

**Annual Report of the USDA National Clonal Germplasm Repository (NCGR), Davis, CA  
2020**

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## **INTRODUCTION**

The National Clonal Germplasm Repository (NCGR) at Davis, receives, collects, preserves, evaluates, and distributes genetic resources of Mediterranean fruit and nut crops. These irreplaceable resources are maintained on a long-term basis to support domestic and international research efforts on germplasm enhancement, cultivar development, molecular biology, and other related research. The Repository operates in cooperation with the Plant Sciences, the Viticulture & Enology Departments, and Foundation Plant Services (FPS) at the University of California, Davis.

### *Permanent/Term Federal Staff at NCGR-Davis*

John Preece, Research Leader  
Malli Aradhya, Geneticist  
Bernie Prins, Horticulturist (*Vitis*)  
Carolyn DeBuse, Horticulturist (*Prunus*)  
Jenny Smith, Biological Science Technician  
Jeff Moersfelder, Field Manager  
Alex Sanchez, Nursery Manager  
Salvador Rivas, Biological Science Technician  
Mary Parker, Secretary (Program Support Assistant)  
Gloria (Patty) Diaz-Britz, Biological Science Technician (term position)

### *UC Affiliates – Assistant Specialists*

Judy Yang  
Franklin Lewis

### *Graduate Students*

Rachel Spaeth

### *Personnel Changes*

Alex Sanchez began on May 10, 2020

Gloria (Patty) Diaz-Britz' former position was eliminated to provide budget flexibility. She has been rehired on a 180-day appointment on soft money.

## **Service**

Distributions of NCGR germplasm are primarily winter collected, dormant cuttings or scionwood; although the NCGR also distributes leaves, summer cuttings, pollen, fruit and other plant parts as requested. Almost no seeds are distributed. Because dormant cuttings are primarily distributed, nearly all orders are shipped in late winter/early spring.

Each item shipped is 3-5 cuttings/item (accession) (Fig. 1). Number of orders and items shipped dropped greatly in 2016 because the NCGR discontinued sending material to the general public. This change has been a benefit to the NCGR and those who receive material. With a manageable number of orders and items, the Repository can work with and better respond to those who require the genetics in the collection for their research. During 2019, orders declined slightly to 256, however, some orders were large, therefore, the number of order items shipped increased dramatically to 6577. This is not a problem for the Repository, it becomes problematic when there are too many orders to process, rather than a few large orders.

Figure 1. Total orders shipped from 2004 – 2019 (NCGR-Davis). There are 3-5 cuttings/item shipped.



Most distributions (96.5%) are to domestic customers (Fig. 2). Of those domestic orders, 38% were to individuals, with the remainder shipped to federal and state agencies, colleges and universities, nonprofits, and commercial companies (Fig. 3).

Figure 2. Orders distributed domestically and internationally during 2019.

