WALNUT IMPROVEMENT PROGRAM 2008

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ABSTRACT

The goal of the Walnut Improvement Program is to provide new cultivars of walnut to the California walnut industry while developing new knowledge and maintaining a breeding population. We also work with collaborators to develop new rootstocks and propagate them. This year we have 38 selections and almost 10 thousand seedlings under or approaching evaluation in the breeding program. Almost 7,000 are half sibs from selections at the Kearney selection block. This is reduced from 10,000 last year. Early harvest is a primary goal and several selections with Payne-time harvest dates are promising. We have identified 95-11-14 as ready for patenting. Controlled crosses between Idaho and Chandler were made again this year to increase the population for developing a DNA map of traits of walnuts.

OBJECTIVES

The objectives of the Walnut Improvement Program are:

- to provide the California walnut industry with genetically superior walnut cultivars and rootstocks
- to develop knowledge that will increase the efficiency of walnut breeding
- to develop and maintain an array of traits available for breeding in the future

The program consists of several projects with specific objectives:

- The classical cultivar breeding project uses traditional methods to develop and release new cultivars that combine precocity (high early yield) and early harvest date with kernel quality, in-shell traits, and disease resistance.
- The backcross breeding project is designed to introduce resistance to blackline disease from the Northern California black walnut into a commercially acceptable English walnut cultivar.
- Rootstock improvement objectives include development of selections with genetic resistance to *Phytophthora*, nematodes, and crown gall. This is done in conjunction with the clonal rootstocks improvement project.
- New technologies that increase the efficiency of breeding and the scope of genetic material available for walnut improvement continue to be evaluated and adapted to walnut breeding as opportunities arise.
- Germplasm collections are maintained and augmented when possible for future breeding use and are available for other researchers.

PROCEDURES

Breeding program.

The procedures for the breeding program have changed as the advanced generation selections have matured and become available as parents. In 2004 and 2005 we collected nuts from the selected

parents at the Kearney Agricultural Center to produce half sib families. In 2006, 2007 and 2008 we made controlled crosses instead of collecting open-pollinated (OP) seed because the family size required for OP seedlings is prohibitive. The crossing design (2007-2009) is shown and consists of crossing our best high quality selections with our earliest harvesting selections:

Seedlings from crosses 2007 (Nuts harvested from crosses 2008)

Early Harvesting

	91-77-6	**91-77-40**	**91-90-41**	**91-96-3**	**92-80-11**	**94-19-85**	**94-20-5**	**95-007-13**	**95-11-14**	**95-18-23**
High Quality										
90-31-12	28		(21)	(26)	37	(12)	6 (36)	63		(25)
93-28-20	28 (17)	19 (31)	(30)	67	72	8 (10)	13	7 (45)	(4)	(10)
94-19-29	17		35	(23)	20		16		(5)	
94-19-45	(50)		54	43	37	(45)	2 (13)		(65)	
95-11-22	40			(8)		(45)	22	57		
95-26-16				(8)	(10)			(15)		
95-26-17	(43)					(21)				
95-26-22			(32)	11	18		19	(73)		(5)
95-26-37		(5)		(96)	14 (42)			115	14	

2008 NOTES:	Cross 94-19-45 x Idaho	52 nuts harvested
	Cross between Chandler x Idaho	90 nuts harvested
	Total nuts harvested (2008)	1013 nuts harvested

In all cases, the seedlings are close planted and any that appear to be terminal bearers or have any of the signs of inbreeding (dwarfs, extra lates etc.) are culled at about age 3. If no nuts have been produced by age 5 (under good growing conditions) they are also cut down. Full evaluations are only done on precocious and laterally fruitful individuals. This is similar to the methods we used for the supplemental pollination families (see previous reports). Surviving seedlings are evaluated for phenology (leafing, flowering and harvest dates), precocity, lateral fruitfulness, estimated yield, blight incidence, and crack-out characteristics (shell shape, texture, thickness and strength, kernel weight, percent kernel, and kernel color, fill, plumpness and ease of removal in halves).

Data is evaluated at the annual crackout evaluation meeting that includes growers, processors, nurserymen, and farm advisors. Participants inspect kernel boxes and data sheets to identify possible selections. Data available includes current year field and crack-out data, performance data from past years, Diamond evaluations and computer-assisted selection. Team evaluations are followed by a general group discussion of each team's recommendations.

Promising individuals are repropagated into three selection blocks (Chico, Kearney and Davis) and grower trials where evaluations continue. The off-campus selection blocks are under the control of Bill Olson (Chico) and the Kearney field staff. Grower field trials are an essential component of releasing a new cultivar. We have increased the number of field trials in the last few years.

Backcross breeding for hypersensitivity to cherry leafroll virus.

The backcross breeding project is designed to introduce resistance to blackline disease from the Northern California black walnut into a commercially acceptable English walnut cultivar. Crosses are conducted using the same methods as in conventional cultivar breeding but the selection process is different. The first backcross cull is based on shell thickness and percent kernel; those exhibiting the black walnut shell characteristics are discarded. Those that are promising are tested by PCR for

hypersensitivity to the cherry leafroll virus as reported in Walnut Research Reports (1998) and modified recently (see WRR 2003).

Marker selection has been improved but has a 10% chance of error. As potential parents and selections advance in the program, there is a need for more stringent testing for hypersensitivity. The screening method used is as described in previous papers: a selection is grafted on both black and English rootstock (two each); after the graft is established, bark from our CLRV-source trees is patched into the English rootstock or into the selection depending on the rootstock species. If the selection is hypersensitive it will survive on the black rootstock because the inoculum patch was rejected, and die (exhibiting a black line) on the inoculated English rootstock. Confirmed hypersensitive, thin-shelled individuals with the best commercial traits are then used as parents for the next generation of backcrosses to an English walnut parent.

Rootstock improvement

Rootstock breeding is aimed at producing selections with genetic resistance to *Phytophthora*, nematodes, crown gall, and environmental stress while retaining or enhancing the vigor of hybrid rootstock. The limiting factor in developing improved rootstocks had been the absence of a commercially viable clonal propagation method but this has been overcome for many rootstock selections (see Clonal Propagation report). The procedures and results of screening for traits of interest are reported separately: nematodes - Mike McKenry; Phytophthora – Greg Browne; crown gall – Dan Kluepfel and Janine Hasey.

New technology for genetic improvement of walnut

This part of the Walnut Improvement Program includes tissue culture, PCR, and isozyme analysis in support of genetic improvement as well as gene transfer and field-testing of transgenic plants. Current laboratory work includes micropropagation, use of DNA marker selection in backcrossing, improvements in storage of long-term cultures, efficiency of introducing material to culture, and improvements in somatic embryogenesis.

In 2005 vector pDE00.0201, developed by Matt Escobar in the Dandekar lab and designed to silence the gall forming ipt and iaaM genes of wild-type *Agrobacterium*, was used in our lab to insert crown gall resistance into somatic embryos of three paradox genotypes (J1, J21 and RR4). Transformants were selected and germinated to generate microshoot lines. Plants of forty independent transformed lines plus controls were generated from rooted microshoots for use in greenhouse testing and for a field trial planted this year on campus.

Transgenics with the following genes continue to be observed and evaluated in large pots:

- Bt - insect resistance (inoculation with codling moth)
- FAD - altered oil composition to avoid rancidity.
- PPO - altered phenolic composition to improve rooting and kernel traits.
- SDH - regulates gallic acid production for aflatoxin control.

NOTE: Transgenics are only grown on campus under USDA guidelines and catkins and nuts are removed. They are grown for proof of concept experiments and are not available for the public.

Germplasm resources

Germplasm collections are maintained and augmented when possible for future breeding use and are available for other researchers. Current collections at Wolfskill and Davis include a diversity of California cultivars, leading cultivars and selections from around the world, material with unusual traits, and germplasm of interest for rootstock development. It differs in emphasis, content, distribution policy, and cultural practices from the USDA Germplasm Repository collection.

