USDA National Clonal Germplasm Repository for Citrus and Dates, (NCGRCD), Riverside, CA

Annual Report to the Date Palm Crop Germplasm Committee CY 2019

Permanent/Term Federal Staff

MaryLou Polek, Research Leader/Plant Pathologist (Category 1)
Robert Krueger, Curator/Horticulturist (Category 4)
Manjunath Keremane, Plant Pathologist (Category 3)
Vicki Newman, Biological Science Technician
Brittany Moreland, Biological Science Technician
Esteban Rodriguez, Biological Science Technician (Lab) (Term Position)
Patricia Moore, Secretary
Lee Gross, Agricultural Science Research Technician (Half time)

University grant funded laboratory technician

Amanda Rawstern (USDA APHIS MAC Funding)

Student workers

Miguel Canchola
Yesenia Charco
Omar Flores
Alexandra Kilzi
Bethany Russell
Nicholas Villa

Mission

The mission of the National Clonal Germplasm Repository for Citrus and Dates (NCGRCD) is to acquire, maintain, evaluate, preserve, and distribute germplasm of citrus, date palms, related Aurantioideae genera, and other *Phoenix* species. The achievement of this goal involves: 1) acquisition of the widest possible genetic diversity within citrus and date palms to reduce genetic vulnerability in the future, 2) testing and treatment of accessions for pathogenic organisms, 3) maintenance of accessions in a protected, pest-free environment, 4) genetic, horticultural, and physiological characterization and evaluation of accessions, 5) establishment of an informational record for each accession covering acquisition, inventory, evaluation, and gene descriptor data, 6) distribution of germplasm to qualified researchers throughout the world, and 7) research into improved methods of collection, evaluation, propagation, preservation, and distribution.

Germplasm Holdings

A total of 169 *Phoenix* accessions are maintained, represented by 666 inventory items (individual plants). The inventory number does not include quarantine trees that have not yet made it to inventory.

The breakdown of *Phoenix* spp is as follows:

	Accessions	Inventory
Total *Phoenix*	169	666
P dactylifera	150	593
P acaulis	1	2
P canariensis	1	8
P hanceana	2	28
P loureiroi	2	10
P paludosa	1	5
P reclinata	2	10
P roebelinii	3	2
P sylvestris	7	8

Accessions of the true date palm, *Phoenix dactylifera*, fall into the following categories:

Named Old World female cv	49
Named New World female cv	9
Superior male selections	5
Backcrossed male accessions	30
Hybrid “Breeding Lines”	17
Baja California Sur seedlings	13
Spanish seedlings	7
Miscellaneous unverified	19
Australian	1

The number of accessions will decrease by approximately 10 % as redundancies are eliminated.

Germplasm Backup

Research at the USDA-ARS National Laboratory for Genetic Resource Preservation (NLGRP) in Fort Collins, CO, has demonstrated that cryopreservation of date pollen is a viable option for long-term preservation in genebanks (see Research section below). In 2019, pollen from 12 male accessions was cryopreserved at NLGRP, and an additional 15 accessions in 2020. Cryopreservation of tissue cultured date palms has proven more challenging due to various factors. Recently, the medium has been changed and bacterial inhibitors added, with promising results.

Germplasm Acquisitions and Pathogen Testing

No new date palm germplasm was acquired in CY 2019. In previous CY, tissue cultured plantlets of several Saudi Arabian cultivars were obtained from Date Palm Developments in the UK, at the request of stakeholders. Due to USDA-APHIS restrictions, new accessions from outside the United States, even when obtained as tissue cultured plantlets, must be obtained under a Plant Controlled Import Permit (PCIP). These permits require testing for specific pathogens (Phytoplasmas, Cadang-cadang viroid, etc) before the date palm plantlets can be released from quarantine.

Although NCGRCD has extensive experience in testing for citrus pathogens, a program for testing date palm pathogens has been lacking. In 2018, a current protocol for phytoplasmas and positive controls were obtained from Professor Brian Bahder, University of Florida, and was implemented in CY 2019. All the quarantine palms were tested; a total of 861 assays were performed including those necessary to optimize the protocol for our conditions. Additionally in CY 2019, a diagnostic protocol for Cadang-cadang viroid was obtained from Dr Rosemary Hammond, USDA-ARS. This protocol has not been implemented yet due to the Covid-19 shutdown. Some additional tests need to be implemented, as the conditions of the permit changed upon renewal.

Distributions

In CY 2019, germplasm distributions consisted of sending pollen from 14 accessions to Gayle Volk, USDA-ARS National Laboratory of Genetic Resource Preservation, Fort Collins, CO, for cryopreservation research and leaf material from 9 accessions to Michael Purugganan, New York University, Abu Dhabi, for genomics studies.

Collection Rationalization

NCGRCD attempts to identify and eliminate the redundancies and fill the gaps of genetic diversity in the collection. The goal is to more efficiently manage and utilize these valuable resources. In making decisions, we take into account criteria such as molecular markers, morphological observations, and passport data. There is an immediate need to prioritize accessions for backup via cryopreservation. Cryopreservation is an efficient and economical means to conserve the genetic diversity of germplasm and specific genotypes for the long-term.

