History of the San Joaquin Valley Agricultural Sciences Center as seen from a plant breeder’s perspective.

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**Origin of the ARS Station.** Our location started in southeast Fresno near the corner of Peach & Butler Avenues when the ‘Peach Avenue Station’ began functioning in 1916 as a result of the actions of California grape growers. Immigrants were arriving in the San Joaquin Valley to farm, and, in many cases, brought varieties of grapes from their home country. Thus, there were hundreds of varieties of grapes in circulation throughout the San Joaquin Valley and recommendations were few regarding those varieties best suited for any particular end use. So, California grape growers donated a 20-acre parcel of vineyard land to the Federal government for varietal evaluation so that unbiased recommendations of the best varieties to be grown for table grapes, raisins, and wine could be provided. The property was known as the USDA Experiment Vineyard and was part of the USDA Bureau of Plant Industry. Dr. Elmer Snyder arrived in Fresno in 1916 to manage the grape evaluation effort, and he and his assistant Frank Harmon initiated the first grape hybridizations and, thus, the first grape breeding efforts in Fresno in 1923.

**Grape Breeding.** The USDA Experiment Vineyard lacked permanent buildings until 1927 when pump and implement sheds were built, but, in the 1930s, buildings began to spring up. With new labs and offices, the Peach Avenue Station became productive in research on a variety of topics related to grape production. Snyder and Harmon published numerous research articles on cultural practices affecting grape quality and methods of grape propagation. The elusive character of seedlessness was examined, as this character was of great importance to breeding. Between 1923 and 1951, nearly 46,000 grape seedlings were produced from planned hybridizations in the quest for new seedless cultivars. In 1946, the first table grape cultivar from their breeding efforts was released (‘Cardinal’).

**Addition of Other Research Groups.** Some of the buildings at the Peach Avenue Station were constructed by the Public Works Administration, a make-work agency set-up during the great depression for the unemployed. The Market Quality Research building was constructed by the PWA in 1933, and it provided research and office space for the developing Market Quality Research program that had been housed at Fresno State College. Research focused primarily on sulfur dioxide fumigation and other means of reducing table grape spoilage in route to market. The Market Quality Research group expanded during the 1950s. Personnel with expertise in controlled atmospheres and fruit/vegetable respiration were added to staff, and buildings were enlarged to account for the new personnel. Market Quality Research was comprised of two Sections: Stored Product Insects and Quality Maintenance and Improvements. Stored-product entomologists began joining the staff in the mid-1960s. Permanent facilities for the entomologists were never planned, and research was conducted in a series of double-wide trailers that were wheeled into the site.
In 1972, the Peach Avenue Station became the Area Headquarters for the then California-Hawaii-Nevada Region of the Agricultural Research Service. It was home to six labs in the Fresno area: Market Quality, Stored Product Insects, Transportation and Packaging, Fruit & Nut Crops, Insects Affecting Man & Animals, and Water Recharge. The Water Recharge group was the final group of researchers to make the Peach Avenue Station their home, moving from the Fresno Air Terminal in 1985.

**Addition of Stone Fruit Breeding.** California was changing quickly in the 1950s, and many people were moving to California for the opportunities offered. Housing needs for the new arrivals dictated the removal of once productive orchards as cities and suburbs expanded into agricultural lands. The San Joaquin Valley was not yet ripe for human growth and was viewed at the time as a new haven for orchards. But while the San Joaquin Valley offered vast and richly productive agricultural lands, the environment was sufficiently different that once-productive varieties would no longer perform in the new environment. The new growing region necessitated new variety development. Dr. John Weinberger came to the Peach Avenue Station in 1955 to manage the grape breeding program, but he was perhaps chosen for the position due to his reputation as an effective peach breeder in Fort Valley, GA, and the need for new peach variety development in the San Joaquin Valley. Dr. Weinberger began hybridizations in peach, plum, and apricot in 1956. At that same time, a muscadine grape breeder named Horace Loomis from Meridian, MS, was brought to Fresno to assist Dr. Weinberger. Together, they made controlled crosses in both stone fruits and grapes and were responsible for evaluating and releasing several dozen new varieties. Like Snyder and Harmon before them, Weinberger and Loomis investigated the seedless trait in grapes, and they diversified the table grape and raisin germplasm through wide genetic crosses and germplasm introductions. During their tenure in Fresno, raisin growers were determining that the need for new growing region necessitated new variety development.

