

DRIED PLUM CULTIVAR DEVELOPMENT AND EVALUATION

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INTRODUCTION

California is the world leader in dried plum production, but is almost entirely dependent on the use of a single cultivar, the Improved French prune. This monoclonal situation lends itself to vulnerability to widespread disease, pest outbreaks and annual, statewide variations in yield caused by variable weather conditions that can negatively or positively affect fruit set and/or fruit retention. In addition to the risks of a monoculture system, the entire industry harvests and dehydrates the crop within a few weeks since the entire crop has a similar developmental pattern. The development of new, acceptable or superior, dried plum cultivars will increase the efficiency of California dried plum production and give some protection against the risks involved with a monoculture. The California dried plum industry is also facing increasing marketing competition from other regions of the world and must seek ways to reduce production costs to stay competitive. Thus the industry would also benefit from the development of new dried plum cultivars that have cost saving characteristics such as improved tree structure that would require less pruning, improved fruit dry matter content that would decrease drying costs, and increased tolerance to pests and diseases. Introducing new dried plums that differ in flavor or color could also promote a broadening of the consumer base.

The Dried Plum (*Prunus domestica*) Development and Evaluation program has enlarged its germplasm and bred new generations of progeny through traditional horticultural breeding methods since its conception in 1985. Through twenty-eight years of evaluation and selection, the breeding program has increased the occurrence of desired characteristics in the germplasm. To insure that the germplasm and new cultivars are well adapted to California's dry, hot climate, the program evaluates elite selections at two locations; the UC Wolfskill Experimental Orchards, near Winters, in the north; and the Kearney Ag Center, near Parlier, in the southern San Joaquin Valley. The breeding program has matured and is now entering what we anticipate to be a very productive period for producing potential new cultivars that are specifically adapted for California growing conditions and markets.

In recent years we have increased our focus on tree and fruit characteristics that will be particularly helpful in reducing grower costs while improving the dried fruit products. To this end we have put a greater emphasis on evaluating tree structure and fresh fruit characteristics that may influence dry-away ratios and ease of dried fruit handling.

In several years during the last decade dried plum orchard yields have been down because of poor weather conditions for fruit set during the bloom period. We believe that this has been largely due to high temperatures during bloom. Since the California industry is composed of one cultivar, the whole industry suffered with poor crops during those years of heat during bloom. Because the critical time of pollination is so important we have increased the evaluation of our seedlings and selections for differences in bloom date. In doing so, new cultivars can potentially introduce greater diversity of bloom timing so that the entire Californian crop will not be dependent on the same set of weather conditions during periods critical for fruit set and retention.

PROGRAM OBJECTIVES

Objectives:

- 1.) To develop new dried plum varieties, through traditional horticultural breeding methods, with the following characteristics:
 - Tree characteristics that reduce labor costs involved in producing dried plums.
 - Increased fruit quality and fruit characteristics that increase efficiency and quality of drying and processing.
 - Earlier or later bloom dates and tolerance to high temperatures during bloom.
 - Earlier/later fruit maturity dates than “Improved French” dried plum..
 - Increased tolerance/resistance to disease.
 - New specialty traits; with the dried product being equal or improved in quality to “Improved French”, but different in taste and/or color.
- 2.) Test and evaluate advanced selections resulting from the current breeding program at UC and grower locations in the Sacramento and San Joaquin Valleys.
- 3.) Cooperate in the FasTrack SCRI research project lead by Dr. Ralph Scorza (USDA Kearneysville WV) to increase breeding efficiency for dried plums.

PROCEDURES

Breeding methods, pollination and seedling cultivation, and selection evaluation have not been substantially modified for several years. They were described in detail in the Dried Plum Cultivar Development and Evaluation annual report in the 2004 Prune Research Reports published by the California Dried Plum Board. The following is a brief description of our testing and evaluation procedures as a reference for the Results section of this report.

Levels of Testing

Field testing and evaluation of dried plum selections developed within this program are being carried out at four levels.