Permits

PCIP-19-0094 (an extension of PCIP-17-00116, renewed as PCIP-19-00094) allows introduction of tissue-cultured date palm plantlets from Date Palm Developments in the UK. This was done at the request of stakeholders. PCIP-18-00443 is in place allowing introduction of tissue cultured date palm plantlets from the United Arab Emirates. This permit was obtained to allow importation of new varieties in cooperation with Phoenix AgroTech.

Databases

NCGRCD maintains accession records in the GRIN-Global database, maintained by the National Plant Germplasm Germplasm System (NPGS) Database Management Unit at ARS Headquarters in Beltsville, MD. Accession records are available to the user community world-wide. NCGRCD also maintains a local database in MS Access. Both databases are up to date regarding accessions. Actual plant inventory is current and up to date in the local database; however, it is currently not maintained in the GRIN database. The local database contains information including; management data used in day-to-day operations, quarantine and pathogen testing data, documentation of propagations, and therapy records. It is not clear at this time whether these observations can be maintained effectively in GRIN, or if it even has a place there. Although inventory will probably be loaded into GRIN Global in the medium term, the local database will have to be maintained for at least some time. Currently, the Curator is the only person with training in the GRIN system, but the Technicians (V Newman & B Moreland) assist in maintaining the local database and training in GRIN-Global training has been initiated for them. The level of human resources devoted to database management is inadequate at NCGRCD; additional funding would be necessary to continuously update the GRIN system to an optimal level, especially if specialized quarantine areas are added.

Facilities

The NCGRCD maintains federal facilities on land located on the University of California, Riverside campus and leased from the University of California (UC). A new lease was executed on September 09, 2019 and will expire on September 08, 2029 (10 years). In addition to the land fee, municipal fees for fire and safety are charged based on the square footage of the facilities.

Federal facilities include approximately 16,000 sq. ft. of APHIS-certified screenhouse (used for maintenance of the protected, sanitized collection); 6,050 sq. ft. of greenhouse space (used for propagations, maintenance of pathogen controls, and pathogen testing); 1,372 sq. ft. of headhouse space (work and storage); 850 sq. ft. of lab space; 88 sq. ft. of office/storage space; and 480 sq. ft. office trailer (also housing the PCR equipment). In addition, approximately 7,500 sq. ft. of greenhouse space is rented from the University and is used to maintain accessions that have not been sanitized and tested, and therefore are held under APHIS/CDFA quarantine. In CY 2016-2018, two UCR greenhouses (GH 16-50 and GH 16-46) were renovated using funds from the National Clean Plant Network (NCPN) that were awarded to Georgios Vidalakis specifically for this purpose. Both greenhouses are fully operational. The NCPN funds have been essential to meet the repository's needs since Federal funds cannot be used for the improvement of State facilities and current federal facilities are inadequate in size. Most of the greenhouse space in Riverside is used for maintenance of citrus germplasm. However, the tissue culture-derived date palms held under the PCIP permit are maintained in a Riverside greenhouse until quarantine release.

The date palm germplasm collection is maintained primarily as a field planting at the Coachella Valley Agricultural Research Station (CVARS), an asset of UC Riverside, in Thermal, CA. The date palm genebank occupies approximately 13 acres. The former collection at the Imperial Valley Research Station in Brawley is no longer attached to ARS and, when last viewed in 2018, was receiving minimal care.

Personnel

Permanent Federal staffing currently consists of 6.5 FTE, 2 of which are SY scientist positions (Category 1 Plant Pathologist and Category 4 Horticulurist). Technical support staff consists of 1 support Plant Pathologist and 2 Biological Science Technicians. The latter two positions manage plant cultural operations, therapy, propagations, plant inventory management, and cryopreservation. Non-technical support staff include a full time secretary and a half-time Agricultural Technician who provides facility maintenance support. In addition, 2.0 FTE of temporary technical staff are employed as technicians, one being an ARS term position and the other a soft-money UCR employee. Six part-time student assistants are employed to perform plant care, laboratory work, and building maintenance.

The budget augmentation provides for the addition of new staff. Two positions will be added; a permanent Biological Technician position for the laboratory and a Post-doctoral scientist to conduct genetic and molecular characterization of the germplasm collection. The Term Position will be filled with a person to assist with the backlog of data entry into the GRIN system.

Support

NCGRCD is part of the USDA ARS National Plant Germplasm System (NPGS) and the USDA-ARS Pacific West Area (PWA). The National Program Leader for NP 301 is Dr. Peter Bretting. Dr. Robert Matteri is currently the area director and Drs. Thomas Shanower and Bill Orts are the associate directors. Federal administrative support is primarily provided by the staff at the Pacific West Area Office and in Riverside. The Riverside Location administrative staff include Dr. Todd Skaggs, Location Coordinator; Nancy Knap, Administrative Officer; Patricia Gonzalez, Financial Analyst; and Daniel Kain, IT Specialist.

