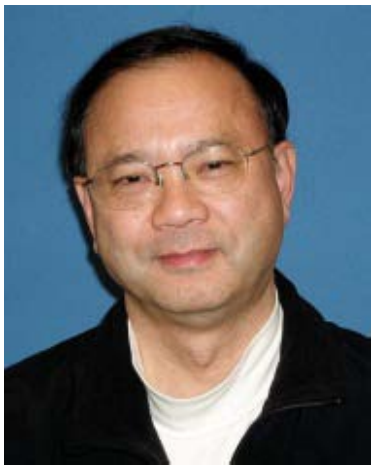
Karayiannis, I., and, **Ledbetter, C.** 2009. Susceptibility of certain apricot and plumcot cultivars to plum pox virus infection. Acta Horticulturae 825:153-156.

**Ledbetter, C. A.** 2008. Shell cracking strength in almond (*Prunus dulcis* [Mill.] D.A. Webb.) and its implication in uses as a value-added product. Bioresource Technology 99:5567-5573.

Sisterson, M. S., Civerolo, E. L., Chen, J., **Ledbetter, C. A.,** and Groves, R. L. 2008. Effects of almond leaf scorch disease on almond yield: implications for management. Plant Disease 92:409-414.

**Ledbetter, C. A.**, and Sisterson, M. S. 2008. Advanced generation peach-almond hybrids as seedling rootstocks for almond: First year growth and potential pollenizers for hybrid seed production. Euphytica 160:259-266.

**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
2003–present – Research Plant Physiologist, USDA-ARS, Parlier, 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:**


Islam, M. S., Glynn, J. M., Bai, Y., Duan, Y., Coletta-Filho H. D., Kuruba, G., Civerolo, E. L., and **Lin, H**. 2012. Multilocus microsatellite analysis of 'Candidatus Liberibacter asiaticus' associated with citrus Huanglongbing worldwide. BMC Microbiology. doi:10.1186/1471-2180-12-39.

**Lin, H**. Islam, M. S., Bai, Y., Wen, A., Lan, S., Gudmestad N. C., and Civerolo, E. L. 2012. Genetic diversity of '*Ca.* Liberibacter solanacearum' strains in the United States and Mexico revealed by simple sequence repeat markers. European Journal of Plant Pathology. 132:297-308.

**Lin, H**., Islam, M. S. and Ramming D.W. 2012. Genome-wide identification and characterization of simple sequence repeat loci in grape phylloxera*, Daktulosphaira vitifoliae.* Genetics and Molecular Research. 11:1409-1416.

Glynn J. M, Islam, M. S., Bai, Y., Lan, S., Wen, A., Gudmestad, N. C., Civerolo, E. L. and **Lin, H**. 2012 Multilocus sequence typing of '*Cadidatus* Liberibacter solanacearum' strains in North America and New Zealand. Journal Plant Pathology, 94:223-228.

**Lin, H.**, Lou, B. H., Glynn, J. M., Doddapaneni, H., Civerolo, E. L. Chen, C. W. Duan, Y. P., Zhou, L. J., and Vahling, C. M. 2011. The complete genome sequence of '*Candidatus* Liberibacter solanacearum', the bacterium associated with potato zebra chip disease. PLoS One. 6(4): e19135. doi:10.1371.

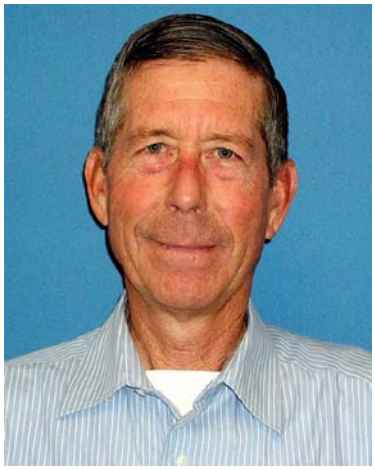
Yang, L., **Lin, H**., Takahashi, Y., Chen, F., Walker, M. A., and Civerolo, E. L. 2011. Proteomic analysis of grapevine stem in response to *Xylella fastidiosa* inoculation. Physiological and Molecular Plant Pathology 75:90-99.

Crosslin, J. M., **Lin, H**. and Munyaneza, J. E. 2011. Detection of '*Candidatus* Liberibacter Solanacearum' in the Potato Psyllid, *Bactericera cockerelli* (Sulc), by Conventional and Real-Time PCR. Southwestern Entomologist, 36:125-135.

Zhou, L., Powell, CA., Hoffman, MT., Li, WB., Fan, GH, Liu, B., **Lin, H.** and Duan, YP. 2011. Diversity and Plasticity of the Intracellular Plant Pathogen and Insect Symbiont "*Candidatus* Liberibacter asiaticus" as Revealed by Hypervariable Prophage Genes with Intragenic Tandem Repeats. Applied Enviornmental Microbiology, 77:18, 6663-6673.

Cheng, D. W., **Lin, H**., and Civerolo. E. L. 2010. Extracellular genomic DNA mediates enhancement of *Xylella fastidiosa* biofilm formation *in vitro*. Journal of Plant Pathology 92:405-410.

**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 *Phylloxera 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:**

Li, C., Erwin, A., Pap, D., Coleman, C., Higgins, A. D., Kiss, E., Kozma, P., Hoffmann, S., **Ramming, D. W.,** and Kovács, L. G. Selection for *Run1-Ren1*dihybrid grapevines using microsatellite markers. American Journal of Enology and Viticulture Submitted.

Ramming, D. W., Gabler, F., Smilanick, J. L., Margosan, D. A., Cadle-Davidson, M., Barba, Mahanil, P.S., Frenkel, O., Milgroom, M. G., and Cadle-Davidson, L. 2012. Identification of race-specific resistance in North American *Vitis* spp. limiting *Erysiphe necator* hyphal growth. Phytopathology 102(1):83-93.

Lin, H., Islam, M.S. and **Ramming, D.W.**. 2012. Genome-wide identification and characterization of simple sequence repeat loci in grape phylloxera, *Daktulosphaira vitifoliae.* Genetics and Molecular Research 11(2): 1409-1416.

Mahanil, S., **Ramming, D.**, Cadle-Davidson, M., Owens, C., Garris, A., Myles, S., and Cadle-Davidson, L. 2012. Development of marker sets useful in the early selection of *Ren4* powdery mildew resistance and seedlessness for table and raisin grape breeding. Theoretical & Applied Genetics 124:23–33.

**Ramming, D. W.**, Gabler, F., Smilanick, J., Margosan, D., Cadle-Davidson, M., Barba, P., Consolie, N., Mahanil, S., and Cadle-Davidson, L. 2011. A single dominant locus *ren4* confers non-race-specific penetration resistance to grapevine powdery mildew. Phytopathology 101:502-508.

Riaz, S., Tenscher, A.C., **Ramming, D.W.** and Walker, M.A.. 2011. Using a limited mapping strategy to identify major QTLs for resistance to grapevine powdery mildew (*Erysiphe necator*) and their use in marker-assisted breeding. Theoretical & Applied Genetics. 122:1059-1073.

**Ramming, D. W.** 2010. Greenhouse screening of grape rootstock populations to determine inheritance of resistance to *Phylloxera*. American Journal of Enology and Viticulture 61:234-239.

Breksa III, A. P., Takeoka, G. R., Hidalgo, M. B., Vilches, A., Vasse, J., and **Ramming, D.W.** 2010. Antioxidant activity and phenolic content of sixteen raisin grape cultivars and selections. Food Chemistry 121:740-745.

**Ramming, D. W.**, Walker, M. A., Tenscher, A., and Krivanek, A. F. 2009. Breeding table and raisin grapes with increased fruit quality while retaining Pierce's disease resistance. Acta Horticulture 827:445-450.

Riaz, S., Tenscher, A. C., Graziani, R., Krivanek, A. F., **Ramming, D. W.,** and Walker, M. A. 2009. Using marker-assisted selection to breed Pierce's disease-resistant grapes. American Journal of Enology and Viticulture 60:199-207.

**Ramming, D. W.** 2009. Water loss from fresh berries of raisin cultivars under controlled drying conditions. American Journal of Enology and Viticulture 60:208-214.

Garris, A. J., Cousins, P., and **Ramming, D.** 2009. Parentage analysis of Freedom rootstock. American Journal of Enology and Viticulture 60:357-361.

**Ramming, D. W.** 2008. 'Thomcord' grape. HortScience 43:945-946.

Fidelibus, M. W., Christensen, L. P., Katayama , D. G., and **Ramming, D. W.** 2008. Early-ripening grapevine cultivars for dry-on-vine raisins on an open-gable trellis. HortTechnology 18:740-745.

**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:**

**Rogers, E.E.** 2012. Evaluation of *Arabidopsis thaliana* as a model host for *Xylella fastidiosa*. Molecular Plant-Microbe Interactions, 25:747-754.