RESULTS AND DISCUSSION

Cultivar breeding

Three new walnut cultivars (varieties) were patented in 2006: 'Sexton', 'Gillet' and 'Forde'. These are characterized by high early yields, harvest dates before Chandler, low blight scores and large light-colored kernels. They are described in more detail in a separate Walnut Research Report (2004) and brief descriptions are included in the Descriptions of Selections at the end of this report.

Data on the selections are provided in Tables1-4. A description of each selection can be found at the end of this report. There are now almost 10,000 seedlings under evaluation and 38 selections as follows:

Year	Crosses (n)	Original Seedlings (n)	Selections (n)	Under Evaluation (n)
1990	15	591	2	2
1991	18	493	3	3
1992	15	243	1	1
1993	14	116	1	1
1994	15	587	2	2
1995	15	758	8	8
1996	7	333	1	1
1997	13	611	7	8
1998	5	1759	7	7
1999	1	993	1	1
2000	12	2503	4	43
2001	16	210	1	17
2002	5	1200	-	321
2003	11	4608	-	707
2004	7 hs**	6000	-	3518
2005	9 hs	3332	-	3332
2006	22	954	-	954
2007	27	1045	-	1045
2008	33	1013 seed	-	
Total	82	25323	38	9971

**hs denotes half sib families

Backcross breeding for hypersensitivity to cherry leafroll virus.

Backcross breeding to develop an English walnut with a hypersensitive response to the cherry leafroll virus is proceeding. We continue to test backcross seedlings for both nut quality and virus resistance and currently have approximately 600 seedlings under active evaluation. Field trials of hypersensitive selections with small but commercially acceptable kernels are in field trials in San Benito County with Bill Coates and in Contra Costa County with Janet Caprile. See separate reports.

In 2001 we started the current backcross selection testing block for final confirmation of hypersensitivity by bark patch testing. Additional selections were added in 2002-2005 to a total of 81. Patches were checked the last three years for blackline formation. To date 14 have tested hypersensitive, 6 were questionable and the remainder was tolerant. Only one selection that had tested hypersensitive by DNA appeared to be tolerant in the patch test.

Rootstock improvement

A number of potential rootstock selections have been identified in the past and are maintained and micropropagated in the laboratory for confirmation testing and field trials (See Clonal Propagation report). This material includes tolerant backcross selections (vigorous, CLRV tolerant), several *Phytophthora* survivors from growers' orchards, PDS selections for crown gall, nematode, and Phytophthora resistance.

Three new genotypes were introduced into tissue culture this year for microshoot production and rooting. WIP5 is a tolerant backcross that we had not previously been able to culture and had been propagated only from hardwood cuttings. RX032 is a *J. microcarpa* paradox selected by Mike McKenry for its nematode resistance traits. In addition we introduced the English cultivar Serr for use in rootstock trials. Attempts to introduce additional genotypes of interest for nematode resistance into culture, including PI1596568, *J. cathayensis* B12, and *J. cathayensis* seedling #21 are continuing. Serr and WIP5 shoots are now in the rooting process. During the year, microshoot cultures of both rootstock genotypes and English cultivars were provided to several commercial laboratories.

Gene insertion

Additional plants of the 40 independent lines expressing a construct for crown gall silencing in three separate background genotypes (J1, J21, and RR4) and control plants were produced this year and grown in the greenhouse for further testing. Results of crown gall resistance tests are reported separately in this volume by Kluepfel. A sub-set of these genotypes was grown in large pots and grafted with Chandler scions for use in testing for any movement of DNA, RNA, or other macromolecules across the graft union from the rootstock to the scion and to test that the horticultural traits of the scion material on these rootstocks are not altered. In addition, a one-acre field trial of these rootstock lines was established in the spring of 2008.

Genotypes exhibiting altered expression of shikimate dehydrogenase (SDH), an enzyme that regulates the production of gallic acid which plays a role in aflatoxin resistance were maintained in large pots in the greenhouse so they can be used to study gallic acid production in nuts and its role in insect and disease resistance. Transgenic trees expressing or silencing the polyphenol oxidase gene, thought to play a role in disease resistance and kernel color traits, were kept in large pots for use by Matt Escobar. Chandler trees expressing the cry1A(c) BT gene have shown good efficacy against codling
moth in previous USDA tests. They were grafted onto potted rootstock so they could be maintained

for future use, if desired, and trees in the UC field collection were removed.

Genomics

We are continuing to evaluate the oldest individuals of a population of Chandler x Idaho seedlings that we have been generating over the last six years. Data collected on this population, including leafing, flowering, and harvest dates, yield, disease, and insect resistance traits, and nut and kernel characteristics, will be critical to the success of the new walnut genomics initiative.

The parents were chosen to develop a very large seedling population that segregates for as many important traits as possible (kernel color, phenology, lateral bearing, shell appearance, protogyny/protandry, insect resistance, blight response, etc.). Trees from this cross will continue to be evaluated for horticultural traits as they mature over the next several years. Additional trees have been germinated from this year's cross will be planted in the spring. DNA from these trees will eventually be used to map each of the traits in the walnut genome and to develop markers for more efficient selection in breeding.

Germplasm resources and maintenance

We continue to maintain a collection of in vitro germplasm for use by the Walnut Improvement Program, other cooperating researchers, and commercial labs and nurseries. Hartley microshoots were supplied throughout the year to the Kluepfel lab for use in a *Brenaria* research project and we supplied *in vitro* rooted microshoots to Kendra Baumgartner for use in developing screening methods for *Armillaria* resistance. Microshoots of modified gallic acid genotypes were propagated in support of completing analyses for the aflatoxin project and we continue to maintain a long-term *in vitro* nematode population for use in nematode resistance research by the Dandekar lab and others.

In cooperation with David Ellis and Maria Jenderek at the USDA-ARS cryopreservation facility at Ft. Collins, Colorado, we were able to successfully freeze Chandler somatic embryos in liquid nitrogen, recover viable embryos, and grow them out normally in culture. A set of Chandler somatic embryos is now stored in the USDA's long-term germplasm cryo-storage facility at Ft. Collins as a backup to our laboratory supply and to provide long-term storage without exposure to possible genetic changes that can occur during long-term culture. The frozen embryos will now be available from the USDA to other researcher on request. This year we continued the cryopreservation work using a set of RR4 paradox somatic embryos, one of the background genotypes used for the crown-gall transgenic work. We are also continuing to work with Ft. Collins to develop a reliable method for cryopreservation of shoot cultures for safe long-term storage.

For the second year, we also sent dormant field-grown buds of Chandler and Franquette to Ft. Collins as part of cryopreservation work designed to develop methods for backing up field material of important genotypes for protection from catastrophic disease or other events and in the interest of developing a long-term backup method for the USDA walnut collection at the National Clonal Germplasm Repository – Davis. These buds were used in tests to see if dormant walnut buds could survive the initial desiccation step generally used prior to the actual freezing, employing a procedure similar to that developed for cryo-storage of butternut. Following treatment of the buds at Ft. Collins, they were sent to Burchell Nursery which generously provided grafters and rootstock for the post-treatment viability testing. Results were encouraging and we plan to continue this work in cooperation with the USDA and Tom Burchell.