In 2019 the NCGRCD maintained three agreements with UC Riverside: two Research Support Agreements (RSA) and one Non-Assistance Cooperative Agreements (NACA). The RSA's were with the Agricultural Operations Department (P Mauk, PI) to provide infrastructure support (utilities, communications, facilities maintenance, cultural care for field plantings, etc). The NACA is with Dr. Georgios Vidalakis (Plant Pathology & Microbiology). The NCGRCD works closely with Vidalakis to improve diagnostic protocols, conserve genetic resources for the long-term, import and evaluate germplasm developed in Florida, and other phytosanitary issues. This NACA will expire August 31, 2021.

Health, Safety, Environmental Management

Biological Science Technician Brittany Moreland is the Collateral Duty Safety Officer (CDSO) for the Riverside Location (including the US Salinity Laboratory) and serves on USDA and UC safety committees. NCGRCD also takes part in various USDA and UC safety activities and initiatives such as mock fire and earthquake drills, hands-on fire extinguisher training, and review of shut-off valves. The lab is certified as

Biological Safety level II laboratory by UCR. The chemical inventory is reviewed annually and old and unused chemicals are properly disposed of through the University Environmental Health and Safety Department. In CY 2019, a comprehensive safety inspection of the repository facilities was conducted by Phil Smith, ARS Safety & Occupational Health Manager. Only minor corrections were necessary and have been addressed.

Date Research Activities

Puffy Skin in Date Palms: Production of soft cultivars of dates (fruit consistency) suffers from a problem involving skin separation, called "puffy skin" by the growers. This is a fruit quality defect in which excessive portions of the skin of the date pull away from the flesh, causing a blistered or puffed appearance. This decreases the market value of the date. This problem appears to be influenced by temperature and humidity during the khalal period of date fruit maturation. A cooperative project with Dr. Thomas Perring, Entomology, UC Riverside is investigating bunch and irrigation management as tools to mitigate this problem. Initial results indicate that date palms can grow with substantially less water applied than standard industry practice. This research is supported by a CDC grant to Dr. Perring.

Date Palm Water Use: To supplement the above experiment, an SCRI grant was received in late 2018. The PI on the proposal is Ali Montazar, UCCE Farm Advisor for Irrigation in Riverside and Imperial Counties. R Krueger is a co-PI along with other UCCE personnel. Experimental plots were established in Coachella and Bard Valleys, actual irrigation application measured, and measurements of stress, yield, and fruit quality made. Initial results support the water requirements estimated in the puffy skin experiments.

Date Palm Decline: The Sky Valley area is experiencing a large amount of date palm decline and death. This problem is under investigation by several scientists and extension personnel. Initial symptoms appear in the fruit bunches, then lower leaves necrose, and finally the terminal bud dies and the tree with it. In many cases, the root system is weak or nearly non-existent. Initial sampling was inconclusive, with several usually non-pathogenic fungi being isolated. In addition, declines exhibiting slightly different symptoms have been observed in the Coachella and Imperial Valleys. Whereas these declines are not extensive throughout the Valley, the incidence appears to be increasing. Systematic surveys have not been performed; palms are observed and sampled when growers contact cooperating personnel. The most consistently isolated species is *Fusarium proliferatum*, which has been reported as a pathogen in other countries and possibly in Florida. Pathogenicity tests have thus far been negative. However, a personal communication from Professor Monica Elliott, retired, University of Florida, indicates that this species does not usually produce a pathogenic response under experimental conditions even when consistently associated with declining palms. Chief personnel are D Hodel, UCCE, Los Angeles County (retired); P Mauk, University of California, Riverside; and R Krueger. Assistance in diagnoses were formerly provided by Dr Akif Eskalen, however, he has moved to UC Davis. Dr. Philippe Rolshausen, UC Riverside, now provides diagnoses.

Date palm mineral nutrition: The declines described above in some cases appear similar to problems associated with mineral deficiencies. We have sampled the declining palms and analyzed the mineral levels which appear to be like those in apparently healthy palms, however, nutritional relationships in date palms are not well understood. Nutrient levels in US-grown date palms are generally lower than in date palms grown in other countries, but the significance of this is unknown. Chloride ion levels in leaves are generally very high, but this is common in healthy-appearing palms as well. We would like to get a better handle on nutritional aspects of date production and sought funding from the California Department of Food and

Agriculture Fertilizer Research and Education Program (FREP) by Mauk and Krueger. However, the proposal was not funded primarily because date palms were not a priority crop for the FREP. We hope to pursue additional work in this area in the future.

Alternatives to glyphosate for weed control in date palms: There is increasing societal pressure to reduced use of glyphosate. In addition, resistance to glyphosate is appearing in some weed populations. Thus, there is a need to identify alternatives to glyphosate for various crops, including date palms. Two proposals were submitted to address this question by Sonia Rios, UCCE, Riverside County, with R Krueger as one of the PI's. One proposal was not funded; the decision on the second is pending.