Lee, M. W., **Rogers, E. E.**, and Stenger, D. C. 2012. *Xylella fastidiosa* plasmid-encoded PemK toxin is an endoribonuclease. Phytopathology 102:32-40.

Lee, M. W., **Rogers, E. E.**, and Stenger, D. C. 2010. Functional characterization of replication and stability factors of an incompatibility group P-1 plasmid from *Xylella fastidiosa*. Applied and Environmental Microbiology 76:7734-7740.

Stenger, D. C., Lee, M. W., **Rogers, E. E.**, and Chen, J. 2010. Plasmids of *Xylella fastidiosa* mulberry-infecting strains share extensive sequence identity and gene complement with pVEIS01 from the earthworm symbiont *Verminephrobacter eiseniae*. Physiological and Molecular Plant Pathology 74:238-245.

Ledbetter, C.A. and **Rogers, E. E**. 2009. Differential susceptibility of *Prunus* germplasm (subgenus Amygdalus) to a California isolate of *Xylella fastidiosa*. HortScience 44:1928-1931.

Yamaguchi, M., Valliyodan, B., Zhang, J., LeNoble, M. E., Yu, O., **Rogers, E. E.**, Nguyen, H. T., and Sharp, R. E. 2010. Regulation of growth response to water stress in the soybean primary root. I. Proteomic analysis reveals region-specific regulation of phenylpropanoid metabolism and control of free iron in the elongation zone. Plant Cell and Environment 33:223-243.

**Rogers, E. E.**, Wu, X., Stacey, G., and Nguyen, H. T. 2009. Two MATE proteins play a role in iron efficiency in soybean. Journal of Plant Physiology 166:1453-1459.

Stacey, M. G., Patel, A., McClain, W. E., Mathieu, M., Remley, M., **Rogers, E. E.**, Gassmann, W., Blevins, D. G., and Stacey, G. 2008. The Arabidopsis AtOPT3 protein functions in metal homeostasis and movement of iron to developing seeds. Plant Physiology 146:589-601.

Durrett, T. P., Gassmann, W., and **Rogers, E. E.** 2007. The FRD3-mediated efflux of citrate into the root vasculature is necessary for efficient iron translocation. Plant Physiology 144:197-205.

**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:**

**Sisterson, M. S.** 2012. Host selection by *Homalodisca vitripennis*: the interplay between feeding, egg maturation, egg load, and oviposition. Arthropod-Plant Interactions, Accepted Feb 18, 2012.

**Sisterson, M S.,** C. A. Ledbetter, J. Chen, B. S. Higbee, R. L. Groves, and K. M. Daane. 2012. Management of almond leaf scorch disease: long term data on yield, tree vitality, and disease progress. Plant Disease, Accepted Feb 10, 2012.

Krugner, R., **M. S. Sisterson**, & H. L. Lin. 2012. Effects of gender, origin, and age on transmission of *Xylella fastidiosa* to grapevines by *Homalodisca vitripennis* (Hemiptera: Cicadellidae). Annals of the Entomological Society of America 105: 280-286.

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

*Draeculacephala minerva* and other *Xylella fastidiosa* vectors in California almond orchards and vineyards. Journal of Economic Entomology 104: 367-374.

Tabashnik, B. E., **M. S. Sisterson**, P. C. Ellsworth, T. J. Dennehy, L. Antilla, L. Liesner, M. Whitlow, R. T. Staten, J. A. Fabrick, G. C. Unnithan, A. J. Yelich, C. Ellers-Kirk, V. S. Harpold, X. Li, & Y. Carrière. 2010. Suppressing resistance to Bt cotton with sterile insect releases. Nature Biotechnology 28: 1304-1307.

Stenger, D. C., **M. S. Sisterson**, & R. French. 2010. Population genetics of *Homalodisca vitripennis* reovirus validates timing and limited introduction to California of its invasive insect host, the glassy-winged sharpshooter. Virology 407: 53-59.

Wistrom, C., **M. S. Sisterson**, M. P. Pryor, J. M. Hashim-Buckey, & K. M. Daane. 2010. Distribution of glassy-winged sharpshooter and threecornered alfalfa hopper on plant hosts in the San Joaquin Valley, California. Journal of Economic Entomology 103: 1051-1059.

**Sisterson, M. S.**, S. R. Thammiraju, K. Lynn-Patterson, R. L. Groves & K. M. Daane. 2010. Epidemiology of diseases caused by *Xylella fastidiosa* in California: evaluation of alfalfa as a source of vectors and inocula. Plant Disease 94: 827-834.

**Sisterson, M. S.** 2009. Transmission of insect-vectored pathogens: effects of vector fitness as a function of infectivity status. Environmental Entomology 38: 345-355.

Stenger, D. C., **M. S. Sisterson**, R. Krugner, E. A. Backus, & W. B. Hunter. 2009. A new phytoreovirus infecting the glassy-winged sharpshooter (*Homalodisca vitripennis*). Virology 386: 469-477.

**Sisterson, M. S.** 2008. Egg load dynamics of *Homalodisca vitripennis.* Environmental Entomology 37: 1200-1207.

**Sisterson, M. S.,** R. Yacoub, G. Montez, E. E. Grafton-Cardwell, & R. L. Groves. 2008. Distribution and management of citrus in California: implications for management of glassy-winged sharpshooter. Journal of Economic Entomology 101: 1041-1050.

Gassmann, A. J., S. P. Stock, **M. S. Sisterson**, Y. Carrière, & B. E. Tabashnik. 2008. Synergistic interactions between entomopathogenic nematodes and Bt crops: integrating biological control and resistance management. Journal of Applied Ecology 45: 957-966.

**Sisterson, M. S.,** J. Chen, M. A.Viveros, E. L. Civerolo, C. Ledbetter, & R. L. Groves. 2008. Effects of almond leaf scorch disease on almond yield: implications for management. Plant Disease 92: 409-414.

**Sisterson, M. S.** 2008. Effects of insect vector preference for infected or healthy plants on pathogen spread: insights from a model. Journal of Economic Entomology 101: 1-8.

**Sisterson, M. S.,** R. W. Biggs, N. M. Manhardt, Y. Carrière, T. J. Dennehy, & B. E. Tabashnik. 2007. Effects of transgenic Bt crops on insecticide use and abundance of two generalist predators. Entomologia Experimentalis et Applicata 125: 305-311.

**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:**

**Wallis, C. M.,** Huber, D. P. W., and Lewis, K. J. 2011. Ecosystem, location, and climate effects on foliar secondary metabolites of lodgepole pine populations from central British Columbia. Journal of Chemical Ecology 37:607-621.

**Wallis, C.**, Eyles, A., Chorbadjian, R. A., Riedl, K., Schwartz, S., Hansen, R., Cipollini, D., Herms, D. A., and Bonello, P. 2011. Differential effects of nutrient availability on the secondary metabolism of Austrian pine (*Pinus nigra*) phloem and resistance to *Diplodia pinea.* Forest Pathology 41:52-58.

**Wallis, C. M.**, Reich, R. W., Lewis, K. J., and Huber, D. P. W. 2010. Lodgepole pine provenances differ in chemical defense capacities against foliage and stem diseases. Canadian Journal of Forest Research 40:2333-2344.

Barto, K., Enright, S., Eyles, A., **Wallis, C.**, Chorbadjian, R., Hansen, R., Herms, D. A., Bonello, P., and Cipollini, D. 2008. Effects of fertilization and fungal and insect attack on systemic protein defenses of Austrian pine. Journal of Chemical Ecology 34:1392-1400.

**Wallis, C.**, Eyles, A., Chorbadjian, R., McSpadden-Gardner, B., Hansen, R., Cipollini, D., Herms, D., and Bonello, P. 2008. Systemic induction of phloem secondary metabolism and its relationship to resistance to a canker pathogen in Austrian pine. New Phytologist 177:767-778.

Eyles, A., Chorbadjian, R., **Wallis, C.**, Hansen, R., Cipollini, D., Herms, D., Bonello, P. 2007. Cross-induction of systemic induced resistance between an insect and a fungal pathogen in Austrian pine over a fertility gradient. Oecologia 153:365-374.

**Wallis, C.**, Stone, A., Sherman, D., Damsteegt, V., Gildow, F., Schneider, W. L. 2007. Adaptation of plum pox virus to a herbaceous host (*Pisum sativum*) following serial passages. Journal of General Virology 88:2839-2845.

**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:**

**Yokomi, R. K.,** Mello, A. F. S., Saponari, M., and Fletcher, J. 2008. PCR-based detection of *Spiroplasma citri* associated with citrus stubborn disease. Plant Disease 92: 253-260.

Mello, A. F. S., **Yokomi, R. K**., Melcher, U., Chen, J. C., Wayadande, A. C., and Fletcher, J. 2008. Genetic diversity of *Spiroplasma citri* strains from different geographical regions, hosts, and dates of isolation. Phytopathology 98: 960-968.