Level 1 testing involves evaluations made in the seedling blocks located at UC Davis. The initial fruit evaluation is made on the original self-rooted seedlings in the high density seedling blocks. Fresh and dried fruit characteristics are evaluated at this level of testing. If a positive evaluation results, the seedling becomes a “selection” and is then considered for re-propagation in dried plum selection blocks located at the Kearney Research and Extension Center in Parlier, CA and at the Wolfskill Experimental Orchards in Winters, CA.

Level 2 testing occurs in the selection blocks at Kearney and Wolfskill. Depending on the perceived potential of the individual selection, two to four trees of any one selection are established on commercial rootstocks. This level of testing is concerned with fruit characteristics

and tree growth habit. Variations in fruit size, tree vigor, maturity date and other characteristics may, and often do, occur when the selection is moved onto a rootstock from the original seedling. Individual selections are evaluated using specific criteria that match the goals of the program. These criteria must be achieved before advancing to Level 3. Therefore there are multiple types of Level 2 trees: those that have yet to fruit in the selection block; others that are still being evaluated and have the potential to advance to grower's orchards and others that are kept for germplasm and breeding purposes.

Level 3 testing involves the establishment of advanced selections in grower orchards in various locations. Testing at this level is still somewhat preliminary since these plantings are the first instance in which selections are established in varying soil types and in varying climatic regions. Again, depending on the perceived value of the individual item, two to one hundred trees of any one selection are established at any one location. Level 3 grower tests are established in counties throughout the Sacramento and San Joaquin Valleys where dried plums are a commercial crop. In recent years we have increased our selectivity of trees advancing to Level 3 status. The specificity of criteria for new advanced selections is so narrow, we have chosen to not promote trees to this level until we have confidence in the desirability of their structure, production and process-ability.

Level 4 testing involves the planting of extensive test acreage, usually of a single targeted selection. The size of these Level 4 plantings depends on the apparent potential of the individual selection and the level of risk that the cooperating grower is willing to assume. Ideally these plantings would be as large as 20-40 acres. At this level, thorough tests of process-ability and acceptability in the commercial market are conducted. These tests are designed to gauge the commercial value of the item prior to formal release. The promotion of items to Level 4 is based on the industry's input and feedback. When the California Dried Plum Board decides a selection is ready for such extensive testing the University and breeders will develop a research agreement with the Dried Plum Board and the grower. Release of the selection for full-scale commercial production will be delayed until a decision by the Dried Plum Board is made concerning the suitability and desirability of the selection for further commercial production.

Dried Plum/Prune Testing Group

The Plum/Prune Testing Group incorporates the participation of growers and processors to evaluate and test dried plum selections for their potential as new cultivars before patenting and public release. For the first twenty years of this project the University of California conducted the dried plum/prune breeding and evaluation program with joint support from the Department of Plant Sciences (previously the Department of Pomology) and the California Dried Plum Board. This program was originally initiated at the request of the California Dried Plum Board with the primary goal of developing cultivars that would extend the harvest season with quality characteristics that equal or exceed those of the California standard, Improved French. This project made substantial progress toward that goal with the development of Sutter and Muir Beauty, which have the potential to be harvested up to two weeks earlier than Improved French.

The process used in the final evaluation and release of Sutter and Muir Beauty was based on a traditional model that public breeding programs have used for the past 50 years. After identifying selections that appeared promising and evaluating those selections at the University

and in limited grower trials, the selections deemed suitable for public use were patented and released. This assumed that there would be enough interest from growers, packers and nurseries to promote the cultivars and allow them to receive the true test of time in the commercial marketplace. While this model is still valid in a general sense, it is now apparent that it may not be the most efficient or effective model for the evaluation and release of dried plum cultivars in the future.