Genomics research: The date palm germplasm collection has proven valuable in date palm genomics studies. Our two main collaborations are with the Weil Medical School Qatar (J Malek, PI) and New York University Abu Dhabi (M Purugganan, PI). Over the years, genomics studies in which NCGRCD has participated have suggested multiple sites of domestication with main east and west gene pools; an X-Y type system of sex expression in this dioicous crop; and genetic bases for fruit color and other important traits. Collaboration in this area is ongoing.

Cryopreservation: Collaborative work done at NLGRP by Dr. Gayle Volk and a visiting scholar, Annie Oliveira, has demonstrated that cryopreservation of date pollen is possible. After reducing moisture content by equilibration, pollen was placed into liquid nitrogen vapor (LNV). Viability was assessed periodically for up to 9 months by rehydrating, plating onto a medium, and counting germinated pollen grains after 18 hr. Germination rates of up to 47 % were achieved, demonstrating that long-term storage of date pollen in LNV can be used for long-term preservation in secure genebanks.

Publications and Presentations CY 2019

Krueger RR (202X) Date palm (*Phoenix dactylifera* L) biology and utilization. In: Al-Khayri J, Johnson D, Jain SM (eds). The Date Palm Genome. Springer, Berlin (submitted and accepted)

Oliveira ACA, Ledo AS, **Polek ML, Krueger R,** Shepherd A, Volk GM (202X) Date palm pollen preservation for genebanks. (submitted)

Salomon-Torres R, Sol-Uribe JA, Valdez-Salas B, Garcia-Gonzalez C, **Krueger R**, Hernandez-Balbuena D, Norzagaray-Plascencia S, Garcia-Vazquez JP, Ortiz-Uribe N (2020) Effect of four pollinating sources on nutritional properties of Medjool date (Phoenix dactylifera L) seeds. MDPI Agriculture 10:45 doi:10.3390/agriculture10020045

Hazzouri K, Gros-Balthazard M, Flowers JM, Copetti D, Lemansour A, Lebrun M, Masmoudi K, Ferrand S, Dharm MI, Fresquez S, Rosas U, Zhang J, Talag J, Lee S, Kudrna D, Powell RF, Leitch IJ, **Krueger R**, Wing R, Amiri KM, Purugganan MD (2019) Genome-wide association mapping of date palm fruit traits. Nature Communications 10:4680 (https://doi.org/10.1038/s41467-019-12604-9).

Mohamoud YA, Mathew LS, Torres MF, Younuskunju S, **Krueger R**, Suhre K, Malek JA (2019) Novel subpopulations in date palm (*Phoenix dactylifera*) identified by population-wide organellar genome sequencing. BMC Genomics 20:498.

Salomón-Torres R, Ortiz-Uribe N, Valdez-Salas B, Rosas-González N, García-González C, Chávez D, Córdova-Guerrero I, Díaz-Rubio L, Haro-Vázquez MP, Mijangos-Montiel JL, Morales-Maza A, Mahadevan P, **Krueger R** (2019) Nutritional assessment, phytochemical composition and antioxidant analysis of the pulp and seed of Medjool date grown in Mexico. PeerJ 7:e6821 http://doi.org/10.7717/peerj.6821

Ortiz-Uribe N, Salomon-Torres R, **Krueger R** (2019) Date palm status and perspective in Mexico. Agriculture 9, 46; doi:10.3390/agriculture9030046

Chaludavi SR, Young P, Thompson K, Barhi BA, Gajera B, Naryanan S, **Krueger R**, Bennetzen JL (2019) Phoenix phylogeny, and analysis of genetic variation in a diverse collection of date palm (Phoenix dactylifera) and related species. Plant Diversity, published on line 12-2018. https://doi.org/10.1016/j.pld.2018.11.005 41(5):330-339

Committee Service and Meeting Attendance (M Polek)

- Joint Conference of the International Organization of Citrus Virologists and International Research Conference on Huanglongbing (IRCHLB) VI: member of Steering Committee, Scientific Program Committee, Moderator
- Central California Tristeza Eradication Agency Technical Advisory Committee, Vice Chair
- Member Plant Germplasm Operations Committee; attended annual meeting (remote format)
- Member W6 Regional Technical Advisory Committee (USDA Repositories located in western USA); attended annual meeting (remote format)
- Member California Department of Pesticide Regulation Pest Management Advisory Committee
- California Citrus Nursery Society; attended Variety Committee Meeting and reported on the NCGRCD
- Executive Board Member CAFÉ (California Agriculture and Food Enterprise)
- Advisory Committee for USDA-NIFA project "Developing an Infrastructure and Product Test Pipeline to Deliver Novel Therapies for Citrus Greening Disease", (S Brown PI)
- Advisory Committee: Bt toxin-based strategies for management of *Diaphorina citri* and citrus greening (B Bonning PI)
- Advisory Committee: Biopesticidal dsRNA therapy for psyllid mortality and abatement of vector-mediated CLas transmission (J Brown PI)
- Riverside County 4H STEM Day; organized USDA ARS participation
- UCR Plant Pathology Career Day: speaker
- Hosted UCR Graduate Virology Class, promoted careers in USDA ARS
- Hosted UCR Field Plant Pathology Graduate Class, promoted careers in USDA ARS
- Hosted several Technical and Diplomatic groups from Vietnam, South Africa, Brazil

