

Field Evaluation of Almond Varieties – 4th Generation

Project No.

Project leaders: Roger Duncan (UCCE Stanislaus County), Luke Milliron (UCCE Butte, Glenn, and Tehama Counties); Mohammad Yaghmour, UCCE Kern County

Project cooperators: John Duarte, Stanislaus County grower; CSU Chico, Butte County grower; Pacific Ag Inc, Kern County grower

Summary:

This project is the fourth generation of almond variety trials conducted by the University of California and sponsored by the Almond Board of California. The overall goal of this project is to enhance supply diversification by identifying better almond varieties that respond to different market demands and provide enhanced traits such as self-compatibility, pest resistance, and high yield efficiency. These trials will enable growers to make informed decisions when choosing varieties for their new orchards. The specific purpose of this project is to evaluate the most promising experimental almond selections from public and private breeding programs throughout the world and compare them to new and standard commercial varieties in side-by-side field trials in three California almond growing regions. The field trials in Kern and Stanislaus Counties were planted in fall 2022 and the trial in Butte County was planted in spring, 2023. Horticultural information will be recorded beginning in the second leaf.

Objectives 2022-2023:

- a) Work with California, federal, and international public and private breeding programs and nurseries to determine a preliminary list of almond varieties and experimental selections to evaluate in California regional field trials. Utilize an expert panel to objectively select final varieties for inclusion in the trials.
- b) Establish field trials farmed under commercial conditions in three regions of the California Central Valley: Butte County (UCCE Advisor Luke Milliron), Stanislaus County (UCCE Advisor Roger Duncan), and Kern County (UCCE Advisor Mohammad Yaghmour).

Objectives 2024-2027:

- a) Monitor and record key horticultural information valuable for grower decision making, including bloom period, hull split period, harvest timing, disease and insect susceptibility, tree horticultural characteristics, yield, and kernel quality.
- b) Extend results to industry via conventional UCCE methods, including newsletters, field days, classroom presentations, online media, and grower-directed publications.

Annual or Final Results and Discussion

The field trials in Kern and Stanislaus Counties were planted in fall 2022 and the trial in Butte County was planted in spring, 2023. Therefore, there are no data to report yet. However, a few observations were made during the first leaf.

- Planting at the Stanislaus and Kern County sites went well with no problems and trees got off to an excellent start. At the Butte County site, trees were planted very late out of cold storage and approximately 20% will be replaced in spring 2024.
- The winter and spring of 2022-23 was very wet with several frost events. In the Stanislaus trial, newly emerging shoots of many varieties died back or were killed by bacterial blast (confirmed by F. Trouillas lab; Fig 1). The most blast-affected varieties were Yorizane, Aldrich, Shasta, Vela, Florida, UCD B2 and UCD B15. A few trees had to be replaced but most recovered fully.
- Trees of UC Davis selections B6 and B11 (Stanislaus & Kern) and B3 (Kern County) had very poor bud break in spring 2023, where sometimes only one or two buds pushed, often only inside the carton or at the very top of the tree (Fig 2). The decision was made to remove UCD B11 from the experiment altogether due to extensive bud break problems. Trees were replaced with industry standards Monterey or Fritz in the Kern trial, Bennett-Hickman in the Stanislaus trial, and Monterey on Viking in the Butte trial. Affected trees of B6 and B3 were left in the trials and retrained up the stake where necessary.
- Foliar symptoms of potassium deficiency on the Spanish variety 'Constanti' became evident in the Kern County trial by midsummer in the first leaf. Potassium deficiency was confirmed by leaf analyses, indicating 1.1% K in leaves of Constanti compared to 1.8% in Nonpareil. Potassium deficiency symptoms were not evident on Constanti in the Stanislaus or Butte County trials.

Outreach Activities

There have been no outreach activities related to this project yet.

Materials and Methods:

In summer 2021, leading public and private almond breeders and nurseries from California, Australia, Spain, and Israel were asked to submit in-shell samples along with horticultural descriptions of promising experimental and commercial almond varieties for potential inclusion in the trials. A total of 47 candidate varieties was received. A panel of eight experts, including handlers, marketers, growers, and UC Cooperative Extension almond advisors, blindly evaluated the submitted almond samples and selected 25 for inclusion in the trial. Twenty-three of the 25 selections are reported to be self-fertile. Selections were made largely based on kernel quality, but also the reported horticultural characteristics including self-compatibility, harvest time, bloom time, pest susceptibility, and yield potential were considered. The trials also include industry standards for comparison, including Nonpareil, Monterey, Aldrich, Butte, Fritz, and Independence.