Table 1. Cultivar and Selection Evaluations at Davis (Spring 2008)

	Seedling or	Leafing		Pollen Shedding				Pistillate Bloom				
	Grafted	Date	DAP[a]	1st	Peak	Last	Abund.[b]	1st	Peak	Last	% Lateral	Yield[b]
Cultivars												
Payne	G	3/18	0	3/20	3/27	4/8	7	4/1	4/7	4/11	100	7
Hartley	G	4/3	16	4/5	4/14	4/28	5	4/19	4/24	4/29	0	5
Vina	G	3/25	7	3/28	4/6	4/17	8	4/11	4/15	4/20	100	8
Serr	G	3/18	0	3/20	3/28	4/3	7	3/31	4/3	4/9	100	6
Chandler	G	4/2	15	4/1	4/11	4/22	7	4/14	4/20	4/24	100	6
Howard	G	4/1	14	4/4	4/10	4/23	7	4/13	4/17	4/24	100	7
Tulare	G	3/31	13	4/4	4/12	4/27	7	4/12	4/17	4/24	100	7
R. Livermore	G	4/3	16	4/5	4/14	4/23	6	4/15	4/18	4/23	0	7
Sexton	G	3/21	3	3/24	4/1	4/10	6	4/1	4/6	4/13	100	8
Gillet	G	3/21	3	4/5	4/12	4/18	7	3/24	3/31	4/7	100	8
Forde	G	3/27	9	4/11	4/14	4/18	7	3/31	4/6	4/11	100	7
Selections												
59-124	G	3/15	-3	3/19	3/24	4/5	7	3/30	4/2	4/6	100	7
77-012	G	4/2	15	4/9	4/16	4/19	4	4/4	4/10	4/15	100	7
90-027-21	G	3/19	1	3/22	3/31	4/10	7	4/4	4/9	4/12	100	8
90-027-23	G	4/3	16	4/5	4/12	4/25	7	4/15	4/18	4/24	100	6
91-077-6	G	3/22	4	3/25	3/31	4/10	7	4/3	4/8	4/13	100	8
91-077-40	G	3/24	6	4/6	4/12	4/18	7	3/24	4/1	4/10	100	8
91-090-41	G	4/2	15	3/29	4/9	4/16	7	4/12	4/18	4/22	100	7
93-028-20	G	3/24	6	3/26	4/5	4/12	6	4/8	4/14	4/18	100	6
94-019-85	G	3/17	-1	3/21	3/27	4/8	6	3/29	4/4	4/11	100	6

[a]Days after Payne leafing date at Davis
[b]1=low, 9=high

Table 1. Cultivar and Selection Evaluations at Davis (Spring 2008) – (cont.)

	Seedling or	Leafing		Pollen Shedding				Pistillate Bloom				
	Grafted	Date	DAP[a]	1st	Peak	Last	Abund.[b]	1st	Peak	Last	% Lateral	Yield[b]
94-020-35	G	3/17	-1	3/21	3/30	4/9	8	4/1	4/7	4/12	100	7
95-007-13	G	3/18	0	3/24	3/30	4/15	8	4/5	4/8	4/12	100	7
95-011-14	G	3/17	-1	4/1	4/8	4/15	6	3/17	3/25	4/6	100	7
95-011-16	G	3/23	5	3/24	4/2	4/10	7	4/7	4/11	4/16	100	7
95-026-16	G	3/23	5	4/8	4/13	4/18	6	3/26	4/5	4/10	100	7
95-026-22	G	3/24	6	3/24	4/3	4/14	7	4/10	4/13	4/17	100	7
96-013-13	G	3/22	4	4/10	4/14	4/17	3	3/24	3/28	4/8	100	7
97-003-11	G	3/22	4	3/28	4/6	4/19	7	4/5	4/10	4/17	100	5
97-003-23	G	4/2	15	4/10	4/13	4/16	2	4/14	4/18	4/23	90	5
97-003-29	G	4/2	15	4/9	4/14	5/2	7	4/17	4/23	4/26	100	5
97-003-40	G	3/31	13	4/12	4/20	4/26	3	4/8	4/10	4/13	100	5
97-003-65	G	3/22	4	3/25	4/2	4/7	3	4/6	4/9	4/12	100	6
00-005-30	S	3/18	0	4/6	4/13	4/18	5	3/21	3/29	4/5	100	7
00-005-149	S	3/24	6	4/10	4/15	4/18	7	3/26	4/3	4/10	100	8
00-006-48	S	4/7	20	4/7	4/13	4/19	5	4/17	4/21	4/26	100	6
00-011-107	S	4/2	15	4/9	4/14	4/17	2	4/5	4/11	4/17	100	7
01-009-14	S	4/7	20	4/7	4/13	4/17	7	4/10	4/17	4/23	100	8

[a]Days after Payne leafing date at Davis
[b]1=low, 9=high

Table 2. Cultivar and Selection Harvest Evaluations at Davis (Fall 2008)

		Harvest			Shell			Average Wt.					Color %			
	[a]Seedling or Graft	Date	[b]DAP	Seas Lgth	[c]Seal	[d]Strgth	Thick mm	Nut (g)	Kernel (g)	% Kernel	[e]Kernel Fill	[f]Ease of Removal	Extra Light	Light	Light Amber	Amber
Cultivars																
Payne	G	9/18	0	164	5	5	1.3	11.2	5.7	50.7	5	5	0	90	10	0
Hartley	G	10/6	18	165	5	6	1.4	14.1	6.4	45.5	4	5	10	80	10	0
Vina	G	9/23	5	161	5	5	1.3	13.8	7.2	52.4	5	5	0	30	70	0
Serr	G	9/19	1	169	5	5	1.1	14.4	8.5	59.0	6	5	10	80	10	0
Chandler	G	10/12	24	178	5	5	1.3	14.5	7.7	53.1	5	4	100	0	0	0
Howard	G	10/1	13	167	5	6	1.4	13.3	6.8	50.7	5	5	0	78	22	0
Tulare	G	10/3	15	169	5	5	1.2	15.4	8.7	56.5	5	4	0	100	0	0
R. Livermore	G	10/3	15	168	5	6	1.4	12.3	6.3	51.4	6	4			red	
Sexton	G	10/6	18	183	5	6	1.5	16.6	8.4	50.9	5	5	0	89	11	0
Gillet	G	9/20	2	173	4	5	1.4	15.3	7.6	50.0	5	5	22	78	0	0
Forde	G	10/8	20	185	5	5	1.4	14.9	8.2	55.0	5	5	60	40	0	0
Selections																
59-124	G	9/15	-3	166	5	6	1.4	16.9	9.0	53.5	6	5	0	100	0	0
77-012	G	9/22	4	165	5	5	1.3	12.6	6.1	48.9	5	5	20	80	0	0
90-027-21	G	9/19	1	163	5	6	1.3	14.6	7.0	48.3	4	5	0	40	60	0
90-027-23	G	9/23	5	158	5	5	1.2	16.0	8.3	52.1	5	5	0	90	10	0
91-077-6	G	9/19	1	164	4	5	1.3	18.7	10.7	57.2	5	5	0	30	70	0
91-077-40	G	10/5	17	187	5	6	1.5	16.4	8.3	50.4	6	6	10	80	10	0
91-090-41	G	9/27	9	162	4	4	1.1	15.1	9.1	60.1	5	5	0	100	0	0

[a] S = seedling, G= grafted
[b]="DAP" denotes "Days after Payne harvest at Davis
[c]=Shell seal: 3 - poor, 5 - good, 7 - very strong
[d]=Shell strength: 3 - poor, 5 - good, 7 - very strong
[e]=Kernel fill: 3 - poor, 7- well
[f]=Ease of Removal: 3 - easy, 7 - difficult

Table 2. Cultivar and Selection Harvest Evaluations at Davis (Fall 2008) – (cont.)