Service and Meeting Attendance (R Krueger)

- Plant Germplasm Operations Committee (attended virtual meeting)
- International Organization of Citrus Virologists Conference/International Research Conference on HLB (local and scientific organizing committees; pre-, mid-, post-conference meetings and tours; session moderator; also serve as treasurer of IOCV)

- Central California Tristeza Eradication Agency Technical Advisory Committee
- Florida Budwood Technical Advisory Committee (conference calls)
- National Clean Plant Network – Citrus Tier 2 Board member (attended board meeting, communications workshop, quality management meeting)
- Riverside Location Environmental Management System Committee (meet quarterly)
- UCR Date Field Day (co-presented puffy skin project)
- Indio Date Festival (educational booth co-sponsored with UCR)
- Various UCR and RCC classes, Career Center, etc (Botany, Plant Pathology, Pesticide Training, etc)
- Riverside County 4H STEM Day
- PWA Workforce Diversity Committee (conference calls)
- Coordinated tour and career workshop for American Association of Hispanics in Higher Education (AAHHE) Caminos Fellow
- Reviews: 2 submissions, 1 promotion review (Pakistan)

Critical Issues

Having recently received a significant budget augmentation, the future of the NCGRCD is not so dire. Nonetheless, there are some issues threatening the repository that the Crop Germplasm Committee should be aware of. These include:

- Cooperative field and back up collections with UCR needs rationalization, genetic gaps needs to be identified.
- Personnel Issues: the unit lacks genetic, data management, and tissue culture expertise. This could be alleviated by the hiring of a post-doctoral scientist.
- Term (temporary) position needs to be converted to permanent (request has been submitted)
- Several retirements are anticipated within the next 5 years.

USDA ARS National Clonal Germplasm Repository for Citrus and Date Palms

Date Palm Crop Germplasm Committee

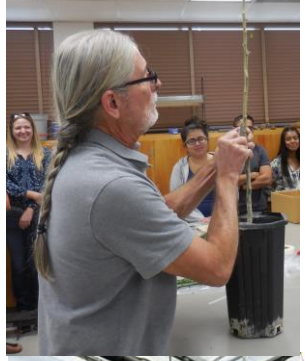
May 19, 2020

Financial Status

RED LETTER DAYS!!!

- May 17, 2019: Permanent budget augmentation
- September 09, 2019: Lease with the University signed

Staff - Current



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University/Grant Funded
USDA APHIS MAC
Amanda Rawstern,
Laboratory Technician

Student Workers
Miguel Canchola
Ysenia Charco
Omar Flores
Alexandra Kilzi
Bethany Russell
Nicholas Villa

Staff - Future

- Post-doctoral Research Scientist: Genetics/ horticultural evaluation
- Permanent Biological Technician - Laboratory
- Term Biological Technician - Data Entry

USDA Agricultural Research Service

Current Holdings

	Accessions	Inventory
Total *Phoenix*	**169**	**666**
P dactylifera	150	593
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P loureiroi	2	10
P paludosa	1	5
P reclinata	2	10
P roebelinii	3	2
P sylvestris	7	8

Germplasm Acquisitions and Pathogen Testing

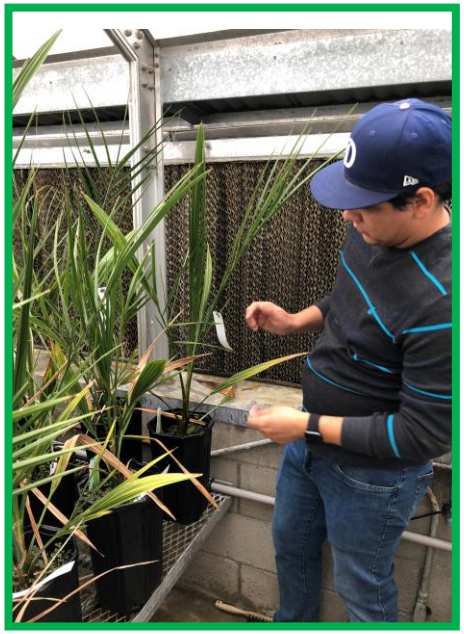
Dr. Brian Bahder
University of Florida

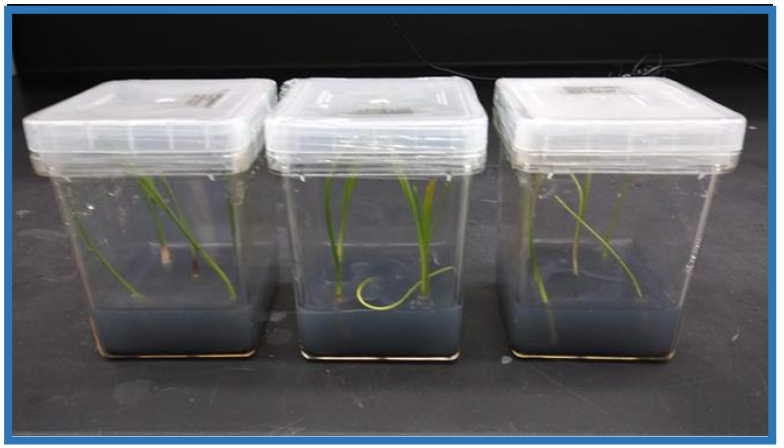
Dr. Rosemarie Hammond
USDA ARS, Beltsville, MD