Saponari, M., Keremane, M., and **Yokomi, R. K.** 2008. Quantitative detection of *Citrus tristeza virus* (CTV) in citrus and aphids by real-time reverse transcription-PCR (TaqMan). Journal of Virological Methods 147: 43-53.

Mello, A. F. S., Wayadande, A. C., **Yokomi, R. K.,** and Fletcher, J. 2009. Transmission of different strains of *Spiroplasma citri* to carrot and citrus by *Circulifer tenellus* Baker (Hemiptera:Cicadellidae). Journal of Economic Entomology 102: 1417-1422.

Mello, A. F. S., **Yokomi, R. K.,** Melcher, U., Chen, J. C., and Fletcher, J. 2010. Citrus stubborn severity is associated with *Spiroplasma citri* titer but not with bacterial genotype. Plant Disease 94: 75-82.

Mello, A. F. S., **Yokomi, R. K**., Melcher, U., Chen, J., Civerolo, E., Wayadande, A., and Fletcher, J. 2010. New perspectives on the epidemiology of citrus stubborn disease in California orchards. Plant Health Progress. Doi:10.1094/PHP-2010-0526-04-SY.

Mello, A. F. S., **Yokomi, R. K.,** Payton, M. E. and Fletcher, J. 2010. Effect of citrus stubborn disease on navel orange production in a commercial orchard in California. Journal of Plant Pathology 92: 429-438.

Mello, A. F. S., **Yokomi, R. K.,** and Fletcher, J. 2010. Assessment of citrus stubborn disease incidence in citrus, p. 123-130. In: Proceedings 17th Conference International Organization of Citrus Virologists, IOCV, Riverside, CA.

Saponari, M., and **Yokomi, R. K.** 2010. Use of the coat protein (CP) and minor CP intergene sequence to discriminate severe strains of *Citrus tristeza virus* in three U.S. CTV isolate collections, p. 43-57. In: Proceedings 17th Conference International Organization of Citrus Virologists, IOCV, Riverside, CA.

**Yokomi, R. K.,** Mello, A. F. S., Fletcher, J., and Saponari, M. 2010. Estimation of citrus stubborn disease incidence in citrus groves by real-time PCR, p. 131-141. In Proceedings 17th Conference International Organization of Citrus Virologists, IOCV, Riverside, CA.

**Yokomi, R. K.,** and Polek, M. 2010. Elevated background in double antibody sandwich-indirect enzyme-linked immunosorbent assay for the detection of *Citrus tristeza virus* in mandarin varieties, p. 36-42. In: Proceedings 17th Conference International Organization of Citrus Virologists, IOCV, Riverside, CA.

**Yokomi, R. K.,** Polek, M., Grafton-Cardwell, E. E., Vidalakis, G., O'Connell, N., and Saponari, M. 2010. Assessment of the *Citrus tristeza virus* isolates detected in spring 2007 at the Lindcove Research and Extension Center, Exeter, California, p. 28-35. In: Proceedings 17th Conference International Organization of Citrus Virologists, IOCV, Riverside, CA.

**Yokomi, R. K.,** Saponari, M., and Sieburth, P. J. 2010. Rapid differentiation and identification of potential severe strains of *Citrus tristeza virus* by real-time reverse transcription-polymerase chain reaction assays. Phytopathology 100: 319-327.

**Yokomi, R. K**., Saponari, M., and Vidalakis, G. 2011. Molecular analysis among MCA13-reactive isolates reveals a rapid strategy for assessment of *Citrus tristeza virus* severity. Acta Horticulturae 892: 251-256.

Vidal, E., **Yokomi, R. K.,** Moreno, A., Bertolini, E., and Cambra, M. 2012. Calculation of diagnostic parameters of advanced serological and molecular tissue-print methods for detection of *Citrus tristeza virus.* A model for other plant pathogens. Phytopathology 102: 114-121.

## 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:**
January 2012–present – Research Leader/Supervisory Research Plant Pathologist USDA-ARS-SJVASC, CPQRU, Parlier, CA
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: Phacidiopycnis rot caused by *Phacidiopycnis piri*, Sphaeropsis rot caused by *S. pyriputrescens* and speck rot caused by *Phacidiopycnis 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:**

Yin, Y. N., Kim, Y. K., and **Xiao, C. L.** 2012. Molecular characterization of pyraclostrobin resistance and structural diversity of the cytochrome *b* gene in *Botrytis cinerea* from apple. Phytopathology 102:315-322.

Kim, Y. K., and **Xiao, C. L.** 2011. Stability and fitness of pyraclostrobin- and boscalid-resistant phenotypes in field isolates of *Botrytis cinerea* from apple. Phytopathology 101:1385-1391.

Yin, Y. N., Kim, Y. K., and **Xiao, C. L.** 2011. Molecular characterization of boscalid resistance in field isolates of *Botrytis cinerea* from apple. Phytopathology 101:986-995.

**Xiao, C. L.**, Kim, Y. K., and Boal, R. J. 2011. Control of Sphaeropsis rot in stored apples caused by *Sphaeropsis pyriputrescens* with postharvest fungicides. Plant Disease 95:1075-1079.

**Xiao, C. L.**, Kim, Y. K., and Boal, R. J. 2011. First report of occurrence of pyrimethanil resistance in *Penicillium expansum* from stored apples in Washington State. Plant Disease 95:72 (Note).

Kim, J. H., Campbell, B. C., Mahoney, N., Chan, K. L., Molyneux, R. J., and **Xiao, C. L.** 2010. Use of chemosensitization to overcome fludioxonil-resistance in *Penicillium expansum*. Letters in Applied Microbiology 51:177-183.

Kim, Y. K., and **Xiao, C. L.** 2010. Influence of environmental factors on conidial germination and survival of *Sphaeropsis pyriputrescens*. European Journal of Plant Pathology 126:153-163.

Kim, Y. K., and **Xiao, C. L.** 2010. Resistance to pyraclostrobin and boscalid in populations of *Botrytis cinerea* from stored apples in Washington State. Plant Disease 94:604-612.

Zhao, H., Huang, L., **Xiao, C. L.**, Liu, J., Wei, J., and Gao, X. 2010. Influence of culture media and environmental factors on mycelial growth and conidial production of *Diplocarpon mali*. Letters in Applied Microbiology 50:639-644.

Zhao, H., Kim, Y. K., Huang, L., and **Xiao, C. L.** 2010. Resistance to thiabendazole and baseline sensitivity to fludioxonil and pyrimethanil in *Botrytis cinerea* populations from apple and pear in Washington State. Postharvest Biology and Technology 56:12-18.

Liu, Q., Peever, T. L., and **Xiao, C. L.** 2009. Population structure of *Potebniamyces pyri* in the U.S. Pacific Northwest and evidence of outcrossing inferred with sequence-characterized amplified region markers. Phytopathology 99:532-539.

Liu, and **Xiao, C. L.** 2009. Infection of 'd'Anjou' pear fruit by *Potebniamyces pyri* in the orchard in relation to Phacidiopycnis rot during storage. Plant Disease 93:1059-1064.

Spotts, R. A., Seifert, K., Wallis, K. M., Sugar, D., **Xiao, C. L.**, Serdani, M., and Henriquez, J. L. 2009. Description of *Cryptosporiopsis kienholzii* and species profiles of *Neofabraea* in major pome fruit growing districts in the Pacific Northwest USA. Mycological Research 113:1301-1311.

Spotts, R. A., Serdani, M., Wallis, K. M., Walter, M., Harris-Virgin, T., Spotts, K., Sugar, D., **Xiao, C. L.**, and Qu, A. P. 2009. At-harvest prediction of gray mold risk in pear fruit in long-term cold storage. Crop Protection 28:414-420.

**Xiao, C. L.**, and Boal, R. J. 2009. Residual activity of fludioxonil and pyrimethanil against *Penicillium expansum* on apple fruit. Plant Disease 93:1003-1008.

**Xiao, C. L.**, Kim, Y. K., and Boal, R. J. 2009. A new canker disease of crabapple trees caused by *Phacidiopycnis washingtonensis* in Washington State. Online. Plant Health Progress doi:10.1094/PHP-2009-0612-01-BR (Note).

**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:**

**Burks, C. S.,** and Kuenen, L. P. S. 2012. Effect of mating disruption and lure load on the number of *Plodia interpunctella* (Hübner) (Lepidoptera: Pyralidae) males captured in pheromone traps. Journal of Stored Products Research 49:189-195.

Sutivisedsak, N, Cheng, H. N., **Burks, C. S.**, Johnson. J. A., Siegel J.P., Civerolo, E. L., and Biswas, A. Use of nutshells as fillers in polymer composites. J. Polym. Environ. 20 (1): 305-314. 2012.