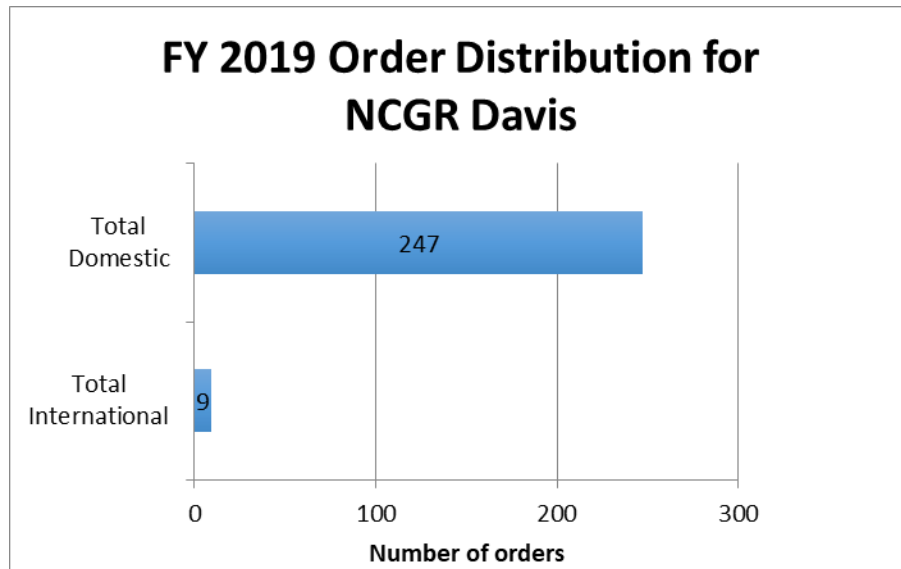
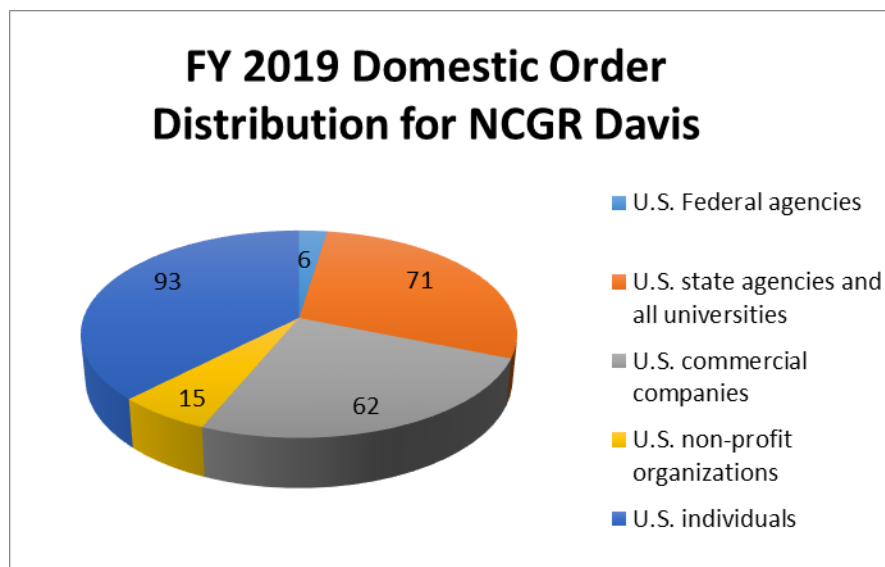


Figure 3. Orders distributed to domestic customers during 2019.



The NCGR hosted 3 tasting events at Wolfskill. Multiple tours of the NCGR were provided to domestic and international individuals and groups. During 2020, we had none and are planning no fruit tasting events because of the Corona Virus. Tours are now a rare event and those are limited to walking tours to maintain physical distance.

## **Acquisitions**

### New Acquisitions

Limited land space makes it difficult to add to the collections. During the winter of 2019/2020, about 90 *Prunus* seedlings were received from APHIS quarantine and planted in the field at Wolfskill.

## **Collection maintenance and propagation**

Inadequate labor is a challenge for maintenance of the 14 collections. Grant money from the Almond Board of California and a private individual has been received for equipment and labor.

The contractor for pruning the grapes lost his crew to another contractor who pays more. The result was that along with the staff, a volunteer force was assembled to prune the National grape collection. This worked well until we had an employee contract bacterial pneumonia. Because it was a respiratory disease, we stopped the volunteer program for this year. The result is that about 85% of the grapes were totally pruned with the remainder hedged.

Most of the tree collections are being hedged this week. This follows past hedging and is working well for the collections. However, this is the first time that the pistachios have been hedged. The trees were overgrown and are crowded. The hedging provides high quality scionwood for distribution.

The outlook remains poor for obtaining additional land from the university. There is land available at the USDA-ARS San Joaquin Valley Agricultural Experiment Station at Parlier, across from the Kearney Ag. Center.

Because of an Armillaria infestation in the almonds, it has been necessary to repropagate the almond and persimmon collections. Persimmon has resistance to Armillaria. Because of lack of land, the collections must be flipped while they still occupy the land. We have one row of persimmons and 2.5 rows of almonds repropagated and planted in their new locations. This effort will continue until the collection locations have switched. To make room, the old almond collection has been pushed out, except for the trees that have yet to be propagated successfully.