- Plant Controlled Import Permit (PCIP) (Krueger)
- PCIP-18-00443 is in place allowing introduction of tissue cultured date palm plantlets from the United Arab Emirates.
- Testing for specific pathogens (Phytoplasmas, Cadang-cadang viroid) now required
- New acquisitions held in quarantine
- Positive controls obtained
- Phytoplasma testing complete

Releases – Date Palms

- 22 accessions currently held, being tested
- Pathogen testing program initiated *de novo*
- Phytoplasma testing complete
- Viroid testing being initiated
- Fusarium and other tests being investigated



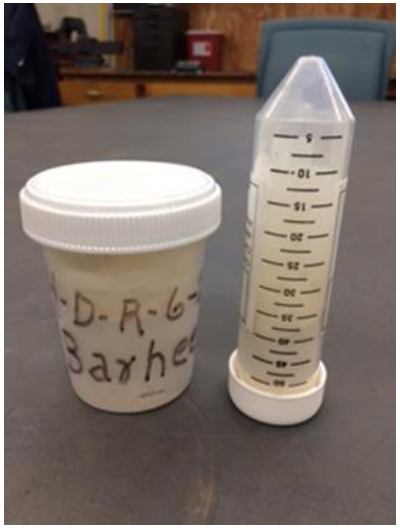


Tissue Culture Introductions from DPD 2017 - 2018

- Sultana (Qassim, Saudi Arabia)
- Yellow Sukkary (Qassim, Saudi Arabia)
- Anbarah (Qassim, Saudi Arabia)
- Ajwah (Qassim, Saudi Arabia)
- Asha Al Hassa (Qassim, Saudi Arabia)
- Oliver male (Alice Springs, Australia)

Distributions/Backup

- pollen from male accessions sent to Dr. Gayle Volk, USDA ARS NLGRP for cryopreservation
  - 2019: 12 accessions
  - 2020: 15 accessions
- leaf material from 9 accessions to Michael Purugganan, New York University, Abu Dhabi, for genomics studies



Critical Issues/Threats to the Collection

- Pests & Diseases
  - Fusarium (Dates)
  - Palm Weevils (Dates)
  - Unknown problems (4C issue)
- Human Error
- Government Funding
- University policy

CVARS Row 4C Issue

- First noticed May, 2017
- Marginal necrosis
- Spread in line with irrigation
- Three different microbes isolated
- Pathogenicity tests
- Palms appeared to recover
- Similar symptoms in production (less severe)
- Mauk, Polek, Eskalen, Rohlshausen, Hodel