**Burks, C.S.,** Brandl, D.G., and B. S. Higbee. 2011. Effect of natural and artificial photoperiods and fluctuating temperature on age of first mating and mating frequency in the navel orangeworm, *Amyelois transitella.* 11pp. Journal of Insect Science 11:48.

**Burks, C. S.**, Higbee, B. S., Siegel, J. P., and Brandl, D. G. 2011. Comparison of trapping for eggs, females, and males of the navel orangeworm *Amyelois tranistella* (Walker) in almonds. Enviornmental Entomology 40: 706-713.

**Burks, C. S.**, McLaughlin, J. R., Miller, J. R., and Brandl, D. G. 2011. Mating disruption for control of *Plodia interpunctella* (Hübner) (Lepidoptera: Pyralidae) in dried beans. Journal of Stored Products Research 47:216-221.

Higbee, B. S., and **Burks, C. S.** 2011. Effect of bait formulation and number of traps on detection of navel orangeworm (Lepidoptera: Pyralidae) oviposition using egg traps. Journal of Economic Entomology 104:211-219.

**Burks, C. S.**, Higbee, B. S., Kuenen, L. P. S., and Brandl, D. G. 2009. Monitoring *Amyelois transitella* males and females with phenyl propionate traps in almonds and pistachios. Entomologia Experimentalis et Applicata 133:283-291.

Higbee, B. S., and **Burks, C. S.** 2008. Effects of mating disruption treatments on navel orangeworm (Lepidoptera: Pyralidae) sexual communication and damage in almonds and pistachios. Journal of Econonomic Entomology 101: 1633-1642.

**Burks, C. S.**, Higbee, B. S., Brandl, D. G., and Mackey, B. E. 2008. Sampling and pheromone trapping for comparison of abundance of *Amyelois transitella* in almonds and pistachios. Entomologia Experimentalis et Applicata 129:66-76.

**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 $CO_2$ 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.**, Walse, S. S., Gerik, J. S. Status of alternatives for methyl bromide in the United States. Outlooks on Pest Management 23: 53-58. 2012

Jiao, S., **Johnson, J. A.**, Fellman, J. K., Mattinson, D. S., Tang, J., Davenport, T. L., Wang, S. Evaluating the storage environment in hypobaric chambers used for disinfesting fresh fruits. Biosystems Engineering 111: 271-279. 2012

Jiao, S., **Johnson, J. A.**, Tang, J.,and Wang. S. Industrial-scale radio frequency treatments for inset control in lentils. Journal of Stored Product Research 48: 143-148. 2012

Hansen, J. D., **Johnson, J. A.**, and Winter, D. A. History and use of heat in pest control: a review. International Journal of Pest Management 57: 267-289. 2011

Jiao, S., **Johnson, J. A.**, Tang, J., Tiwari, G., Wang, S. Dielectric properties of cowpea weevil, black-eyed peas and mung beans with respect to the development of radio frequency heat treatments. Biosystems Engineering. 108: 280-291. 2011

**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., Tiwari, G., Jiao. S. **Johnson, J. A.**, Tang, J. Developing postharvest disinfestation treatments of legumes using radio frequency energy. Biosystems Engineering. 105: 341-349. 2010

Guo, W., Wang, S., Tiwari, G. **Johnson, J. A**., and Tang, J. Temperature and moisture dependent dielectric properties of legume flour associated with dielectric heating. LWT - Food Sci. Tech. 43: 193-201. 2010

**Johnson, J. A.**, and Zettler, J. L. Response of postharvest tree nut lepidopteran pests to vacuum treatments. J. Econ. Entomol. 102: 2003-2010. 2009.

Arthur, F. H., **Johnson, J. A.**, Neven, L. G., Hallman, G. J., Follett, P. A. Insect pest management in postharvest ecosystems in the United States of America. Outlooks on Pest Management 20 (6) 279-284. 2009.

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

Wang, S., Monzon, M., **Johnson, J. A.**, Mitcham, E. J., Tang, J. Industrial-scale radio frequency treatments for insect control in walnuts I: Heating uniformity and energy efficiency. Postharvest Bio. and Tech. 45: 240-246. 2007

Wang, S., Monzon, M., **Johnson, J. A.**, Mitcham, E. J., Tang, J. Industrial-scale radio frequency treatments for insect control in walnuts II: Insect mortality and product quality. Postharvest Bio. and Tech. 45: 247-253. 2007

**Lodewyk P. S. Kuenen, Research Entomologist, CPQ**

**Education:**

1973 BS, Biology, Cornell University, Ithaca, New York.
1978 MS, Entomology, University of California, Riverside.
1982 PhD, Entomology, University of California, Riverside.

**Professional Work Experience:**

1998 - present – Research Entomologist, USDA, ARS, Commodity Protection and Quality. Parlier, CA.
1996 - 1998 – Research Associate, Cornell University, Entomology Department.
1996 - 1996 – Visiting Scientist, Pennsylvania State 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.
1988 - 1989 – Senior consultant, Cedar Does It, Inc., N.B., CANADA.
1982 - 1988 – Entomologist, Pheromone Research Group, Research and Productivity Council, Chemistry Department, N.B., CANADA.

**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:**


Siegel, J.P., **Kuenen, L.P.S**, Higbee, B.S., Noble, P., Gill, R., Yokota, G.Y., Krugner, R., and Daane, K. M. Postharvest survival of navel orangeworm assessed in pistachios. California Agriculture. 62(1):30-35. 2008.

**Kuenen, L.P.S.** Bentley, W., Rowe, H.C. and Ribeiro, B. Bait formulations and longevity of navel orangeworm egg traps tested. California Agriculture. 62(1):36-39. 2008.

Gilbert, C., and **Kuenen, L.P.S.** Multimodal Integration: Visual Cues Help Odor-Seeking Fruit Flies. Current Biology. 18(7):R295-R297. 2008.

Burks, C.S., Higbee, B.S., **Kuenen, L.P.S.**, and Brandl, D.G. Monitoring *Amyelois transitella* males and females with phenyl propionate traps in almonds and pistachios. Entomologia Experimentalis et Applicata. 133(3):283-291. 2009.

**Kuenen, L.P.S.,** McElfresh J, S. and Millar, J.G. Identification of critical secondary components of the sex pheromone of the Navel Orangeworm (Lepidoptera: Pyralidae). Journal of Economic Entomology. 103(2):314-330. 2010.

**Kuenen, L.P.S.,** Leal, W.S. Millar, J.G., Pesak, D.J., Parra-Pedrazzoli, A.L. and Zalom, F.G. U.S. Patent Number US 7,655,253 B2. Navel Orangeworm Pheromone Composition. February, 2010.

**Kuenen, L.P.S.** and Siegel, J.P. Protracted Emergence of Overwintering *Amyelois transitella* (Lepidoptera: Pyralidae) From Pistachios and Almonds in California. Environ. Entomol. 39(4): 1059–1067, 2010.

Siegel, J.P., **Kuenen, L.P.S.,** and C. Ledbetter. Variable Development Rate and Survival of Navel Orangeworm (*Amyelois transitella*, Lepidoptera: Pyralidae) on Wheat Bran Diet and Almonds. J. Econ. Entomol. 103(4): 1250–1257, 2010.

Yokoyama, V.Y., Caceres, C.E., **Kuenen, L.P.S.**, Wang, Xin-geng, Rendon, P.A., Johnson, M.W. and Daane, K.M. "Field releases, reproduction, and flight endurance of an olive fruit fly parasitoid, *Psyttalia* cf. *concolor* (Hymenoptera: Braconidae) reared on irradiated Mediterranean fruit fly, *Ceratitis capitata.* Biological Control 54(2):90–99, 2010.

Kanno, H., **Kuenen, L.P.S.**, Klingler, K.A., Millar J.G. and Cardé R.T. Attractiveness of a four-component pheromone blend to male Navel Orangeworm moths. Journal of Chemical Ecology. 36:584–591, 2010.

Siegel, J.P., and **Kuenen, L.P.S.** Variable Development Rate and Survival of Navel Orangeworm (Lepidoptera: Pyralidae) in Pistachios. Journal of Economic Entomology. 10(2):532-539, 2011.

Burks, C.S. and **Kuenen, L.P.S.** Effect of Mating Disruption and Lure Load on the number of *Plodia interpunctella* (Hübner) (Lepidoptera: Pyralidae) males captured in pheromone traps. Journal of Stored Products Research. 49:189-195, 2012.

**Kuenen, L.P.S.** Flying Faster: Flight Height Affects Orthokinetic Responses During Moth Flight to Sex Pheromone. Journal of Insect Behavior. In press.