**Embryo Culture Comes to the Peach Avenue Station.** Both Weinberger and Loomis retired in the mid-1970s, and Dr. David Ramming was hired to manage the breeding program. Dr. Ramming received his training at Rutgers University where he learned the technique of embryo culture in peaches. This technique was used to rescue and germinate small embryos from early ripening peaches that would not have otherwise been viable with typical seed culture. Dr. Ramming modified this technique for grapes and demonstrated that embryos from seedless grapes could be successfully cultured. With embryo culture-assisted seedless X seedless crosses, a much higher percentage of seedless vines could be realized in the progeny. Embryo culture has been used routinely since the mid-1980s in both stone fruit and grapes to improve breeding efficiency. While labor intensive, embryo culture has been successfully used for the development of earlier ripening stone fruits (e.g., ‘Mayfire’ nectarine, ‘Spring Baby’ peach) and both table grapes and raisins coming from seedless X seedless culture (e.g., ‘Scarlet Royal,’ ‘Sweet Scarlet,’ and ‘Princess’ table grapes; ‘DOVine’ and ‘Sunpreme’ raisin grapes).

**Growth of the Peach Avenue Station.** The Peach Avenue Station started out as a grape evaluation site, but slowly grew into an important breeding and postharvest quality center with a diversity of research projects. Office and laboratory space in the old buildings was completely full, and newer personnel had to make do with ‘temporary’ space in trailers. And, the city of Fresno was growing as well. Located outside of and to the southeast of Fresno in 1916, the Peach Avenue Station had been surrounded by Fresno by the mid-1980s. Hence, efforts were initiated to find a more suitable location in the surrounding area.

**New property acquired in Parlier.** Ban and Tac Yorizane were well established stone fruit and grape producers with an operation just outside Parlier, CA, and had been thinking it was time to retire from farming their 120 acres. The farm was purchased on 12 February 1992. Trees from the breeding program were first established at the Parlier location on 27 February 1992. At that point, Parlier was really just a field site as there were no offices or lab facilities.

Groundbreaking for the new facility occurred in the spring of 1998. The new San Joaquin Valley Agricultural Sciences Center was ready for dedication in the fall of 2000. Peach Avenue Station personnel began organizing their labs, offices, and farming equipment for the move while the finishing touches were being added to the Parlier facility. The actual physical move from Fresno to Parlier took place in October 2001.

This is an excerpt from a longer article at: [https://www.ars.usda.gov/ARSUserFiles/20340500/History.pdf](https://www.ars.usda.gov/ARSUserFiles/20340500/History.pdf)
Research Updates

Characterization of the resistance against zebra chip in tubers of advanced potato lines from Mexico

Submitted to: Crop Protection

Authors: O. Rubio-Covarrubias, M. Cadena-Hinojosa, S. Prager, C. Wallis, J. Trumble

Potato zebra chip (ZC) disease is an emerging threat to North American, Central American, and New Zealand potato growers as it renders tubers unmarketable due to discoloration of fresh market and fried potato products. As a result, four different breeding lines of potato (246, 865, 510, and NAU) were assessed for expression of resistance to ZC and related changes in host physiology. Compared to the highly susceptible cultivar Atlantic, all four breeding lines exhibited reduction in freshly-cut symptoms. However, the breeding lines did not have reduced symptomology when fried. Because the majority of these breeding lines are intended to be consumed fresh and not fried, these breeding lines possibly may be deployed in areas where ZC is endemic to maintain profitability for potato growers in those areas.