		Harvest			Shell			Average Wt.					Color %			
	[a]Seedling or Graft	Date	[b]DAP	Seas Lgth	[c]Seal	[d]Strgth	Thick mm	Nut (g)	Kernel (g)	% Kernel	[e]Kernel Fill	[f]Ease of Removal	Extra Light	Light	Light Amber	Amber
93-028-20	G	9/25	7	164	5	5	1.3	16.6	9.2	55.2	5	5	10	90	0	0
94-019-85	G	9/18	0	167	5	5	1.1	15.2	8.9	58.2	5	5	11	78	11	0
94-020-35	G	9/24	6	170	5	6	1.3	17.3	8.8	50.9	6	7	0	100	0	0
95-007-13	G	9/15	-3	160	5	5	1.2	17.1	9.7	56.9	5	5	0	100	0	0
95-011-14	G	9/14	-4	173	5	5	1.2	13.6	7.9	58.6	5	5	80	20	0	0
95-011-16	G	9/24	6	166	5	5	1.3	16.0	9.1	56.9	5	5	90	10	0	0
95-026-16	G	9/19	1	167	6	6	1.4	14.8	7.4	50.2	6	5	10	80	10	0
95-026-22	G	9/22	4	162	6	7	1.7	18.5	9.3	50.3	6	6	10	80	10	0
96-013-13	G	9/30	12	186	5	6	1.4	14.9	7.8	52.2	5	4	0	60	40	0
97-003-11	G	10/4	16	177	4	5	1.2	16.5	10.0	60.4	6	5	0	100	0	0
97-003-23	G	10/6	18	171	5	5	1.2	14.9	8.1	54.5	4	4	50	50	0	0
97-003-29	G	10/4	16	164	6	7	1.8	20.1	9.2	45.9	6	5	0	50	50	0
97-003-40	G	10/3	15	176	5	6	1.4	19.0	8.9	46.8	6	5	25	75	0	0
97-003-65	G	10/1	13	175	5	6	1.4	17.3	9.5	54.5	5	5	0	89	11	0
98-001-442	G	10/2	14		5	6	1.5	19.8	9.9	50.2	5	5	0	44	56	0
98-003-54	G	9/30	12		5	6	1.4	18.3	8.8	48.0	5	5	100	0	0	0
00-005-30	S	9/11	-7	166	5	6	1.3	16.9	9.0	53.3	5	4	0	78	22	0
00-005-149	S	9/11	-7	161	4	5	1.3	14.8	8.1	54.4	5	5	0	44	56	0
00-006-48	S	9/30	12	162	5	5	1.3	15.2	8.0	52.6	6	5	90	0	10	0
00-011-107	S	9/18	0	160	5	5	1.3	15.0	8.0	53.4	4	3	30	60	10	0
01-009-14	S	9/16	-2	152	4	4	1.2	15.3	7.8	51.4	4	3	0	80	20	0

[a] S = seedling, G= grafted
[b]="DAP" denotes "Days after Payne harvest at Davis
[c]=Shell seal: 3 - poor, 5 - good, 7 - very strong
[d]=Shell strength: 3 - poor, 5 - good, 7 - very strong
[e]=Kernel fill: 3 - poor, 7- well
[f]=Ease of Removal: 3 - easy, 7 - difficult

Table 2. Cultivar and Selection Harvest Evaluations at Davis (Fall 2008) – (cont.)

[a]Seedling or Graft	Harvest			Shell			Average Wt.					Color %			
	Date	[b]DAP	Seas Lgth	[c]Seal	[d]Strgth	Thick mm	Nut (g)	Kernel (g)	% Kernel	[e]Kernel Fill	[f]Ease of Removal	Extra Light	Light	Light Amber	Amber

[a] S = seedling, G= grafted
[b]="DAP" denotes "Days after Payne harvest at Davis
[c]=Shell seal: 3 - poor, 5 - good, 7 - very strong
[d]=Shell strength: 3 - poor, 5 - good, 7 - very strong
[e]=Kernel fill: 3 - poor, 7- well
[f]=Ease of Removal: 3 - easy, 7 - difficult

Table 3. 2008 UCD Cultivar/Selection Evaluations by Diamond Walnut Growers Inc.

Cultivar	Location	Sample Wt	# Nuts per sample	Avg nut wt (g)	% Large	% Med	% Baby	% Large Sound	% Stain	% Broken	% Adh Hull	% External Damage
Payne	Chico	710	64	11.09	100.0%	0.0%	0.0%	97.2%	0.0%	0.0%	3.1%	3.1%
Serr	KAC	1001	79	12.67	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Tulare	KAC	1000	68	14.71	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Howard	Stolp	1000	74	13.51	97.3%	1.4%	1.4%	93.0%	0.0%	0.0%	1.4%	1.4%
Chandler	Davis	1001	77	13.00	100.0%	0.0%	0.0%	98.7%	0.0%	0.0%	0.0%	0.0%
Chandler	Chico	1000	97	10.31	97.9%	2.1%	0.0%	99.2%	0.0%	0.0%	0.0%	0.0%
Chandler	KAC	1000	88	11.36	95.5%	4.5%	0.0%	95.3%	0.0%	0.0%	0.0%	0.0%
Chandler	S505	1000	73	13.70	100.0%	0.0%	0.0%	98.9%	0.0%	1.4%	0.0%	1.4%
Sexton	Davis	1001	61	16.41	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Sexton	Chico	1002	89	11.26	98.9%	1.1%	0.0%	99.4%	0.0%	0.0%	0.0%	0.0%
Sexton	KAC	1002	74	13.54	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Gillet	Chico	1000	74	13.51	100.0%	0.0%	0.0%	98.8%	0.0%	0.0%	0.0%	0.0%
Gillet	KAC	1003	62	16.18	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Gillet	S505	1000	78	12.82	100.0%	0.0%	0.0%	97.6%	0.0%	0.0%	0.0%	0.0%
Forde	Davis	1000	69	14.49	100.0%	0.0%	0.0%	99.3%	0.0%	0.0%	0.0%	0.0%
Forde	Chico	1003	81	12.38	93.8%	3.7%	2.5%	94.6%	1.2%	0.0%	0.0%	1.2%

Table 3. 2008 UCD Cultivar/Selection Evaluations by Diamond Walnut Growers Inc.

Cultivar	Location	Sample Wt	# Nuts per sample	Avg nut wt (g)	% Large	% Med	% Baby	% Large Sound	% Stain	% Broken	% Adh Hull	% External Damage
Forde	KAC	1001	62	16.15	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Forde	S505	1003	62	16.18	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Forde	Stolp	1002	84	11.93	100.0%	0.0%	0.0%	89.2%	1.2%	0.0%	1.2%	2.4%
91-77-6	Davis	1001	62	16.15	100.0%	0.0%	0.0%	97.1%	0.0%	0.0%	0.0%	0.0%
91-77-6	KAC	980	67	14.63	100.0%	0.0%	0.0%	95.9%	1.5%	1.5%	0.0%	3.0%
93-26-6	KAC	1001	56	17.88	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
94-19-85	Chico	1003	79	12.70	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
94-19-85	KAC	1003	68	14.75	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
95-007-13	Davis	1000	66	15.15	100.0%	0.0%	0.0%	99.4%	0.0%	0.0%	0.0%	0.0%
95-007-13	Chico	1000	68	14.71	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
95-007-13	KAC	1001	63	15.89	100.0%	0.0%	0.0%	97.8%	0.0%	0.0%	1.6%	1.6%
95-007-13	S505	1002	68	14.74	100.0%	0.0%	0.0%	97.9%	0.0%	0.0%	0.0%	0.0%
95-11-14	Davis	1001	74	13.53	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
95-11-14	Chico	1000	96	10.42	97.9%	2.1%	0.0%	96.8%	0.0%	0.0%	0.0%	0.0%
95-11-14	KAC	1001	77	13.00	100.0%	0.0%	0.0%	98.3%	0.0%	0.0%	0.0%	0.0%
95-11-14	S505	1002	79	12.68	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
95-11-16	S505	1000	70	14.29	100.0%	0.0%	0.0%	99.3%	0.0%	0.0%	0.0%	0.0%

Table 3. 2008 UCD Cultivar/Selection Evaluations by Diamond Walnut Growers Inc.