**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.
1993-1997 – Postdoctoral Research Associate, Plant Physiologist, USDA, ARS, Horticultural Crops Research Laboratory, Fresno, CA.
1992-1993 – Postdoctoral National Research Council Fellow, Kennedy Space Center, FL.
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 disinfestation 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:**

Obenland, D. M., Collin, S., Sievert, J., Negm, F., and Arpaia, M. L. 2012. Influence of maturity and ripening on aroma volatiles and flavor in 'Hass' avocado. Postharvest Biol. and Technol. (In Press).

Obenland, D., Collin, S., Sievert, J. and Arpaia, M. L. 2012. Impact of high temperature forced air heating of navel oranges on quality attributes, sensory parameters, and flavor volatiles. HortScience 47(3):386-390.

Obenland, D., Collin, S., Mackey, B., Sievert, J. and Arpaia, M. L. 2011. Storage temperature and time influences sensory quality of mandarins by altering soluble solids, acidity and aroma volatile composition. Postharvest Biol. Technol. 59:187-193.

Boyd, O., Weng, P., Sun, X., Alberico, T., Laslo, M., Obenland, D. M., Kern, B. and Zou, S. 2011. Nectarine promotes longevity in Drosophila melanogaster. Free Radical Biol. Med. 50:1669-1678.

Obenland, D., Margosan, D., Smilanick, J. L. and Mackey, B. 2010. Ultraviolet fluorescence to identify navel oranges with poor peel quality and decay. HortTechnology 20:991-995.

Obenland, D., Margosan, D., Collin, S., Sievert, J., Fjeld, K., Arpaia, M. L., Thompson, J. and Slaughter, D. 2009. Peel fluorescence as a means to identify freeze-damaged navel oranges. HortTechnology 19:379-384.

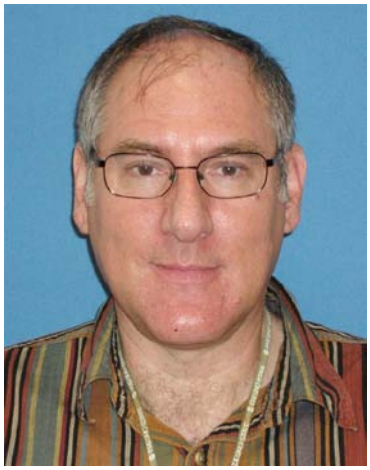
Obenland, D., Collin, S., Mackey, B., Sievert, J., Fjeld, K., and Arpaia, M. L. 2009. Determinants of flavor acceptability during the maturation of navel oranges. Postharvest Biol. Technol. 52:156-163.

Slaughter, D.C., Obenland, D. M., J.F. Thompson, Arpaia, M. L. and D.A. Margosan. 2008. Non-destructive freeze damage detection in oranges using machine vision and ultraviolet fluorescence. Postharvest Biol. and Technol. 48:341-346.

Obenland, D. M., Vensel, W. H. and Hurkman, W. J. 2008. Alterations in protein expression associated with the development of mealiness in peaches. J. Hortic. Sci. Biotech. 83:85-93.

Obenland, David M., Collin, Sue, Sievert, Jim, Fjeld, Kent, Toyota, Margo and Arpaia, Mary Lu. 2008. Commercial packing and storage of navel oranges alters aroma volatiles and reduces flavor quality. Postharvest Biol. Technol. 47(2):159-167.

**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.
1990-1997 – Research Scientist, Illinois Natural History Survey, Champaign, IL.
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:**


**Siegel, J. P.**, Kuenen, L. P. S, Higbee, B. S., Noble, P., Gill, R., Yokota, G. Y., Krugner, R., and Daane, K. M. Postharvest survival of navel orangeworm assessed in pistachios. *Calif. Agricul*. 62(1):30-35. 2008.

Higbee, B. S. and **Siegel, J. P.** New navel orangeworm sanitation standards could reduce almond damage. *Calif. Agricul*. 63(1):24-28. 2009.

Niu, G., **Siegel, J. P.**, Schuler, M. A. and Berenbaum, M. R. Comparative toxicity of mycotoxins to navel orangeworm (*Amyelois transitella*) and corn earworm (*Helicoverpa zea*). *J. Chem Ecol*. 35(8):951-957. 2009.

Kuenen, L. P. S., and **Siegel, J. P.** Protracted emergence of overwintering *Amyelois transitella* (Lepidoptera: Pyralidae) from pistachios and almonds in California. *Environ. Entomol.* 39(4):1059-1067. 2010.

**Siegel, J. P.**, Kuenen, L. P. S., and Ledbetter, C. Variable development rate and survival of navel orangeworm (Lepidoptera: Pyralidae) on wheat bran diet and almonds. *J. Econ. Entomol*. 103(4):1250-1257. 2010.

**Siegel, J. P.** and Kuenen, L. P. S. Variable development rate and survival of navel orangeworm (*Amyelois transitella*, Lepidoptera: Pyralidae) on pistachio. *J. Econ. Entomol*. 104(2):532-539. 2011.

Niu, G., Rupasinghe, S. G., Zangerl, A. R., **Siegel, J. P.**, Schuler, M. A., and Berenbaum, M. R. A substrate-specific cytochrome P450 monoxygenase, CYP6AB11, from the polyphagous navel orangeworm (*Amyelois transitella*). *Insect Biochem. Mol. Biol*. 41:244-253. 2011.

Burks, C. S., Higbee, B. S., **Siegel, J. P.**, and Brandl, D. G. Comparison of trapping for eggs, females and males of the navel orangeworm *Amyeolis transitella* (Walker) in almonds. *Environ. Entomol*. 40(3):706-713. 2011

Hodson, A. K., **Siegel, J. P.**, and Lewis, E. E. Ecological influence of the entomopathogenic nematode, *Steinernema carpocapsae*, on pistachio orchard soil arthropods. *Pedobiologia-Int. J. Soil Biol*. 55:51-58. 2012.

Niu, G., Pollock, H. S., Lawrance, A., **Siegel, J. P.**, and Berenbaum, M. Effects of naturally occurring and synthetic synergists on the toxicity of three insecticides, a phytochemical and a mycotoxin to the navel orangeworm *Amyelois transitella* (Lepidoptera: Pyralidae). *J. Econ Entomol*. 105(2):410-417. 2012

Sutivisedsak, N., Cheng, H. N., Burks, C. S., Johnson, J. A., **Siegel, J. P.**, Civerolo, E. L., Biswas, A. Use of nut shells as filler in polymer composites. *J. Polymers and the Environment*.

Higbee, B. and **Siegel, J. P.** Field Efficacy and application timing of methoxyfenozide, a reduced-risk treatment for control of navel orangeworm (Lepidoptera: Pyralidae) in almond. Journal of Economic Entomology. In press.

**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:**

Ozkan, R., **Smilanick, J.L.,** and Karabulut, O.A. 2011. Toxicity of ozone gas to conidia of *Penicillium digitatum, Penicillium italicum,* and *Botrytis cinerea* and control of gray mold on table grapes. Postharvest Biol. Technol. 60:47–51.

Ramming, D.W., Gabler, F., **Smilanick, J.L.,** Cadle-Davidson, M., Barba,P., Mahanil,S., Frenkel, O., Milgroom, M.G., Cadle-Davidson, L. 2011. Identification of race-specific resistance in North American Vitis species limiting *Erysiphe n*ecator hyphal growth. Phytopathology 102(1):83-93.

Ramming, D. W., Gabler, F., **Smilanick, J.L**., Cadle-Davidson, M., Barba, P., Mahanil, S., and Cadle-Davidson, L. 2011. A single dominant locus, *Ren4*, confers rapid non-race-specific

resistance to grapevine powdery mildew. Phytopathology 101:502-508.

Romanazzi, G., Lichter, A., Gabler, F.M., and **Smilanick, J.L**. 2012. Recent advances on the use of natural and safe alternatives to conventional methods to control postharvest gray mold of table grapes. Postharvest Biology and Technology 63 (2012) 141–147.

Palou, L., **Smilanick, J.L.,** Montesinos-Herrero, C., Valencia-Chamorro, S., and Perez-Gago, B. 2011. “Novel approaches for postharvest preservation of fresh fruits.” Chapter in the book "Citrus Fruits: Properties, Consumption and Nutrition." Nova Science Publishers, Inc.

Karaca, H., and **Smilanick, J.L.** 2011. The influence of plastic composition and ventilation area on ozone diffusion through some food packaging materials. Postharvest Biology and Technol. 62:85-88.

**Smilanick, J.L.,** F. Mlikota Gabler, and D.A. Margosan. 2011. Evaluation under commercial conditions of the application of continuous, low concentrations of ozone during the cold storage of table grapes. ISHS Acta Horticulturae 945: 357-362.

Romanazzi, G., Lichter, A., Gabler, F.M., and **Smilanick, J.L.** 2011. Recent advances on the use of natural and safe alternatives to conventional methods to control postharvest gray mold of table grapes. Postharvest Biology and Technology 63:141-147.