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Effect of approved generic doses of gamma irradiation as phytosanitary treatment on the postharvest quality of 'Seedless Kishu' mandarins (Citrus chinokuni mukakukishu)

Submitted to: Food Chemistry

Authors: J. Ornelas-Paz, M. Meza, D. Obenland, K. Rodriguez, A. Prakash

Mandarins may require a quarantine treatment for the purpose of insect disinestation prior to export into some foreign markets. Irradiation potentially provides a rapid and effective means to do this, but mandarins are more delicate than other types of citrus and the effect of irradiation on mandarin quality has not been well evaluated. In this study, ‘Seedless Kishu’ mandarins were treated with gamma irradiation at a variety of doses and then stored for three weeks at 6°C and one week at 20°C to simulate commercial handling and marketing practices. Irradiation was found to significantly modify the composition of many compounds involved in the sensory, nutrient, and health-promoting attributes of mandarins. Also, the appearance of the fruit was negatively affected even at the lowest dose that would be needed for a postharvest quarantine treatment. This study indicates that ‘Seedless Kishu’ would not be a good candidate for treatment with irradiation for phytosanitary purposes.

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Effect of phytosanitary irradiation on the quality of two varieties of pummelos (Citrus maxima (Burm.) Merr.)

Submitted to: Scientia Horticulturae

Authors: A. Jain, J. Paz, D. Obenland, K. Rodriguez, A. Prakash

Pummelo is an increasingly important citrus crop that may require a quarantine treatment to enable export from the United States, although little is known regarding its response to the potential treatments. Irradiation is increasingly being considered an alternative to chemical phytosanitary treatments, such as methyl bromide. In this study, the effect of 150 Gy or 1000 Gy gamma irradiation doses on pummelo quality was evaluated following storage at 12°C for 3 weeks and also after one additional week at 20°C. Neither irradiation nor storage affected juice content, organic acids, sugars, peel or pulp color, or consumer sensory preference, although numerous volatiles increased in concentration as a result of irradiation treatment and fruit were somewhat softer. Peel pitting was increased in the irradiated fruit, especially in the fruit stored at 15°C, although it was found that the pitting was largely prevented if physical handling of the fruit was kept to a minimum after irradiation. The results suggest that irradiation could serve as a potential phytosanitary treatment for Chandler and Sarawak pummelos, provided that the fruit is subject-
Development of an activated carbon-based electrode for the capture and rapid electrolytic reductive debromination of methyl bromide from post-harvest fumigations

Submitted to: Environmental Science and Technology

Authors: Y. Li, C. Liu, C. Yi, S. Walse, R. Olver, D. Zilberman, W. Mitch

Methyl bromide (MB) is a postharvest fumigant that is highly effective against insect and microorganism pests. MB is also an atmospheric source of reactive bromine gases, which deplete stratospheric ozone. Anthropogenic utilization of MB is regulated by international agreement under the Montreal Protocol. In instances where postharvest chamber fumigations are permitted, contribution(s) to ozone depletion can be minimized, or eliminated, by removing MB from the ventilation effluent via activated carbon sorbent. As part of a larger research project to optimize activated carbons for this use, we conducted experiments to determine how MB was destroyed by electrolysis when we used a novel cathode, comprised of small activated carbon particles coated onto a carbon cloth. The cathode achieved 99% reductive debromination of MB sorbed at 30% by weight to the carbon within 15 h at -1 V applied potential vs. standard hydrogen electrode, a timescale and efficiency suitable for the logistical and infrastructural demands of routinely conducting postharvest fumigations. The cathode exhibited stable performance over 50 MB capture and destruction cycles. Initial cost estimates indicate that this technique could treat MB fumes at $5/kg, roughly one-third the cost of current alternatives. Finding cost-effective techniques for eliminating emissions into the atmosphere, such as the one described in this study, may help ensure that the continued use of MB has minimal environmental impact.