Therefore we have developed a different strategy for the final evaluation and future release of dried plum/prune cultivars derived from the breeding program. In 2005 we organized a Dried Plum/Prune Testing Group that helped to develop a better process for the release of new cultivars and participate in carrying out that strategy. The group has met two times a year since 2005 to develop testing strategies and evaluate advanced plum/prune selections. Participation in the group involves two general meetings a year, one in the summer just before prune harvest to look at fresh fruit and tree characteristics and a second time in the fall or winter, for the evaluation and discussion of dried product characteristics. The objective is to benefit from greater grower and processor input on individual selections as well as increase grower test plot participation so that by the time a selection is identified for release, the industry is well informed about the cultivar and comfortable about committing to plant, process and sell the cultivar commercially.

The Dried Plum/Prune Testing Group is currently the primary group that will make recommendations to the California Dried Plum Board for initiating large-scale Level 4 commercial testing of new selections. The advantage for participation in this testing group is that growers and processors gain first-hand information on all new selections in the program on which to base future planting/marketing strategies, participate in test plantings, have early access to new cultivars slated for release, and help direct the breeding and evaluation program to address germplasm-based issues in the future.

RESULTS

Bloom Data

The importance of bloom data has grown in the last decade because of the changing weather patterns that California has experienced. It has become more common to have heat spells in March that often have temperatures near 80°F. If high temperatures occur when Improved French is blooming the biological mechanisms for successful pollination and fertilization are negatively affected. The result has been low fruit set across the state. Variation for time of bloom is naturally found within the breeding program's germplasm. Introducing new cultivars to the California dried plum industry that have bloom times earlier or later than Improved French could reduce the risk of having the entire crop reliant on good weather conditions occurring during French bloom. In 2013 bloom was unusually short and this may have been instrumental in causing the short crop that occurred this year. Many of our selection trees had heavy crop loads and were not affected by the unusual bloom. This short pollination time was in direct contrast to 2012, when bloom time was very long. What took 2 months in 2012, took less than 2 weeks in 2013, thus emphasizing how the industry is at the mercy of the weather in this critical time period.

Bloom data, including date of full bloom (90% flowers open), amount of bloom, and the first and final day of bloom have been recorded for all the Level 2-4 selections since 2003. Table 1 shows the average number of days each top selection blooms before or after Improved French's full bloom. Because bloom time varies from year to year, depending on annual chilling accumulation and spring time temperatures, the table also shows the range of number of days over the years each top selection blooms before or after Improved French's full bloom.

Table 1. Bloom data at the Winters selection orchard for the 2013 top selections.

Cultivar	Full Bloom Date (90%)	Days in Bloom 2013	Days from French 2013	Average Days from French
G33N- 27	10-Mar	9	-12	-13
G43N- 1	15-Mar	6	-7	-8
G39N- 57	15-Mar	10	-7	-9
Tulare Giant	16-Mar	7	-6	-8
G39N- 34	16-Mar	8	-6	-8
F11S-38	16-Mar	9	-6	-9
G31N- 27	17-Mar	13	-5	-6
G16N-19	17-Mar	5	-5	-4
G5N- 35	21-Mar	9	-1	-1
Imp. French	22-Mar	8	--	

Level 4 Testing

As of now, there are no active Level 4 selections. We would however recommend to the industry to start discussing the promotion of G16N-19 to Level 4. As seen in Table 2, this selection has looked very promising for the last four years. With the exception of one tree in 2012, G16N- 19 has consistently had a dry away ratio of 2.8 or below. We feel the harvest time will be a good fit for the industry because it harvests a week or two after Improved French. The size is a little larger than Improved French, and the average of all the count per pound estimates made in Table 2 comes to 42.6 ct/lb. The fruit size from this tree will rarely dip below a C screen, which in turn should increase returns for growers. Table 2. The last four years of data for G16N-19.

Table 2. Data from the last four years of our top item G16N-19.