Ramming, D. W., Gabler, F., **Smilanick, J.L.,** Margosan, D. A., Cadle-Davidson, M., Barba, P., Mahanil, S., Frenkel, O., Milgroom, M. G., and Cadle-Davidson, L. 2012. Identification of race-specific resistance in North American Vitis spp. limiting *Erysiphe necator* hyphal growth. Phytopathology 102:83-93.

Karaca, H., Walse, S.S., and **Smilanick, J.L.** 2012. Effect of continuous gaseous ozone exposure on fungicide residues on table grape berries. Postharvest Biol. Technol. 64 (1):154–159.

Cerioni, L., and **Smilanick, J.L.** 2012. Control of postharvest green and blue molds of lemons with potassium phosphite and hydrogen peroxide, 2011. Plant Disease Management Reports 6:V079.

Feliziani, E., Fjeld, K., Romanazzi, G., and **Smilanick, J.L.** 2012. Continuous ozone concentrations during cold storage to control postharvest gray mold in grapes, 2011. Plant Disease Management Reports 6:SMF010

**Smilanick, J.L.,** Mansour, M., and E. Feliziani. 2012. The effect of the residues of vineyard fungicides on postharvest decay, 2011. Plant Disease Management Reports 6:SMF011

**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
2003-2007 – Postdoctoral Research Associate, Chemistry Research Group, CMAVE-USDA-ARS, Gainesville, FL

**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 disinfestations 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 disinfest 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*

**Walse, S.S;** Karaca, H., Fungicide residue remediation on table grapes using ozone fumigation. *Environ. Sci. Technol*. 45(16):6961-6969. 2011.

Montesinos-Herrero, C.; Smilanick, J.L; Tebbets, J. S.; **Walse, S.S**. Palou, L. Control of citrus postharvest decay by ammonia gas fumigation and its influence on the efficacy of the fungicide imazalil. *Postharvest Biology and Technology* 59(1):85-93. 2011.

Bañuelos, G.S; Fakra, S.; **Walse, S.S**.; Marcus, M.A.; Yang, S.I.; Pickering, I.J.; Pilon-Smits, E.A.H.; Freeman, J.L. Selenium accumulation, distribution and speciation in spineless prickly pear cactus: a salt, boron and drought tolerant, selenium-enriched nutraceutical fruit crop. *Plant Physiology*. 115:315-327. 2011

**Walse, S.S**.; Teal, P.E.A. Sugar-based solutions for the environmentally regulated abiotic release of volatile insect pheromones. Provisional serial No. Docket No. 0036.09. Feb. 2009.

**Walse, S.S.**; Alborn, H.T.; Teal, P.E.A. Glucosylated suspensosides, water-soluble pheromone conjugates from the oral secretions of male *Anastrepha suspensa*. *J. Nat. Prod* 71(10):1726-1731. 2008

**Walse, S.S.**; Alborn, H.T.; Teal, P.E.A. Environmentally regulated abiotic release of volatile pheromones from the sugar-based oral secretions of caribflies. *Green Chem. Let. Rev.* 1(4):205-217. 2008.

**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.
1975 – Researcher, Institute for Cancer Research, College of Physicians and Surgeons, Columbia University, New York, NY.

**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.** and Miller, G. T. 2007. Olive fruit fly biology and cultural control practices in California. IOBC/WPRS Bull. 30: 263-269.

**Yokoyama, V. Y.**, Rendón, P., and Sivinski, J. 2008. *Psyttalia* cf. *concolor* (Hymenoptera: Braconidae) for biological control of olive fruit fly (Diptera: Tephritidae) in California. Environ. Entomol. 37: 764-773.

Wang, X. G., Johnson, M. W., Daane, K. M., and **Yokoyama**, **V. Y.** 2009. Larger olive fruit size reduces the efficiency of *Psyttalia concolor*, as a parasitoid of the olive fruit fly. Biol. Contr. 49: 45-51.

**Yokoyama, V. Y.**, Cáceres, C. E., Kuenen, L. P. S., Wang, X. G., Rendón, P. A., Johnson, M. W., and Daane, K. M. 2010. Field perfomance and fitness of an olive fruit fly parasitoid, *Psyttalia humilis* (Hymenoptera: Braconidae) mass reared on irradiated Medfly. Biol. Contr. 54: 90-99.

Wang, X. G., Johnson, M. W., **Yokoyama**, **V. Y.,** Pickett, C. H., and Daane, K. M. 2010. Comparative evaluation of two olive fruit fly parasitoids under varying abiotic conditions. BioControl 56: 283-293.

**Yokoyama, V. Y.**, Rendón, P. A., Wang, X. G., Opp, S. B., Johnson, M W., and Daane, K. M. 2011. Response of *Psyttalia humilis* (Hymenoptera: Braconidae) to olive fruit fly (Diptera: Tephritidae), and conditions in California olive orchards. Environ. Entomol. 40: 315-323.

**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.** 2011. Olive fruit fly (Diptera: Tephritidae) in California: Longevity, oviposition, and development in canning olives in the laboratory and greenhouse. J. Econ. Entomol. 105: 186-195. .

**Yokoyama, V. Y.**, Wang, X. G., Aldana A., Cáceres, C. E., Rendón, P. A., Yokoyama-Hatch, H. A., Johnson, M. W., and Daane, K. M.. 2012. Performance of *Psyttalia humilis* (Hymenoptera: Braconidae) reared from irradiated host on olive fruit fly in California. Environ. Entomol. (In press)

**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:**
1994-2000 – Soil Scientist, USDA-ARS, Riverside, CA.
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:**

McDonald, J.A., S. Gao, R. Qin, B. Hanson, T. Trout, and **D. Wang**. Effects of water seal on reducing 1,3-dichloropropene emissions from different soil textures. *Journal of Environmental Quality* 38:712-718. 2009.

Qin, R., S. Gao, **D. Wang**, B. Hanson, T. Trout, and H. Ajwa. Relative effect of soil moisture on emissions and distribution of 1,3-dichloropropene and chloropicrin in soil columns. *Atmospheric Environment* 43:2449-2455. 2009.

**Wang, D.,** C. Rosen, L. Kinkel, A. Cao, N. Tharayil, and J. Gerik. Production of methyl sulfide and dimethyl disulfide from soil-incorporated plant materials and implications for controlling soil-borne pathogens. *Plant and Soil* 324:185-197. 2009.

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.

**Wang, D.,** G. Browne, S. Gao, B. Hanson, J. Gerik, R. Qin, and N. Tharayil. Spot fumigation: Fumigant gas dispersion and emission characteristics. *Environmental Science & Technology* 43:5783-5789. 2009.

Qin, R., S. Gao, H. Ajwa, B. Hanson, T. Trout, **D. Wang**, and M. Guo. Interactive effect of organic amendment and environmental factors on degradation of 1,3-dichloropropene and chloropicrin in soil. *Journal of Agricultural and Food Chemistry* 57:9063–9070. 2009.

*Wang, Q.X.*, **D. Wang**, J. Tang, D.D. Yan, H. Zhang, F.Y. Wang, M.X. Guo, and A. Cao. Distribution and emission of chloropicrin applied as gelatin capsules. *Journal of Environmental Quality* 39:917-922. 2010.

**Wang, D.,** S. Gao, R. Qin, and G. Browne. Lateral movement of soil fumigants 1,3-dichloropropene and chloropicrin from treated agricultural fields. *Journal of Environmental Quality* 39:1800-1806. 2010.

**Wang, D.** and J. Gartung. Infrared canopy temperature of early-ripening peach trees under postharvest deficit irrigation. *Agricultural Water Management* 97:1787-1794. 2010.

**Wang, D.** Chapter 5: Pesticide models for simulating environmental transport of soil fumigants. pp. 211-225. In K. Bundgaard and L. Isaksen (eds.) *Agricultural Research and Technology*. Nova Science Publishers, Inc., Hauppauge, NY. 2010. (Book Chapter).

*Cabrera, J.A.*, **D. Wang**, S. Schneider, and B. Hanson. Effect of methyl bromide alternatives on plant parasitic nematodes and grape yield under vineyard replant conditions. *American Journal of Enology and Viticulture* 62:42-48. 2011.

Gao, S., B. Hanson, **D. Wang**, G. Brown, R. Qin, H. Ajwa, and S.R. Yates. Methods evaluated to minimize emissions from pre-plant soil fumigation. *California Agriculture* 65:41-46. 2011.

Gao, S. and **D. Wang**. Vapor flux measurements - chamber methods. pp. 191-207. In S. Saponaro, E. Sezenna, and L. Bonomo (eds.) *Vapor Emission to Outdoor Air and Enclosed Spaces for Human Health Risk Assessment: Site Characterization, Monitoring and Modeling*. Nova Science Publishers, Inc., Hauppauge, NY. 2011. (Book Chapter).