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Effect of long-term continuous fumigation on soil microbial communities

Submitted to: Applied Soil Ecology

Authors: S. Rana-Dangi, R. Torado-Corbala, J. Gerik, B. Hanson

Soil fumigation is used heavily in California by producers of high value crops to control a wide array of soil-borne pests. Fumigants have broad biocidal activity and can affect beneficial soil microbial communities. It is often thought that soil microbial communities make a relatively rapid recovery following fumigation. However, recently it has been found that repeated application of fumigants over time can have greater impacts on soil microorganisms. The main objective of this study was to determine the effect of long-term repeated application of fumigants on soil microbial communities and compare them with non-fumigated sites. Soil samples were collected from Watsonville, CA, and sites were defined by number of years of annual fumigation (yaf) with methyl bromide (15, 26, 33, 39 yaf) at the time of sampling; representative non-fumigated sites were also included for comparison. This study showed that proportion of arbuscular mycorrhizal fungi (AMF) was lower in all fumigated sites as compared to their non-fumigated counterparts which could be a risk to fumigated sites as AMF plays a major role on soil health and fertility. This study helps to understand the effect of long-term methyl bromide fumigation on soil microorganisms and emphasizes the need to study the impact of alternatives to the fumigant methyl bromide to create awareness among farmers of the importance of beneficial microorganisms.

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Determining pomegranate water and nitrogen requirements with high frequency drip irrigation

Submitted to: Agricultural Water Management

Authors: J. Ayars, C. Phene, R. Phene, S. Gao, D. Wang, K. Day

Pomegranate has been identified as a crop with extensive health benefits resulting in an increased interest in production with approximately 12,145 ha growing in California. Even though pomegranate has been cultivated for thousands of years, very little is known about its basic ag-
economic and fertilizer requirements. We conducted an experiment in the San Joaquin Valley of California to determine the water and nitrogen requirements of a multi-trunk pomegranate bush irrigated with high frequency surface and subsurface drip irrigation. We used a large weighing lysimeter to determine the water requirements and three levels of applied nitrogen to characterize the nitrogen requirements. We determined that the water requirement of a mature pomegranate bush was in the range of 853 to 932 mm depending on which irrigation system was used. The subsurface drip irrigated trees required less water than the surface irrigated trees, and these irrigation treatments did not result in reduced yield or quality. Applied nitrogen in excess of 112 kg/ha did not result in increased fruit yield in either irrigation system, and yield did not differ between the two irrigation systems. High frequency irrigation enabled close control of root zone water content that minimized deep percolation losses and transport of nitrate to groundwater. Weed pressure was lower with subsurface drip irrigation compared to surface drip. Use of high frequency subsurface drip irrigation will result in reduced water application and fewer field operations.

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Key factors, soil N processes, and nitrite accumulation affecting nitrous oxide emissions
Submitted to: Soil Science Society of America Journal
Authors: Z. Cai, S. Gao, A. Hendratna, Y. Duan, M. Xu, B. Hanson

Agricultural soil is a significant source of nitrous oxide (N₂O) emissions contributing to global warming, and mitigation strategies depend on better understanding of the environmental factors and processes affecting its production. This study examined the dynamics of both N₂O emission and N transformation processes from urea application by conducting a series of laboratory soil incubation experiments under varying conditions of application rate, soil moisture, temperature, incorporation of biochar, and the use of nitrogen transformation inhibitors (fertilizer stabilizers). Soil water content was found to be the most important environmental factor impacting N₂O emissions. Much higher emissions and total gaseous N loss were found in soil above water holding capacity (WHC) than those below. This research also revealed that nitrite (NO₂⁻) was highly correlated with N₂O emission but within two distinct water content ranges (above or below WHC). Biochar and the inhibitors reduced total N₂O emissions >70%, and the inhibitors also significantly reduced total gaseous N loss. The results can be used to guide development of practices for effective N management and minimizing losses.