## **Evaluation and Research**

Grants focused on the collections at the NCGR-Davis: Almond Board of California, \$150,000 over 3 years, Private individual, \$7,200.

## **Publications in 2019-20 (NCGR staff bolded)**

**Aradhya, M.K.**, D. Velasco, J.-R. Wang, R. Ramasamy, F. M. You, C. Leslie, A. Dandekar, M.-C. Luo, and J. Dvorak. (2019) "A fine-scale genetic linkage map reveals genomic regions associated with economic traits in walnut (*Juglans regia*)." *Plant Breeding* 138, no. 5 (2019): 635-646.

Chater, J.M., D.J. Merhaut, and **J.E. Preece**. 2020. Chapter 46 - Diagnosis and management of nutrient constraints in pomegranate. In: A.K. Srivastava, A.K. and C. Hu (Eds). *Fruit Crops. Diagnosis and Management of Nutrient Constraints*. Elsevier, Amsterdam, Netherlands. pp. 509-519.

Diaz-Lara, A., D. Golino, **J.E. Preece**, and M. Al Rwahnih. "Development of RT-PCR degenerate primers to overcome the high genetic diversity of grapevine virus T." *Journal of Virological Methods* (2020): 113883.

Gradziel, T. B. Lampinen, and **J.E. Preece**. (2019) Propagation from basal epicormic meristems remediates an aging-related disorder in almond clones. *Horticulturae*. 5(28). doi:10.3390/horticulturae5020028 [www.mdpi.com/journal/horticulturae](http://www.mdpi.com/journal/horticulturae)

Jarvis-Shean, K., Archer, L., Leslie, C., **Aradhya, M.**, Kluepfel, D., **Preece, J.E.**, and Brown, P. (2019) Preserving and enhancing the usefulness of the USDA-NCGR walnut collection for breeding. *Walnut Research Reports* 2018. California Walnut Board. pp.45-52.

Jacygrad, E., **J.E. Preece**, W.J. Palmer, R. Michelmore, and D. Golino. 2020. Phenotypic segregation of seedling UCB-1 hybrid pistachio rootstock. *Trees* 34: 531-541.

Johnson, E.P., **J.E. Preece**, **M. Aradhya**, and T. Gradziel. "Rooting response of *Prunus* wild relative semi-hardwood cuttings to indole-3-butyric acid potassium salt (KIBA)." *Scientia Horticulturae* 263 (2020): 109144.

Mathon, C., J.M. Chater, A. Green, D.J. Merhaut, P.A. Mauk, **J.E. Preece**, and C.K. Larive. (2019) Quantification of punicalagins in commercial preparations and pomegranate cultivars, by liquid chromatography-mass spectrometry. *Journal of the Science of Food and Agriculture*, 99:4036-4042. (<https://onlinelibrary.wiley.com/doi/full/10.1002/jsfa.9631>).

Milczarek, R.R., P.S. Liang, T. Wong, M.P. Augustine, J.L. Smith, R.D. Woods, I. Sedej, C.W. Olsen, A.M. Vilches, R.P. Haff, and **J.E. Preece**. (2019). Nondestructive determination of the astringency of pollination-variant persimmons (*Diospyros kaki*) using near-infrared (NIR) spectroscopy and nuclear magnetic resonance (NMR) relaxometry. *Postharvest Biology and Technology*, 149, pp.50-57.

**Preece, J.E.** 2020. The USDA-ARS National Clonal Germplasm Repository for Tree Fruit, Nut Crops, and Grapes, Davis, CA. *J. American Pomological Soc.* 74:111-116

**Preece, J.E. and Aradhya. M.** (2019). Temperate nut crops – chestnut, hazelnut, pecan, pistachio, and walnut. In: Greene, S., Williams, K., Khoury, C., Kantar, M.B., and Marek, L. (eds.) North American Crop Wild Relatives, Volume 2: 417-449.