**Wang, D.**, S.R. Yates, and S. Gao. Chloropicrin emissions after shank injection: two-dimensional analytical and numerical model simulations of different source methods and field measurements. *Journal of Environmental Quality* 40:1443-1449. 2011.

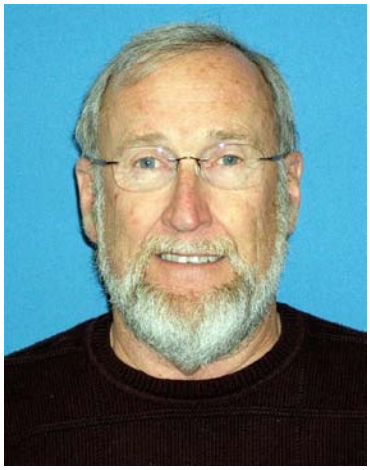
**Wang, D.** Deficit irrigation of peach trees to reduce water consumption. pp. 497-505. In C.A. Brebbia and V. Popov (eds.) *Water Resources Management VI*. WIT Press, Southampton, UK. 2011. (Book Chapter)

Qin, R., S. Gao, H. Ajwa, D. Sullivan, **D. Wang**, and B. Hanson. Field evaluation of a new plastic film (VaporSafe) to reduce fumigant emissions and improve distribution in soil. *Journal of Environmental Quality* 40:1195-1203. 2011.

Gao, S., B. Hanson, R. Qin, **D. Wang,** and S.R. Yates. Comparisons of soil surface sealing methods to reduce fumigant emission loss. *Journal of Environmental Quality* 40:1480-1487. 2011.

Cabrera, J.A., **D. Wang,** S. Schneider, and B. Hanson. Subsurface drip application of methyl bromide alternative fumigants for controlling nematodes in replanted grapevines. *Pest Management Science* 68:773–780. 2012.

**James E. Ayars, Agricultural Engineer, WMR**



**Education:**

1965 BS, Cornell University, Ithaca, New York
1973 MS, Colorado State University, Fort Collins, Colorado
1989 Certificate of Advanced Engineering Study, Cornell University, Ithaca, New York
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
1994–1995 – Acting Research Leader, 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:**

**Ayars, J.E.** and C.J. Phene. 2007. Automation. Chapt 7. In Microirrigation for Crop Production. Eds. F.R. Lamm, J.E. Ayars, F. Nakayama. Elsevier, pg. 259-284.

**Ayars, J.E.** D.A. Bucks, F.R. Lamm and F.S. Nakayama. 2007. Introduction, Chapt 1. In Microirrigation for Crop Production. Eds. F.R. Lamm, J.E. Ayars, F. Nakayama. Elsevier, pg. 1-26.

Lamm, F.R., **J.E. Ayars**, and F.S. Nakayama. 2007. Eds. Microirrigation for crop production. Developments in Agricultural Engineering 13. Elsevier, 618. Pp.

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.

**Ayars, J. E.** 2007. Adapting irrigated agriculture to saline environments. CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition, and Natural Resources, 2. No. 040 13 pg.

Madramootoo, C.A., W.R. Johnston, **J.E. Ayars**, R.O. Evans, and N.R. Fausey. 2007. Agricultural drainage management quality and disposal issues in North America. Irrigation and Drainage. 56(S1):35-45.

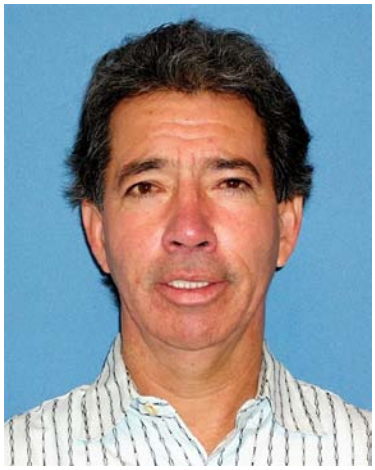
Fouss, J., R.E. Evans, and **J.E. Ayars**. 2007. Watertable control systems. Chapter 18 in Design and Operation of Farm Irrigation Systems Ed. G.J. Hoffman, R.E. Evans, M.E. Jensen, D.L. Martin, and R.L. Elliott. pg. 684-724.

Lord, J.M. and **J.E. Ayars**. Evaluating Performance of Farm Irrigation System.2007. Chapter 21, ASAE Monograph, Design and Operation of Farm Irrigation System. Eds. G. J. Hoffman, R.E. Evans, M.E. Jensen, D.L. Martin, and R.L. Elliott. Pg. 790-803.

**Ayars, J.E.** 2008. Water requirement of irrigated garlic. Transactions of ASABE 51a(5): 1683-1688.

Christen, E.W., **Ayars, J.E.**, Hornbuckle, J.W. and Hickey, M. 2008. Irrigation in vegetables:technology and practice. Irrigation Australia Journal 23(2):19-21. 72.
Ayars, J.E., P.J. Shouse, S.R. Lesch. 2009. In-situ use of groundwater by alfalfa.. Ag Water Management 96(11)1579-1586.

**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 phyto-remediation 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**. Amelioration and conversion of excessive selenium to new resources from a plant-based system. In: Selenium deficiency, toxicity, and biofortification for human health. (Banuelos, G.S, Z.Q. Lin, X. Yin, eds.). USTC Press, Hefei, China. 2009.

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

agricultural products. (eds.) G.S. Banuelos, and Z.Q. Lin. CRC Press, Boca Roca FL. pp.57-70. 2009.

**Bañuelos, G.S.** and Z.Q. Lin. (eds.) Biofortification and development of new agricultural products. CRC Press, Boca Roca FL. 2009.

**Bañuelos, G.S**., Z.Q. Lin, and X. Yin (eds.). Selenium deficiency, toxicity and biofortification for human health. University of Science and Technology of China Press, Hefei, China. ISBN 978-7-312-02592. 2009.

Robinson, B.H., **G.S. Bañuelos**, H.M. Conesa, M.W.H. Evangelou, and R. Schulin. The phytomanagement of trace elements in soil. *Critical Reviews in Plant Science,* 28: 1-27. 2009.

Stapleton, J.J. and **G.S. Bañuelos**. Biomass crops can be used for biological disinfestation and remediation of soils and water. *California Agriculture, 63: 41-46.* 2009.

**Bañuelos, G.S.,** J. Gao, Y. Lin, Y. Huang, Z.Q. Lin, Hon Wah Lam, M., and X. Yin. Daily selenium intake in a moderate selenium deficiency area of Suzhou, China. *Food Chemistry,* BIJP-2010-0059.R2. 2010.

**Bañuelos, G.S**. and B. Hanson. Use of selenium-enriched mustard and canola seed meals as potential bioherbicides and green fertilizer in strawberry production. *Hort. Science,* 45:1-6. 2010.

**Bañuelos, G.S**. and ZQ. Lin. Cultivation of Indian Fig Opuntia in selenium-laden agriculture drainage sediments under field conditions. *Journal of Soil and Land Management,* 26:167-175. 2010.

**Bañuelos, G.S**., J. Robinson and J. daRoche. Developing selenium-enriched animal feed and biofuel from canola planted for managing Se-laden drainage waters in the Westside of central California. *International Journal of Phytoremediation,* 12: 243-253 2010.

Bitterli, C., **Bañuelos, G.S**. and R. Schulin. Use of transfer factors to characterize uptake of selenium by plants. *Journal of Exploratory Geochemistry,* 107: 206-216. 2010.

**Bañuelos, G.S**. and K. Dhillon. Developing a sustainable phytomanagement strategy for excessive selenium in western United States and India. *International Journal of Phytoremediation,* 13:208-222. 2011.

**Bañuelos, G.S.,** S.C. Fakra, S.S. Walse, M.A. Marcus, S.I. Yang, I.J. Pickering, E.A.H. Pilon-Smits, and J.L. Freeman. Selenium accumulation, distribution, and speciation in spineless prickly pear cactus: a drought-and salt-tolerant, selenium enriched nutraceutical fruit crop for biofortified food. *Plant Physiology,* 155: 315-327. 2011.

**Bañuelos, G.S**., D. Leduc and J. Johnson. Evaluation of hybrid polar tree tolerance to irrigation with high salinity under microplot conditions. *Journal of International Phytoremediation,* 12:419-439. 2011.

Colin, F.Q., C.N. Prins, J.L. Freeman, A.M. Gross, L.J. Hantzis, R.J.B. Reynolds, S.I. Yang, P.A. Covey, **G.S. Bañuelos**, I.J. Pickering, S.C. Fakra, M.A. Marcus, H.S. Arathi and E.A.H. Pilon-Smits. Selenium accumulation in flowers and its effects on pollination. *New Phytologist doi: 10.1111/j. 1469-8137.2011.03832.x (2011*).