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Xylella taiwanensis sp. nov. cause of pear leaf scorch disease in Taiwan
Submitted to: International Journal of Systematic and Evolutionary Microbiology
Authors: C. Su, W. Deng, F. Jan, C. Chang, H. Huang, J. Chen

Xylella fastidiosa is group of difficult to culture, xylem-limited plant pathogenic bacteria. Although most members in the group are found in the Americas, a few new members have been reported from other continents, such as Asia, and require further study. Currently, a technique known as DNA-DNA hybridization (DDH) is used to classify bacterial species, but DDH is too labor-intensive with a limited capacity to analyze Xylella. This study utilized a new method, called Average Nucleotide Index (ANI), to analyze 17 whole genome sequences of X. fastidiosa including a pear leaf scorch (PLS) strain from Taiwan. ANI analyses supported the current grouping of all American strains into a single species, X. fastidiosa; were able to define the bacterial subspecies; and provided evidence to establish a new species, X. taiwanensis, for the PLS members from Taiwan. New information from this study will have significant impact on future classification and identification of the bacteria, with direct implications for management and needed regulations for these plant pathogens.

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ARS 2015 Scientific Discoveries
USDA-ARS Pacific West Area Senior Scientist of the Year Award to Dr. Gary Bañuelos

Dr. Gary Bañuelos was selected as PWA Senior Scientist of the Year for his work with phytoremediation of poor quality soils. Gary’s had a long career of working with producers, particularly on the west side of the San Joaquin Valley where soil and water quality is poor, as well as working in other countries to help them develop crops that can alleviate selenium shortages in their diets or to remove excess selenium from soils. Gary has also been very involved in mentoring other scientists and students, including his efforts since 1999 in organizing and directing the American Chemical Society SEED program for underrepresented minority high school students to spend 9 weeks with mentoring ARS scientists at SJVASC.

New Visiting Scientists

Dr. Baoping Cheng will be working for one year with Dr. Hong Lin in the Crop Diseases, Pests and Genetics Research Unit. He will conduct research on molecular characterization and functional identification of several key virulence genes/factors responsible for citrus Huanglongbing (HLB). Dr. Cheng received his PhD in Plant Pathology in 2011 at the Nanjing Agricultural University in China, and he is currently working as an Assistant Researcher in the Institute of Plant Protection at the Guangdong Academy of Agricultural Sciences in China. His current research focuses on detection, identification, and management of citrus diseases.

Dr. Sihong Zhou will be working for one year with Dr. Hong Lin in the Crop Diseases, Pests and Genetics Research Unit. He will conduct research using molecular genetics and biochemical approaches to determine the molecular basis of resistance in grapevines against biotic stress associated with bacterial and fungal diseases. Dr. Zhou works as an Assistant Researcher in the Crop Genetic Improvement and Biotechnology Laboratory at the Guangxi Academy of Agricultural Sciences in China. Dr. Zhou received his PhD in Pesticide Science of Plant Protection in 2015 at China Agricultural University. His research interests are particularly on understanding molecular interactions between host and pathogen.

Dr. Fei Wang will be working for two years with Dr. Chang-Lin Xiao in the Commodity Protection and Quality Research Unit as a visiting postdoctoral scholar. Dr. Wang will conduct research on the use of morphological and molecular phylogenetic approaches to characterize Alternaria species responsible for Alternaria rot of mandarin citrus fruit as well as fungicide resistance in Alternaria spp. from citrus and blueberries. Dr. Wang obtained her Ph.D. in plant pathology in 2015 from Huazhong Agricultural University in Wuhan, China. Her graduate research focused on population genetic diversity and molecular mechanisms of fungicide resistance in the fungal pathogen Villosiclava virens in rice.

Ms. Jariya Roddee is a visiting Ph. D. student from Khon Kaen University in Thailand. She will be working for seven months with Dr. Elaine Backus in the Crop Diseases, Pests and Genetics Research Unit, conducting research to determine differences in performance of Xylella fastidiosa inoculation behaviors on grapevine by inoculative versus non-inoculative blue-green sharpshooters. She will be learning advanced methods in electropenetrography (EPG), histology, and PCR as applied to insect vector studies.

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