Cultivar	Location	% Insect	% Mold	% Shrivel	% Offgrade	% Edible Yield	% Total Yield	Extra Light	Light	Light Amber	Amber	RLI	Relative Value
Payne	Chico	0.0%	0.0%	0.0%	0.0%	53.8%	53.8%	31.4%	50.3%	15.4%	2.9%	53.0	1.04
Serr	KAC	0.0%	0.0%	0.0%	0.0%	57.3%	57.3%	48.1%	36.6%	11.7%	3.7%	54.4	1.14
Tulare	KAC	0.0%	0.0%	0.0%	0.0%	54.1%	54.1%	11.3%	75.2%	10.2%	3.3%	50.8	1.00
Howard	Stolp	1.4%	2.7%	0.0%	4.0%	48.2%	50.2%	24.9%	33.0%	37.3%	4.8%	51.3	0.90
Chandler	Davis	1.3%	0.0%	0.0%	1.2%	50.5%	51.1%	97.6%	2.4%	0.0%	0.0%	60.0	1.10
Chandler	Chico	0.0%	0.0%	0.0%	0.0%	54.0%	54.0%	54.6%	45.4%	0.0%	0.0%	54.5	1.07
Chandler	KAC	0.0%	0.0%	2.3%	0.4%	48.4%	48.6%	54.3%	22.7%	19.8%	3.1%	54.8	0.97
Chandler	S505	0.0%	0.0%	0.0%	0.0%	48.0%	48.0%	83.3%	10.6%	6.0%	0.0%	55.6	0.97
Sexton	Davis	0.0%	0.0%	0.0%	0.0%	51.4%	51.4%	83.3%	11.1%	5.6%	0.0%	57.3	1.07
Sexton	Chico	0.0%	0.0%	0.0%	0.0%	55.9%	55.9%	70.7%	18.8%	10.5%	0.0%	56.5	1.15
Sexton	KAC	0.0%	0.0%	0.0%	0.0%	55.5%	55.5%	18.5%	39.0%	21.6%	20.9%	49.2	0.99
Gillet	Chico	0.0%	1.4%	0.0%	1.0%	51.9%	52.4%	74.4%	17.7%	6.0%	1.9%	54.7	1.03
Gillet	KAC	0.0%	0.0%	0.0%	0.0%	49.8%	49.8%	0.0%	14.0%	23.4%	62.5%	45.3	0.82
Gillet	S505	0.0%	2.6%	0.0%	2.3%	54.4%	55.7%	45.2%	31.6%	16.7%	6.4%	54.3	1.08
Forde	Davis	0.0%	0.0%	1.4%	0.2%	54.4%	54.5%	94.3%	3.5%	2.2%	0.0%	60.3	1.19
Forde	Chico	0.0%	0.0%	0.0%	0.0%	53.2%	53.2%	68.0%	22.5%	9.6%	0.0%	57.1	1.11

Table 3. 2008 UCD Cultivar/Selection Evaluations by Diamond Walnut Growers Inc.

Cultivar	Location	% Insect	% Mold	% Shrivel	% Offgrade	% Edible Yield	% Total Yield	Extra Light	Light	Light Amber	Amber	RLI	Relative Value
Forde	KAC	0.0%	0.0%	0.0%	0.0%	51.4%	51.4%	61.9%	25.2%	9.7%	3.1%	54.3	1.02
Forde	S505	0.0%	0.0%	0.0%	0.0%	51.0%	51.0%	86.9%	4.3%	8.8%	0.0%	58.5	1.09
Forde	Stolp	0.0%	13.1%	0.0%	12.6%	49.9%	57.1%	72.4%	15.8%	11.8%	0.0%	54.8	1.00
91-77-6	Davis	0.0%	0.0%	6.5%	0.7%	54.7%	55.1%	47.6%	40.0%	9.7%	2.7%	53.7	1.07
91-77-6	KAC	0.0%	0.0%	1.5%	0.2%	60.3%	60.4%	28.6%	29.3%	27.1%	15.1%	51.6	1.13
93-26-6	KAC	0.0%	0.0%	0.0%	0.0%	48.9%	48.9%	7.6%	20.9%	37.0%	34.6%	48.3	0.86
94-19-85	Chico	0.0%	0.0%	0.0%	0.0%	50.7%	50.7%	70.3%	21.2%	8.4%	0.0%	54.4	1.00
94-19-85	KAC	0.0%	0.0%	0.0%	0.0%	55.5%	55.5%	26.8%	39.3%	27.1%	6.8%	49.9	1.01
95-007-13	Davis	0.0%	0.0%	1.5%	0.4%	55.9%	56.1%	82.3%	14.1%	3.0%	0.5%	55.4	1.13
95-007-13	Chico	0.0%	0.0%	0.0%	0.0%	57.6%	57.6%	64.9%	21.0%	10.6%	3.5%	52.6	1.10
95-007-13	KAC	0.0%	0.0%	4.8%	0.6%	53.2%	53.5%	21.6%	58.3%	15.0%	5.1%	51.0	0.99
95-007-13	S505	1.5%	0.0%	1.5%	1.8%	53.2%	54.2%	64.9%	23.1%	9.0%	3.0%	54.4	1.05
95-11-14	Davis	0.0%	0.0%	0.0%	0.0%	57.4%	57.4%	39.1%	50.4%	8.7%	1.7%	54.4	1.14
95-11-14	Chico	0.0%	0.0%	2.1%	0.2%	57.5%	57.6%	53.6%	30.8%	15.7%	0.0%	54.3	1.14
95-11-14	KAC	1.3%	0.0%	1.3%	1.6%	53.8%	54.7%	23.9%	58.1%	14.5%	3.5%	54.4	1.07
95-11-14	S505	0.0%	0.0%	0.0%	0.0%	57.3%	57.3%	83.4%	13.8%	2.8%	0.0%	57.4	1.20
95-11-16	S505	0.0%	0.0%	1.4%	0.2%	52.7%	52.8%	70.8%	15.0%	11.8%	2.5%	57.5	1.10

Table 4. Male and female bloom dates at UC Davis, 2008. (In order of harvest date.)