USDA Agricultural Research Service

Research Activities

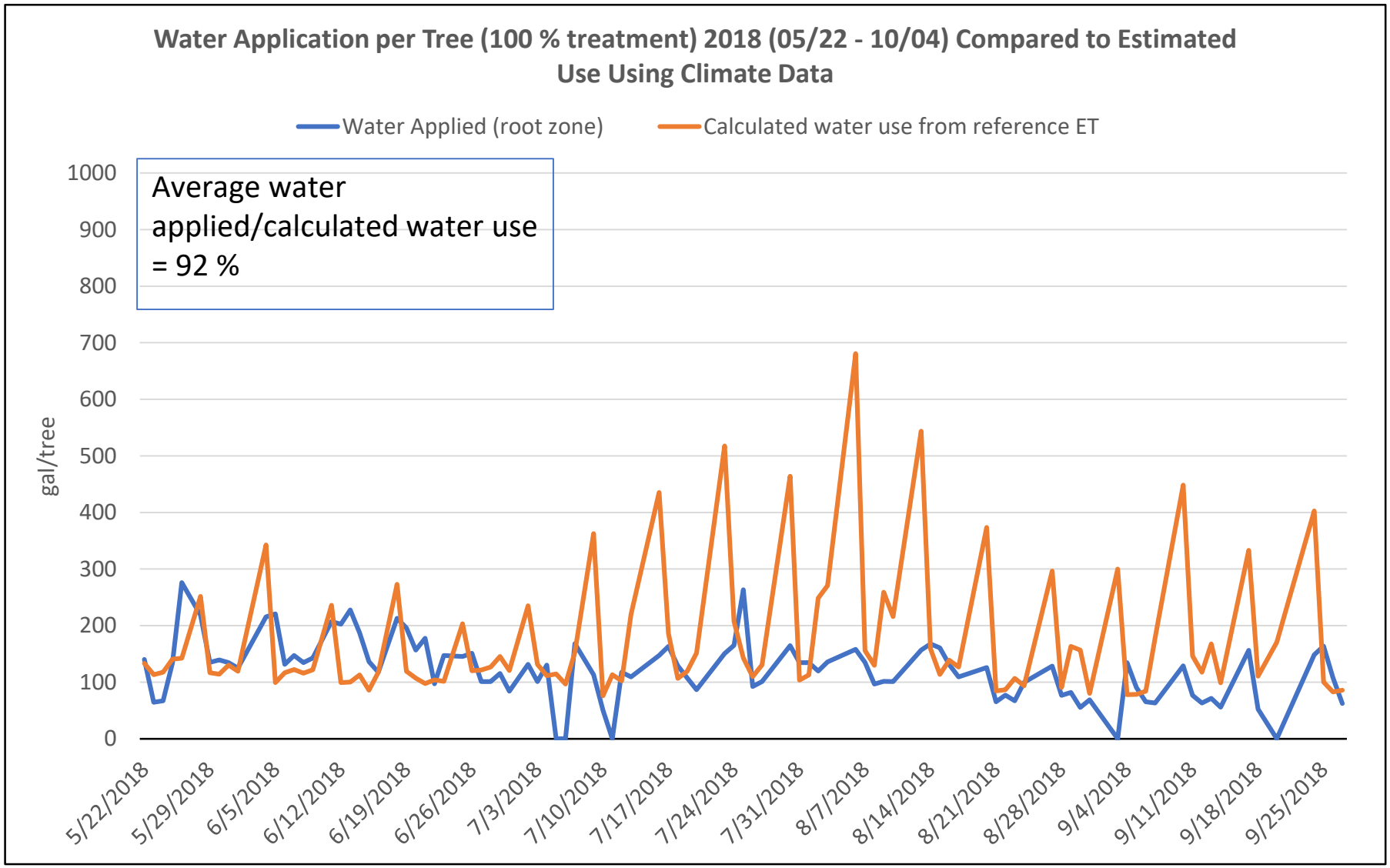
- Managing “Puffy skin” in ‘Medjool’ dates using regulated deficit irrigation (Perring, Krueger)
- Water Use of Date Palms (Montazar, Pureza, Krueger)
- Ongoing genomics collaboration (New York University Anu Dhabi, Weill Medical Center Qatar, Krueger)
- Cryopreservation (Volk, Oliveira, Polek, Krueger)
- Alternatives to Glyphosate (Rios, Krueger)
  - One proposal rejected, one pending

USDA Agricultural Research Service

Managing “Puffy skin” in ‘Medjool’ dates using regulated deficit irrigation (Perring, Krueger)

- “Puffy skin” (skin separation) a production problem in ‘Medjool’, other soft dates
- Appears associated with microclimate (humidity) near khalal stage
- Israel: gradient from less to more arid date production areas
- Other possible factors: mechanical properties of the skin, irrigation, mineral nutrition