Zhu T, Wang L, You FM, Rodriguez JC, Deal KR, Chen L, Li J, Chakraborty S, Balan B, Jiang CZ, Brown PJ, Leslie CA, **Aradhya MK**, Dandekar AM, McGuire PE, Kluepfel D, Dvorak J and Luo MC. (2019). Sequencing a *Juglans regia* × *J. microcarpa* hybrid yields high-quality genome assemblies of parental species. *Horticulture Research*. 6(1):55.

**Annual Report of the USDA National Arid Land Plant Genetic Resources Unit  
(NALPGRU), Parlier, CA  
2020**

**John E. Preece, and Claire Heinitz  
Research Leader and Curator**

## **INTRODUCTION**

The National Arid Land Plant Genetic Resources Unit (NALPGRU), a worksite of NCGR-Davis, serves as an important germplasm regeneration center for other National Plant Germplasm System (NPGS) sites that have species and accessions that require long frost-free seasons or arid conditions for seed production or regeneration of vegetative propagules. A back up collection of *Corylus* is maintained for the National Clonal Germplasm Repository (NCGR), Corvallis, OR. In addition, the NALPGRU is the priority site for conservation of arid land plant species with potential as industrial crops. These genetic resources are acquired, conserved, characterized, and distributed to scientists worldwide. The NALPGRU is located at the USDA-ARS San Joaquin Valley Agricultural Sciences Center, Parlier, CA.

*Staff at the NALPGRU, Parlier*

John Preece, Research Leader (located at NCGR-Davis)  
Claire Heinitz, Curator  
Jerry Serimian, Biological Science Technician

### *Personnel Changes*

One vacant GS-05 technician position is being filled (selection made), and a vacant part-time student Pathways position has been approved for recruitment.

## **Service**

### Distribution

NALPGRU distributions are in the form of seed, green cuttings/propagules, tissue or rooted plants depending on the crop and the nature of the request and are filled and shipped year-round. Overall distributions decreased after 2015 due to a change in policy regarding non-research requests, but are beginning to increase again slightly (Fig. 1). In FY 2019, 79% of orders were sent to domestic cooperators (Fig. 2), and these were sent mainly to universities (Fig. 3).

Figure 1. Total NALPGRU orders and order items shipped from FY 2015-2019.

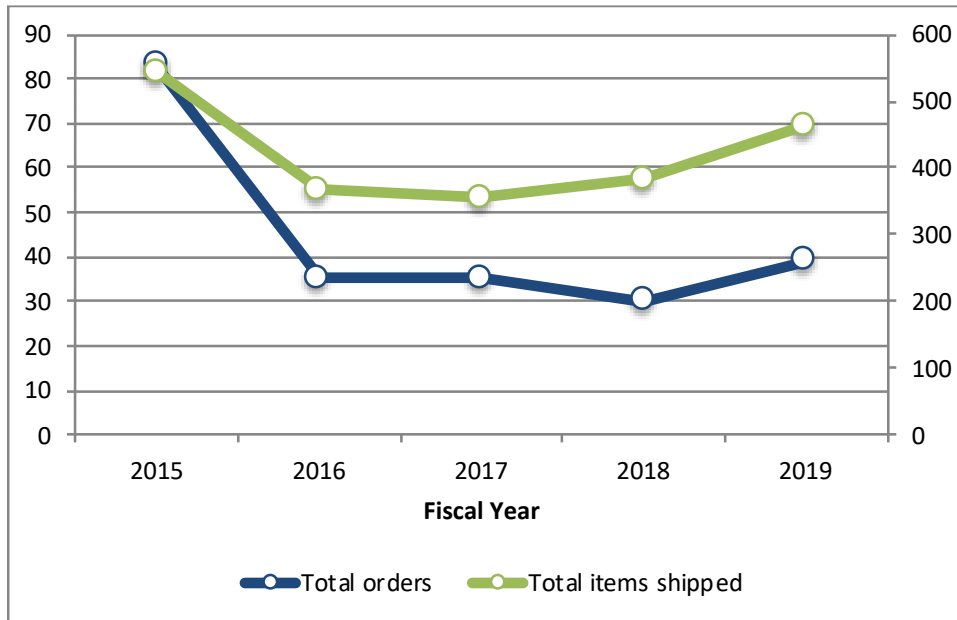


Figure 2. NALPGRU domestic and international distributions from FY 2015-2019.