**Bañuelos, G.S**., C. Stushnoff, S. Walse, T. Zuber, I. Pickering, G. George, I. Yand and J. Freeman. Characterization of the nutritional components in fruit and cladode of selenium-enriched nutraceutical cactus pear fruit varieties grown on agricultural sediment: *Food Chemistry* (DOI:10.1016/j.foodchem.2012.04.021;accepted 2012).

**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 $N_2O$ emission and $NO_3^-$ 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:**

Lin, Z.-Q., N. Terry, S. Gao, S. 2010. Mohamed, and Z.H. Ye. Vegetation changes and partitioning of selenium in 4-year-old constructed wetlands treating agricultural drainage. Int. J. Phytoremediat. 12:255–267.

Ajwa, H, W.J. Ntow, R. Qin, and S. Gao. 2010. Chapter 9. Properties of soil fumigants and their fate in the environment. p. 315–330. *In* Robert Krieger (ed.) Hayes' Handbook of Pesticide Toxicology. Elsevier Inc.

Ryu, J., S. Gao, and K.K. Tanji. 2010. Speciation and behavior of arsenic in evaporation basins, California, USA. Environ Earth Sci. 61:1599–1612.

Gao, S. and D. Wang. Chapter 9 Vapor flux measurements – chamber methods. p. 191-207 *In* S. Saponaro, E. Sezenna, L. Bonomo (ed.) Vapor emission to outdoor air and enclosed spaces for human health risk assessment: site characterization, monitoring and modeling. Nova Science Publishers, Inc., Hauppauge, New York.

Wang, D., S. Gao, R. Qin, and G. Browne. 2011. Lateral fumigant gas transport from treated agricultural fields. J. Environ. Qual. 39: 1800-1806.

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.

Gao, S. B.H. Hanson, D. Wang, G. Brown, R. Qin, H. Ajwa, S.R. Yates. 2011. Methods evaluated to minimize emissions from pre-plant soil fumigation. Calif. Agric. 65(1):41–46.
Qin, R., S. Gao, H. Ajwa, D. Sullivan, D., Wang, and B.D. Hanson. 2011. Field evaluation of a new plastic film (Vapor Safe$^{TM}$) to reduce fumigant emissions and improve distribution in soil. J. Environ. Qual. 40:1195–1203.

Gao, S., T. Pflaum., and R. Qin. 2011. Trapping Efficiency of 1,3-Dichloropropene Isomers by XAD-4 Sorbent Tubes for Air Sampling. Atmos. Environ. 45:4322–4327.

Wang, D., S. Yates, and S. Gao. 2011. Chloropicrin emissions after shank injection: Two-dimensional analytical and numerical model simulations of different source methods and field measurements. J. Environ. Qual. 40:1443–1449.

Yates, S.R., L.L. McConnell, C.J. Hapeman, S.K. Papiernik, S. Gao, and S.L. Trabue. 2011. Managing agricultural emissions to the atmosphere: state of the science, Fate and Mitigation, and Identifying Research Gaps. J. Environ. Qual. 40:1347–1358.

Gao, S., B.D. Hanson, R. Qin, D. Wang, and S. Yates. 2011. Comparisons of soil surface sealing methods to reduce fumigant emission loss. J. Environ. Qual. 40:1480-1487.
Duan, Y., M. Xu, B. Wang, X. Yang, S. Huang, and S. Gao. 2011. Long-term evaluation of manure application on maize yield and nitrogen use efficiency in China. Soil Sci. Soc. Am. J. 75: 1562-1573.

Amit J.J., S. Gao, J.S. Gerik, R. Qin, and B.D Hanson. 2012. Effects of surface treatments and application shanks on nematode, pathogen and weed control with 1,3-dichloropropene. Pest Manag. Sci. 68:225-230.

Gao, S., E. Christen, and A.L. Toto. 2012. Agricultural evaporation basins. Chapter 24. p. 757–785 *In* W. W. Wallender and K.K. Tanji (ed.) "Agricultural salinity assessment and management", 2nd Edition, ASCE Manuals and Reports on Engineering Practice No. , Am. Soc. Civil Eng. Reston, VA.

**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:**
1985-1991 – Research Plant Pathologist, Sugarbeet Production 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:**

Bennett, R., D.W. Spurgeon, W.R. Detar, **J.S. Gerik**, R.B. Hutmacher, and B.D. Hanson, 2011. Efficacy of four soil treatments against *Fusarium oxysporum* f. sp. *vasinfectum* Race 4 on cotton. Plant Dis. 95:967-976.

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.

Cabrera, J.A., D. Wang, **J.S. Gerik**, and J. Gan, 2012. Performance of a substrate trough system to control nematodes and pathogens in strawberry production Calif. Agric. submitted.

Gao, S., B. Hanson, R. Qin, J.A. Cabrera, **J. Gerik**, D. Wang, and G. Browne, 2012. Controlling emissions and improving efficacy using totally impermeable film (TIF) in perennial soil fumigation Calif. Agric. Submitted.

Gao, S., R. Qin, B.D. Hanson, N. Tharayil, T.J. Trout, D. Wang, and **J. Gerik**, 2009. Effects of Manure and Water Applications on 1,3-Dichloropropene and Chloropicrin Emissions in a Field Trial. J. Agric. Food Chem. 57:5428-5434.

**Gerik, J.S**. and B.D. Hanson, 2011. Drip Application of Methyl Bromide Alternative Chemicals for Control of Soilborne Pathogens and Weeds. Pest Manag. Sci. 67:1129-1133.

Hanson, B.D., S. Gao, **J. Gerik**, R. Qin, J.A. Cabrera, A.J. Jhala, M.J.M. Abit, D. Cox, B. Corriear, D. Wang, and G.T. Browne, 2012. A clean start to productive orchards and vineyards: research on methyl bromide alternatives for perennial crop nurseries. 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.

Hanson, B.D., **J.S. Gerik**, and S.M. Schneider, 2010. Effects of reduced-ratemethyl bromide applications under conventional and virtually impermeable plastic film in perennial crop field nurseries. Pest Manag. Sci. 66:892-899.

Jhada, A.J., S. Gao, **J.S. Gerik**, R. Qin, and B.D. Hanson, 2012. Effects of surface seals and application shanks on nematode, pathogen and weed control with 1,3-dichloropropene. Pest Manag. Sci. 68:225-230.

Johnson, J.A., S.S. Walse, and **J.S. Gerik**, 2011. Status of Alternatives for Methyl Bromide in the United States. Outlooks on Pest Management 23:53-58.

Schneider, S.M., B.D. Hanson, **J.S. Gerik**, A. Shrestha, T.J. Trout, and S. Gao, 2009. Comparison of shank-and drip-applied methyl bromide alternatives in Perennial crop field nurseries. HortTechnology 19:331-339.

Wang, D., G. Browne, S. Gao, B. Hanson, **J. Gerik**, R. Qin, and N. Tharayil, 2009. Spot fumigation: Fumigant gas dispersion and emission characteristics. Environ. Sci. Tech. 43:5783-5789.

Wang, D., C. Rosen, L. Kinkel, A. Cao, N. Tharayil, and **J. Gerik**, 2009. Production of methyl sulfide and dimethyl disulfide from soil-incorporated plant materials and implications for controlling soilborne pathogens. Plant Soil 324:185-197.

**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
1981–1993 – Research Horticulturist, USDA-ARS, Booneville, AR
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:**

**Makus, D.J.** 2011. Use of synthetic ground covers to control weeds in blackberries. International Journal of Fruit Science. 11(3):286-298.

**Makus, D.J.** 2011. Watermelon transplanted by chisel, strip-tillage, and bedding methods produce similar yield and quality. Subtropical Plant Science. 63:7-13.

**Makus, D.J.** 2010. Weed control and canopy light management in blackberries. International Journal of Fruit Science. 10(2):177-186.

Lester, G.E., **Makus, D.J.**, Hodges, D. 2010. Relationship between fresh-packaged spinach leaves exposed to continuous light or dark, and bioactive contents: Cultivars, leaf size, and storage duration. Journal of Agriculture and Food Chemistry. 58:2980-2987.

Lester, G.E., Jifon, J.L., **Makus, D.J.** 2010. Impact of potassium nutrition on postharvest fruit quality: Melon (Cucumis melo L.) case study. Plant and Soil Journal. 335:117-131.

**Makus, D.J.,** Zibilske, L.M. 2008. Spinach and mustard greens response to soil type, sulfur addition and lithium level. Subtropical Plant Science. 60:69-77

Zibilske, L.M., **Makus, D.J.** 2009. Black oat cover crop management effects on soil temperature and biological properties on a Mollison in Texas, USA. Geoderma. 149:379-385.

**Makus, D.J.** 2008. Seed germination and establishment of saw-pametto, serenoa repens, in south Texas. Acta Horticulturae. 782:381-385.

**Makus, D.J.** 2007. Use of fabric and plastic barriers to control weeds in blackberries. Journal Subtropical Plant Science. 59:95-103.