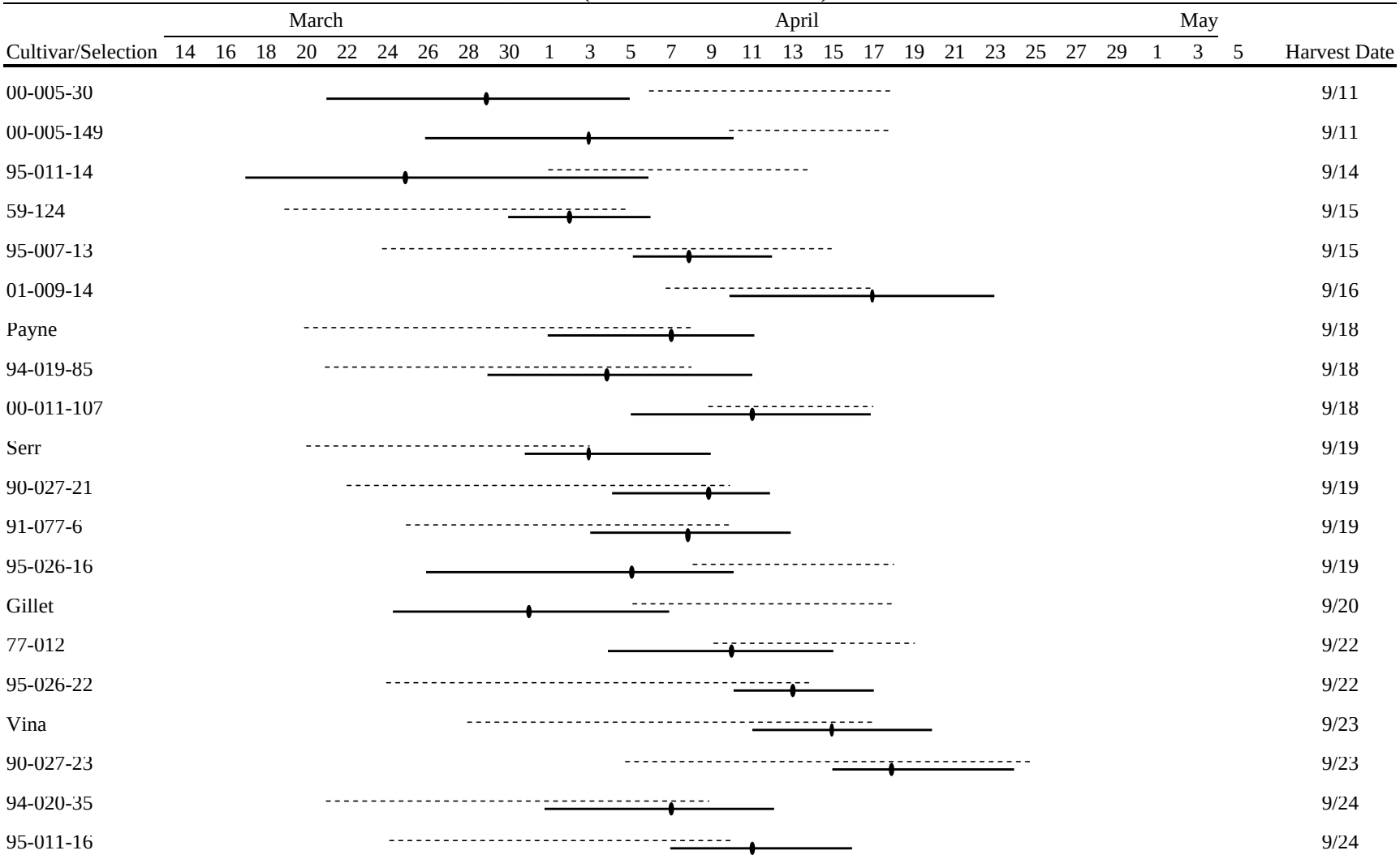
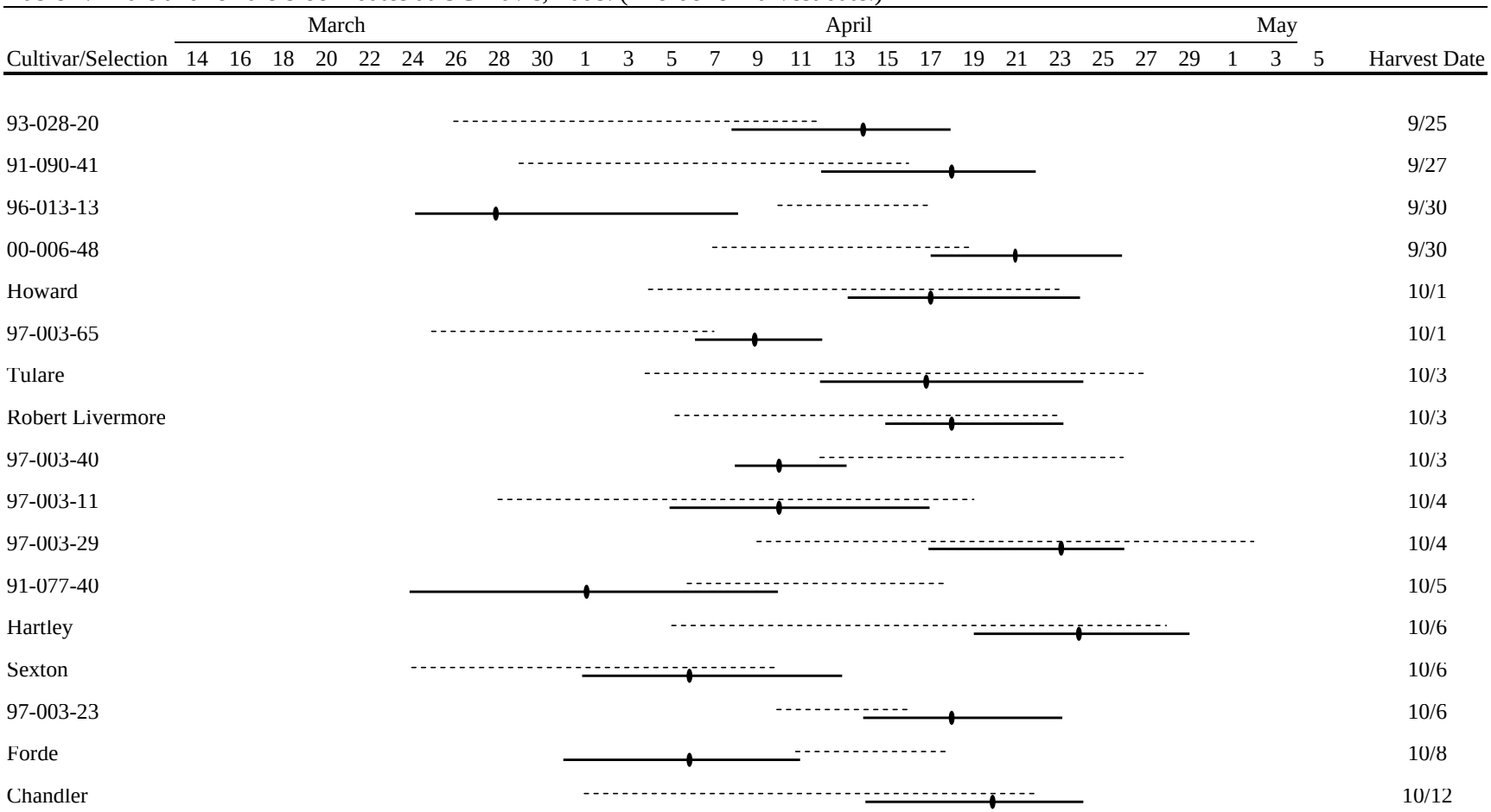


Table 4. Male and female bloom dates at UC Davis, 2008. (In order of harvest date.)



Male Bloom ----------
Female Bloom_____

Description of Selections 2008. (*indicates most promising, indent indicates probable discard)

Sexton (90-031-10) (Chandler x 85-008) (selected 2000): Kernels of this very precocious offspring of a Chandler x Chinese cross average 8.5 g. Color has been very good most years averaging 16% extra light. Nuts have smooth, round, solid shells and yield 53% kernel. Shells and seals can be weak in younger trees but have been good as trees mature. The tree leafs about a week after Payne and harvests a week before Chandler. Yields continue to be excellent with little blight observed most years. Tree tends to have neck buds and narrowly forked branches. Pruning will be needed to set tree structure and to prevent possible stunting from early over-cropping. It maybe suitable for hedgerows where limb structure is less critical, heavy early yield is an objective, and limited tree size is an advantage. Its pollen shed overlaps the female bloom very well and it can have some 2nd flowering like Chico, resulting in some small and late harvesting nuts. Released 2004. (Trials: Deseret, Lang, Conant, Sierra Gold, Scheuring, Grunder, Crane, Driver, Crane Jr., Modesto JC, Swall, Taylor)

Gillet (95-022-26) (76-80 x Chico) (selected 2002): This protogynous selection has excellent yield, 7.9 g kernels, and harvests mid-season, about two weeks earlier than Chandler. Nuts average 51% kernel and yield halves easily. Kernels have excellent color, little shrivel and few veins or blanks. Seals and shell strength appear adequate but may not be sufficiently strong for in-shell use. Seals should be watched, particularly in young trees. This is a large and vigorous tree that has had very little blight. Watch for a possibility of alternate bearing. Released 2004. (Trials: Conant, Scheuring, Grunder, Crane Jr., Modesto JC, Swall, Taylor)