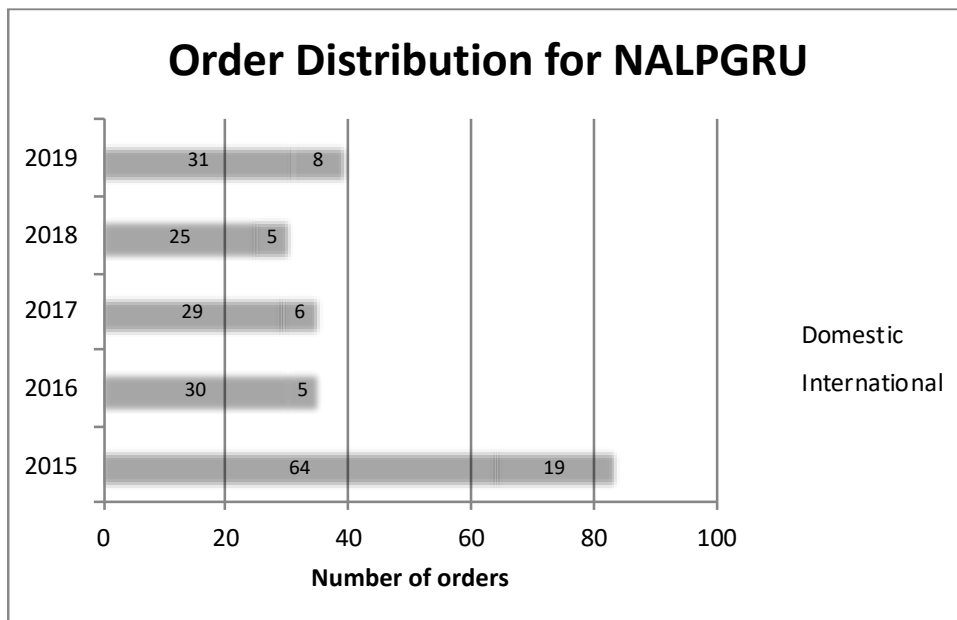
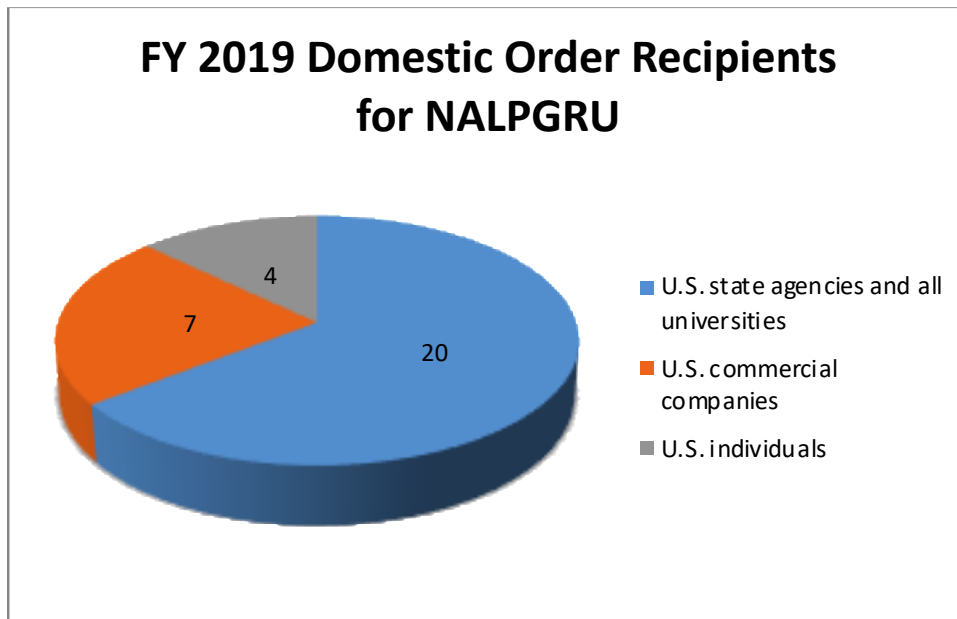