Budwood of experimental selections was submitted to Burchell Nursery for propagation of experimental trees. Varieties were budded onto Hansen rootstock for the Stanislaus and Kern Counties trials and Krymsk 86 for the trial at CSU Chico.

The Kern County trial was planted with potted trees on Hansen rootstock on September 28, 2022 and is farmed by a local grower. Tree spacing is 16' x 22'. The orchard is irrigated with double line drip and the soil type is Milham sandy loam. The trial is arranged in a randomized complete block design with four replications of each variety and 13 trees per replicate (total of 52 trees for each variety). The trial is in a second-generation orchard planted after whole orchard recycling of the previous orchard and fumigation with Telone II.

The Stanislaus County trial is about 12 acres in size and is embedded in a new, first generation, commercial almond orchard east of Modesto and farmed by a local grower. The trial was planted with potted trees on Hansen rootstock on September 22, 2022. The tree spacing is 10' x 20' and drip irrigated with high quality surface water. Approximately 75% of the trial is on a Madera sandy loam soil and 25% San Joaquin sandy loam. The trial is arranged in a randomized complete block design with four replications of each variety and 15 or 16 trees per replication (total of 62 trees for each variety).

The Butte County trial is located at the CSU, Chico University Farm. The test trees were bare root on Krymsk 86 rootstock. Potted Independence and Shasta on Viking were planted because of concerns about local performance of these varieties on Krymsk 86. Potted Monterey and Nonpareil were both planted on Krymsk 86 and Viking for comparison. Due to the extended wet weather in winter and spring 2022/23, there were long delays getting the field ready to plant and trees were not planted until May 23 & 24, 2023. As a result of the prolonged cold storage, approximately 20% of the bare root test trees did not push well and will be replaced in spring 2024. The soil is an Almendra loam, and the orchard is irrigated with full coverage sprinklers. Tree spacing is 14' x 21'. The trial is arranged in a randomized complete block design with four replications of each variety and 14 trees per replicate (total of 56 trees for each variety).



Fig 1. Shoots of first leaf 'Florida' trees killed by bacterial blast (*Pseudomonas syringae*) in the Stanislaus trial.



Fig 2. Many trees of UC Davis selections B6 and B11 (and B3 in Kern) had very poor initial bud push first leaf.

Table 1. List of Varieties Selected for Inclusion in 4th Generation Regional Variety Trials

Variety	Source	Self-Compatible?	Reported Bloom Time +/- Np (days)	Reported Harvest +/- Np (days)
Y117-106-03	USDA Agricultural Research Service	Yes	-1	+10
Y119-12-11	USDA Agricultural Research Service	Yes	0	-14
Y117-91-03	USDA Agricultural Research Service	Yes	+3	-7
Yorizane	USDA Agricultural Research Service	Yes	+2	-3
Carina	University of Adelaide	Yes	-4-5	-2
Mira	University of Adelaide	Yes	+3-4	0
Vela	University of Adelaide	Yes	-2	+10
Lassen	Burchell Nursery	Yes	-3	+14
Conway	Burchell Nursery	No	-2	+7
P10.023	Burchell Nursery	Yes	0	+7
Shasta	Burchell Nursery	yes	+2	0
Pyrenees	Burchell Nursery	Yes	+7	+14
Penta	CEBAS – Spain	Yes	+26	+7
Florida	CEBAS – Spain	Yes	+0	-2-3
Constanti	IRTA – Spain	Yes	+10	+35-42
UCD-B2	UC Davis	Yes	-2	+21
UCD-B3	UC Davis	No	-2	+21
UCD-B4	UC Davis	Yes	0	+21-28
UCD-B6	UC Davis	Yes	0	+14-21
UCD-B8	UC Davis	Yes	0	+14-21
UCD-B9	UC Davis	Yes	+1	+7
UCD-B11	UC Davis	Yes	+2-3	+14-21
UCD-B12	UC Davis	Yes	0	+14-21
UCD-B14	UC Davis	Yes	+2	+21
UCD-B15	UC Davis	Yes	+1	+21-28
Standards				
Monterey		No	+1	+35
Aldrich		No	0	+24
Independence*		Yes		0
Nonpareil		No	--	--
Butte		No	+4	+15
Fritz (Kern)		No	+2	+40
Bennett-Hickman (Stanislaus)	Duarte Nursery	No	-1	+11

*Due to apparent incompatibility of Independence on Krymsk 86 rootstock, Independence at Chico State will be on Viking and compared to Nonpareil and Monterey on Viking.

List of publications that emerged from this work:

- There are no publications related to this project yet.