Water Application Compared to Estimate



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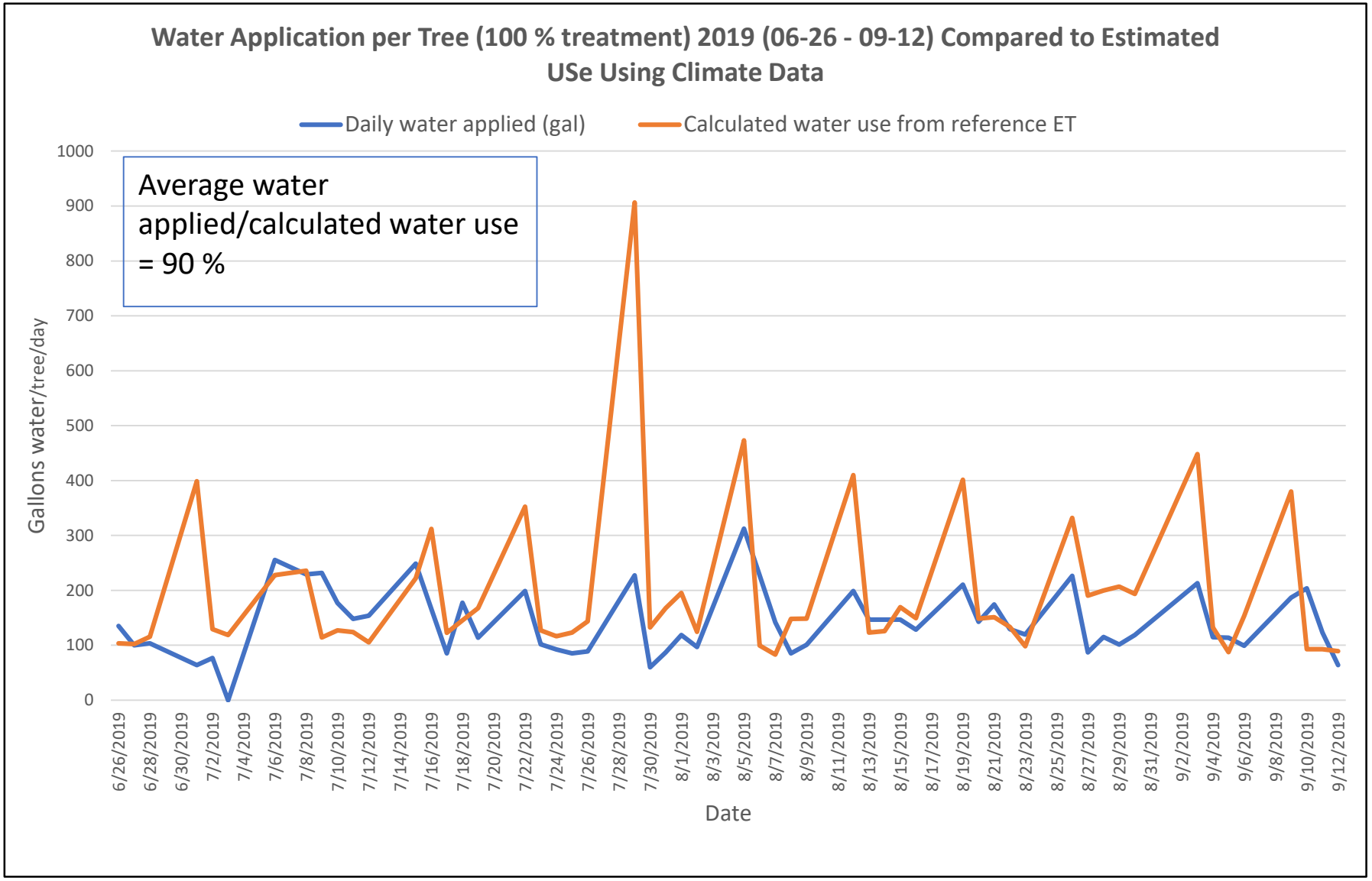


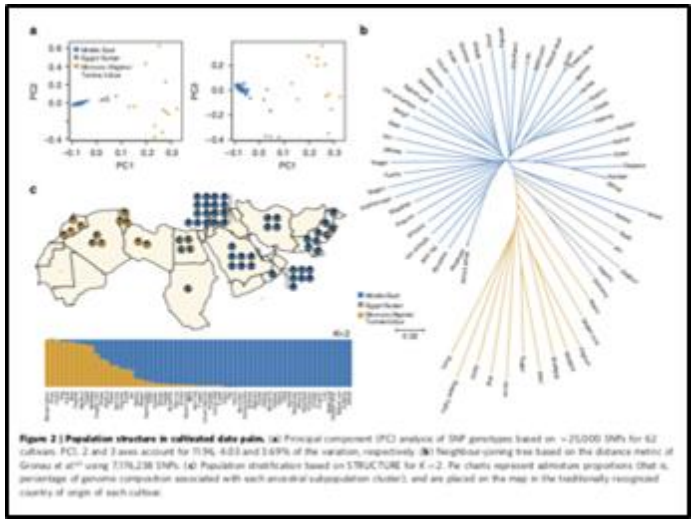
Water Use of Date Palms: SCRI Grant (Montazar, Pureza, Krueger)

- Measure actual water use in Coachella, Bard/Yuma
- Instrumentation installed 2019
- Aerial monitoring for stress
- Grower surveys
- Data collection 2019 – current
- Suggests ~ 150 gal/tree/day in summer

Installing soil moisture probes

Date Palm Genomics: (R Krueger)

- Ongoing collaboration with 2 international consortia led by New York University Abu Dhabi and Weill Medical School Qatar
- Multiple domestication sites
- X-Y type system for sex expression
- Genetic bases for fruit color & other traits
- Co-author on 7 refereed papers, including first published genome



Introgression between eastern and western date palm genepools (Hazzouri et al, 2015)

Sample collection for NYU-AD colleagues

Germplasm Evaluation Grant 2019

- Pilot project to fingerprint accessions focusing on ‘Medjool’ and ‘Deglet Noor’
- Variation in ‘Medjool’?
- 16 SSR markers developed by Billotte et al
- Have some information on collection from INRA using the system
- Dorsaf Nafti, visiting scholar from Tunisia, 2015

Additional Potential Research

- Genomics (ongoing)
  - Collaborative with NYU-AD, WMC-Q, etc
- BARD
  - Yuval Cohen
- Mineral nutrition
- Increase pathogen testing ability
- Return to looking at decline problems
- Weed control (is this an issue)?
- Solicit input from industry

Effects of Covid-19

- Only essential work activities
  - Max telework
  - No travel (including local)
- Acquisitions on hold (cannot test)
- No visits to CVARS since February
- Probably wrap up puffy skin (late in season to start)
- Collection should be safe

COVID 19

When life gives you COVID 19 .....

Make a date shake!