Forde (95-026-37) (Lara x Chico) (selected 2001): This selection has had great color and excellent yield but harvests very close to Chandler. It has large, plump 8.5 g kernels, protogynous bearing habit, and 53% kernel yield. This is a large vigorous tree with little blight. Its strength, seal, fill, plumpness, percent kernel, and yield on young trees are better than Chandler and kernels show an absence of shrivel. Its protogynous flowering suggests its additional potential as a pollenizer for Chandler. Released 2004. (Trials: Conant, Driver, Scheuring, Grunder, Modesto JC, Crane Jr., Swall, Stolp, Taylor)

90-027-21 (Tulare x Sinensis #5) (selected 1998): We are interested in this selection for its apparent resistance to boron. Yield has been consistently good to excellent and nuts are suitable for use as an early in-shell. It is a protandrous, upright, vigorous tree that leafs out and harvests close to Payne. The shells are strong, well sealed, and shaped like Vina. Nuts yield only 48% kernel and kernels average 6.9 g. Kernel color has been mostly light but not excellent. Blight has been severe on unsprayed trees in wet years but little blight has been observed in sprayed blocks even though it leafs early. Nuts tend to have a white interior lining on the shell, sometimes don't fill well at the blossom end, and have packing tissue with a rather woody center. Tree is upright and branchy with a dense canopy and is likely easy to train. Kernel weight and percent are concerns but this selection continues to produce excellent yields. Possible discard. 2003 (Trials: Deseret, Stuke, Conant, Deardorff, Scheuring)

90-027-23 (Tulare x Sinensis #5) (selected 1998): This short-season sibling of the previous selection leafs out close to Chandler but harvests about two weeks earlier. It exhibits good shell strength and kernel color. Kernels average 7.6 g and nuts average 52% kernel. Nuts are Vina shaped and have a striped appearance. This is a vigorous, thrifty tree that consistently harvests about a week after Payne with good yield. (Trials: Deseret, Stuke, Conant, Deardorff, Carriere)

91-077-6 (Howard x 85-008) (selected 2000): This protandrous tree harvests close to Payne time but leafs about a week later than Payne. Yield has frequently been huge on this precocious selection. The large 8.9 g kernels have shown consistently good color with easy removal of halves. The large, round, smooth-shelled nuts average 56% kernel but shell strength and seal may prove insufficient and it shows problems with incomplete shells that continue to some extent even after trees are fully mature, and has frequently exhibited problems with sunburn or black nuts. Definitely not for in-shell use and shows boron sensitivity, but could be used as a high yield early cracking selection. (Trials: Conant, Sierra Gold, Scheuring, Bonturi, Deardorff)

91-077-40 (Howard x 85-008) (selected 2001): This is a rather small tree characterized by precocity, outstanding yield, protogynous bearing habit, and large kernels averaging 8.1 g. Color continues to show a pattern of excellence at Davis but not at other locations. Nuts are well sealed with 51% kernel and strong shells. Harvest averages a week before Chandler and yields have been consistently huge but there can be some second bloom and variable nut size. The large yields can stall growth. This selection may be of interest under power lines or in hedgerows.

***91-090-41** (87-009 x Chandler) (selected 1999): This mid-season selection is notable for its light color, particularly relative to other selections in locations with generally poor color. It has an attractive shell appearance and growth appears to be upright. The nuts have thin shells and average 58% kernel. Seals and strength are not adequate for in-shell use. Yields have consistently been very strong, and color of the 8.0 g kernels has been mostly light to extra-light with easy recovery of halves. Harvest is about two weeks before Chandler and blight has been low. Grower comments, our evaluation data, and Diamond data, suggest consideration for release but shells and seals are rather weak in many cases and remain a concern. (Trials: Deseret, Stuke, Conant, Sierra Gold, Deardorff,)

92-070-12 (Soleze x Chandler) (selected 1999): Attributes of this selection include excellent kernel color, easy removal of halves, excellent shell appearance, 7.3 g kernels, and 54% kernel yield. This selection harvests about a week earlier than Chandler and the blight incidence has been low. Shells are very smooth textured and light colored but the seals and shell strength are rather weak and kernels consistently exhibit some Chandler-like tip shrivel. Great nut appearance and very high value scores from Diamond crackout in multiple years and locations. Nut size is larger and more consistent than Chandler with a greater percent kernel, fewer small nuts, and an earlier harvest date. Possible discard 2003. (Trials: Deseret, Stuke, Conant, Deardorff, Crane Jr.)

93-026-6 (Chandler x Sinensis #5) (selected 2001): Good yield with harvest averaging about a week after Payne or two weeks before Chandler. This protogynous selection has large Hartley-shaped nuts with solid shells and seals that yield 50 % kernel. The large 8.7 g kernels have had mostly light to extra light color. Stem end holes should be watched but have been mostly acceptable. Although rather Hartley-shaped and large, the shells can be irregular and are probably not be consistent enough in appearance for in-shell use. Veins and tip shrivel are consistent defects. (Trials: Driver, Deseret, Stuke, Crain, Conant, Noreen, Sierra Gold, Scheuring)

***93-028-20** (Chandler x PI 159568) (selected 2001): This selection should be considered for use as a mid-season in-shell competitor with Hartley. It has Tulare timing with large, oval, very attractive nuts. It leafs a few days before Chandler but harvests about two weeks earlier with good yield and has had little blight. The smooth, attractive, very solid shells have good seals and 55% kernel. The very plump, Sunland-shaped kernels average 8.9 g and kernel color is excellent. (Trials: Conant, Sierra Gold, Spanfelner)

94-019-29 (Vina x 67-013) (selected 2001): This tree was selected for its great yield, harvest 2 weeks before Chandler, and shell traits suitable for in-shell use. Kernel color has been excellent but shells have been dark in some cases. This tree has shown severe blight susceptibility when not sprayed but has been blight free in selection blocks. Tree is upright and vigorous. Nuts average 53% kernel and average kernel size is 8.0 g. (Trials: Noreen)

94-019-45 (Vina x 67-013) (selected 2001): A large, vigorous, branchy, and heavy cropping selection with moderate blight susceptibility and 8.0 g kernels. Leafing date is similar to Chandler but it harvests early to mid-season with nut traits suitable for in-shell use. Nuts yield 53% kernel. Color has been good but shrivel is a concern some years and harvest date may be spread out. (Trials: Conant)

94-019-85 (Vina x 67-013) (selected 2001): This selection could serve as an early Hartley with a harvest date similar to Payne and a Hartley-shaped nut. Kernel color has been good at Davis and was generally good this year but has shown problems at KAC and Chico in the past. The shell is thin and a bit rough but has relatively good strength, resembling Serr in this regard. Yield has been good, nuts contain 59% kernel with easy halves, and kernels average 8.5 g. Consider for release as an early variety. Watch the yield and color consistency. Continue to watch. (Trials: Bonturi)

94-020-28 (Vina x PI159568) (selected 2005): This protandrous potential in-shell selection has Payne-time harvest date with good yield. The nuts contain 54% kernel and have a smooth, attractive shell that yields easy halves. The very plump kernels average 8.3 g with mostly good color but it has also had some bad years. Trees in selection blocks are still young. Watch for blanks and degree of lateral bearing

94-020-35 (Vina x PI159568) (selected 2001): This early in-shell selection harvests within a few days of Payne with moderate blight and good yield. Shells are very solid and have excellent strength for in-shell use but are pointed and have a rough inner surface, which along with excellent fill, may impede halves. Kernels average 8.2 g with generally light color. Nuts are long and oval like Sunland and the thick shell accounts for nuts averaging only 49% kernel. Tree appears to have a spreading weepy or willowy growth habit. (Trials: Stolp, Moore, Conant, Sierra Gold)