Figure 3. NALPGRU distribution to domestic customers during FY 2019.



### Service Regenerations

A significant component of the NALPGRU mission is seed regenerations of accessions from other NPGS sites that require a long growing season and/or dry conditions. NALPGRU staff work closely with curators at the home sites to coordinate planting, data collection, and harvest. The following accessions were increased at Parlier during the 2019 season:

Site	Crop	# accessions harvested
W6	<i>Allium</i>	258
	<i>Lactuca</i>	3
	<i>Pisum</i>	2
NSGC	<i>Triticum/Hordeum/Secale</i>	842
S9	<i>Capsicum</i>	31
	<i>Vigna</i>	50
	<i>Citrullus</i>	21
NE9	<i>Cucurbita</i>	2
NC7	<i>Helianthus</i>	40

### **Acquisitions**

NALPGRU was approved for funding through the Plant Exploration Office and the New Crops CGC for a collection trip targeting *Parthenium* in southwest Texas. Twenty new accessions were collected in total: 17 *P. argentatum*, 2 *P. incanum*, and 1 *P. confertum*.

### Collection maintenance and propagation

The NALPGRU performs routine regenerations of their seed crops (lesquerella and *Limnanthes*), and manages the rest as clonal accessions with periodic replanting. The *Opuntia* collection is being repropagated, with some heat treatments as necessary for disease, and will be fully replanted in spring 2021. The original *Corylus* backup was removed in 2017 to allow for replanting, and thus far 99 backup trees have been established. New trees will be planted as they are propagated and transferred from Corvallis.

### Evaluation and Research

NALPGRU currently collaborates with external research groups on guayule and *Opuntia* evaluation projects. Guayule research includes abiotic stress tolerance (California State University Agricultural Research Institute, partner with CSU-Fresno and other ARS), root pathogen resistance (ONP funded evaluation project with University of Arizona), and general phenotypic evaluation in field trials (USDA-NIFA “Sustainable Bioeconomy for Arid Regions (SBAR)”, with University of Arizona, ARS, and Bridgestone). Evaluation of the *Opuntia* collection is ongoing at Parlier and University of Nevada Reno with funding from USDA-AFRI.

### Recent Publications (NALPGRU staff bolded)

**Heinitz, C.C.**, S. Riaz, A.C. Tenschler, N. Romero, and M.A. Walker. Survey of Chloride Exclusion in Grape Germplasm from the Southwestern United States and Mexico. *Crop Sci.* *in press*

Khoury, C.K., D. Carver, H.R. Kates, H.A. Achicanoy, M. van Zonneveld, E. Thomas, **C. Heinitz**, R. Jarret, J.A. Labate, K. Reitsma, and others. 2020. Distributions, conservation status, and abiotic stress tolerance potential of wild cucurbits (*Cucurbita* L.). *Plants, People, Planet* 2(3): 269–283.

Walker, M.A., **C. Heinitz**, S. Riaz, and J. Uretsky. 2019. Grape Taxonomy and Germplasm. p. 25–38. *In* The Grape Genome. Springer, Cham.

**Heinitz, C.C.**, J. Uretsky, J.C.D. Peterson, K.G. Huerta-Acosta, and M.A. Walker. 2019. Crop Wild Relatives of Grape (*Vitis vinifera* L.) Throughout North America. p. 329–351. *In* North American Crop Wild Relatives, Volume 2. Springer, Cham.