***95-007-13** (77-012 x Serr) (selected 2001): This Serr seedling harvests at Payne time, with good yield. The nuts have a solid, attractive shell, and kernels have generally good color, but can be a bit veiny. The well-filled nuts yield 53% kernel with easy halves and kernels average 8.4 g. The seals appear adequate and the shells have an attractive appearance but can be a bit rough in some cases. New foliage has been noted to have a wilting appearance in late summer at some locations. This could be an early-harvest cracking variety. Continue to evaluate it in selection blocks and grower trials. (Trials: Stuke, Conant, Scheuring)

***95-011-14** (67-013 x Chico) (selected 2001): This protogynous selection will likely be released as an early-harvest cracking variety. It harvests with, or before, Payne and is characterized by great yield, smooth shells with excellent color and appearance, and mostly Chandler-like extra light kernels averaging 7.7 g. It may have sufficient shell strength for in-shell use but the seals should be watched and nut size is not large. Nuts yield 57% kernel with very easy removal of halves. Kernel quality and harvest date are excellent. This selection has shown some summer heat damage to the foliage and some summer nut drop. Watch for susceptibility to blight and summer heat stressed black nuts. (Trials: Sierra Gold, Scheuring, Conant, Moore, Bonturi, Spanfelner)

95-011-15 (67-013 x Chico) (selected 2001): Another selection with very good yield and kernel color, this tree has a solid shell and seal suitable for in-shell use but doesn't have the shell appearance of its above sibling. The harvest date is about a week before Chandler and nuts average 52% kernel. Nuts are sometimes not well-filled and can have a thick leathery packing tissue. Kernels are not plump and average 7.4 g. but color has been mostly light to extra light. Blight is a serious concern when unsprayed. (Trial: Sierra Gold)

95-011-16 (67-013 x Chico) (selected 2003): This protandrous early in-shell selection harvests about a week after Payne and ahead of Vina. It has large, light colored kernels that average 8.1 g. Nuts have very solid, attractive, oval shells that give 55% kernel. It has a tendency to tip shrivel. Yield is mostly good but watch the variation. (Trials: Scheuring)

95-011-22 (67-013 x Chico) (selected 2001): A high yielding selection with mostly light to extra light kernels and a mid-season harvest date. Nuts have 54% kernel with shell and seal strength suitable for in-shell use. Nut size is a concern. Kernels average 7.1 g but have declined noticeably as trees have aged. (Trials: Conant)

95-013-12 (Vina x Howard) (selected 2003): Selected as an early in-shell possibility, this tree produces good yield close to Payne harvest time. The large, attractive nuts have a rounded Vina or Hartley shape and a very solid shell and yield halves easily but average only 47% kernel. Large, light kernels average 8.4 g. Consider as a lateral bearing, earlier harvesting Hartley replacement.

95-018-23 (Tulare x Chandler) (selected 2003): Excellent yield of mostly extra light kernels and harvests less than a week after Payne. This is a short season selection that leafs after Chandler and has low blight. Shells are thin and have insufficient strength for in-shell use. Nuts yield 51% kernel and easy halves but fill is poor and kernels average only 7.1 g. (Trials: Scheuring, Carriere)

95-026-16 (Lara x Chico) (selected 2003): This protogynous selection harvests with Payne or earlier and has very good kernel color and little blight. Nuts yield 52% kernel and have solid shells and seals. Kernels have averaged only 7.2 g. This could be an early in-shell selection but nut size and consistency of yield are still concerns. We will continue to watch this in the selection blocks where nuts on younger grafted trees are averaging 8.1g. (Trials: Scheuring)

95-026-22 (Lara x Chico) (selected 2001): This protandrous tree harvests mid-season with a very strong shell and seal and good nut size. Kernels average 8.8 g and nuts yield 48% kernel. Kernels have generally been large, shiny, and light. Blight incidence has remained very low. The rough textured shells are very solid and can have inner roughness as well. If nuts are too well filled, kernels can be difficult to remove in halves. This tree continues to have good nut size and yield. (Trials: Conant, Scheuring, Sierra Gold, Carriere, Taylor, Stuke)

96-013-13 (Howard x Chico) (selected 2003): This protogynous tree was selected for its excellent yield, light kernel color, good shell appearance, and mid-season harvest. It had better yield than Tulare trees around it as a seedling, an equivalent harvest date, and better color. The light colored, smooth, attractive shells have been solid and adequate for in-shell use most years. Nuts give 54% kernel but kernels average only 6.9 g and are averaging only 7.6g on young trees in a selection block.

97-003-11 (Tulare x Mixed Chinese – Phase II) (selected 2004): Selected for its mid-season harvest, strong yield, Chandler leafing date, and very large, very plump, light colored kernels averaging 9.5 g. The large well-filled nuts yield 57% kernel. Shells are rough and seals should be watched.

97-003-23 (Tulare x Mixed Chinese – Phase II) (selected 2005): This is has a mid-season harvest. Nuts have a very attractive smooth and light colored shell and give 52% kernel. Kernels have excellent color and easy removal but have averaged only 7.3 g. Continue to watch in selection block.

97-003-40 (Tulare x Mixed Chinese – Phase II) (selected 2005): This is a protogynous mid-season selection with good yield. Nuts have a very solid strong shell and seal resulting in only 48% kernel. Color of the 7.4 g kernels has been good.

97-003-46 (Tulare x Mixed Chinese – Phase II) (selected 2005): This selection harvest very early, approximately with Payne and has large plump 8.6 g kernels with good color and easy removal. Shell strength and seal are probably not good enough or in-shell use. Nuts average 58% kernel.

97-003-65 (Tulare x Mixed Chinese – Phase II) (selected 2005): This selection has excellent color and large 8.3 g kernels with solid shells and 52% kernel but the harvest time may be too close to Chandler, yield needs to be watched further, and it has shown a tendency to produce blanks.

97-003-79 (Tulare x Mixed Chinese – Phase II) (selected 2005): This is a protandrous mid-season selection with exceptionally large 10.2 g kernels, smooth shells, and good yield. Removal of halves is very easy and the shells are solid, yielding 55% kernel. Kernel color may not be adequate. (Trial: Sierra Gold)

97-003-96 (Tulare x Mixed Chinese – Phase II) (selected 2005): This selection harvests about ten days after Payne. Nuts have a solid shell and seal with 51% kernel. The kernel color has been very good and kernels average 7.8 g. Pay attention to veins and watch this on rootstock. (Trial: Sierra Gold)

00-005-30 (59-124 x O.P.) (selected 2007): This large vigorous selection harvests several days earlier than Payne with good yield. The large, plump 9.8g kernels are easily removed in halves and are generally light. The tree has a protogynous bloom habit and nuts yield 55% kernel.

00-005-149 (59-124 x O.P.) (selected 2007): This protogynous selection harvests with Payne but leafs out about a week later. Yields have been consistently huge. The round, smooth-textured nuts average 56% kernel. The 8.6g kernels are plump but color has been inconsistent and perhaps too dark. Gale calls it “Gale’s Caramel” because of its color.

00-006-48 (76-080 x O.P.): This is a late leafing and relatively late harvesting selection with excellent kernel color. It leafs about a week after Chandler and harvests about a week earlier. Nuts yield 53% kernel and the kernel color is consistently outstanding but kernel weights have averaged only 7.6g and yield needs to be watched further. This one is for Lake County.

00-011-107 (Howard x O.P.): This protogynous selection harvests within a week of Payne with excellent yield but leafs approximately with Chandler. Nuts have light colored shells and yield 51% kernel. Kernels average 7.8g, have excellent color, and are easily removed in halves.

01-009-14 (91-094-18 x 91-007-6): This very small and very precocious tree produces huge yields that harvest at Payne time. Nuts give 55% kernel but kernels average only 7.2g and both color and seals need to be watched. This selection needs to be grafted and evaluated further on rootstock.