Harvest date	Location	Pressure	BRIX	Weight g/fruit	count per lb.	Dry away ratio
8/30/10	Winters	6.4	25.5	31.9		
9/7/10	Winters	6	27.9	26	44.6	2.85
8/27/10	Kearney	5.8	25.0	37.2		
9/1/10	Kearney	5.9	27.2	36.8	35.3	2.7
8/29/11	Winters	4.5	26.0	38.8		
9/6/11	Winters	3.8	26.9	32.8		
9/12/11	Winters	3.9	33.0	30.9		
9/16/11	Kearney	5.44	29.9	32.3	36.5	2.5
8/20/12	Winters	5.65	21.3	26.7		
8/27/12	Winters	5.62	19.90	25.90		
9/4/12	Winters	4.30	21.70	26.90	59.4	3.2
9/10/12	Winters	5.20	22.30	27.00	61.2	3.2
8/2/12	Kearney	7.70	19.60	32.20		
8/29/12	Kearney	5.80	27.00	35.50		
9/7/12	Kearney	4.50	25.20	32.80	38.8	2.7
7/15/13	Winters	7.6	18.3	33.8		
8/5/13	Winters	5.2	21.9	37.7		
8/12/13	Winters	5.4	23.7	38.8		
8/26/13	Winters	5.1	26.9	32.8	36.4	2.8
7/17/13	Kearney	9.7	15.0	32.2		
8/14/13	Kearney	6.3	22.7	36.0		
8/22/13	Kearney	6.1	24.3	35.3		
8/30/13	Kearney	4.5	27.8	41.0	39.3	2.8

Level 3 Testing

Level 3 testing is the evaluation of selections that are being grown and tested in grower's orchards. We have chosen to only promote selections to Level 3 status when the tree has proven to meet specific criteria over multiple years. This has limited the number of active Level 3 selections. We only plant trees in grower's orchards when we are fairly confident in their fruit and tree quality. The top selections that are now at Level 3 testing are F11S- 38, G5N- 35 and G16N-19. There are two additional items, G2S- 8 and G39N- 57, both have great potential, but have not yet been tested in grower orchards. Harvest data for the Level 3 selections are shown in Table 3.

Table 3. Level 3 selection performance for 2013 at university selection blocks. ‘Days from French’ refers to the difference between the Imp. French harvest date and the harvest date of the selection at the same location. The harvest date listed is specific for locations where samples were collected.

Selection	Location	Date	Bloom days from French	Harvest days from French	Pressure	Sugar ° Brix)	Dried Count / lbs	Dry ratio	Comments
F11S-38	Winters	7/15/13	-6	-30	3.9	33.4	63	1.7	Last year as Level 3, Will dry on tree, self pollinating. Low dry away ratio
G2S- 8*	Kearney	8/30/13	-2	+16	4.9	22.3	33.2	3.0	Large yellow, wonderful dried and fresh.
	Winters	9/3/13	-5	+12	5.1	26.5	33.6	2.9	
G5N- 35	Kearney	8/22/13	3	+8	3.8	21.7	66.3	3.0	Small statured tree. Fruit very similar to French
	Winters	8/19/13	-1	0	3.2	22.8	62.4	3.0	
G16N- 19	Kearney	8/30/13	0	+16	4.5	27.8	39.3	2.8	Potential Level 4 Large, round, great tasting fruit. Self pollinating
	Winters	8/26/13	-5	+6	5.1	26.9	36.4	2.8	
G39N-57	Kearney	7/17/13	-7	-33	5.9	23.4	37.9	3.0	Early harvest, very small pit, harvest at 5-6 lbs
	Winters	7/15/13	-7	-30	6.3	24.6	47.5	2.4	

*Selections candidates for niche market operations, not candidates for commercial mainstream production.

G16N- 19 is a nice fresh light purple colored fruit that dries to a 3.0 dry away ratio. It was the top item in our dried tasting last year and has a history of quality fruit (Table 2). It has a normal to vigorous growth habit, and since it can produce heavily on first year growth it is not a good candidate for long pruning. It has a unique growing habit that might be compatible with a mechanical pruning type system. In 2014, budded trees will be planted in Winters to test this theory. It harvests late, about 7-16 days after Improved French. It was harvested on August 30th at Kearney with a pressure of 4.5 and a sugar of 27.8. It was harvested a few days earlier in Winters, with a brix of 28.3. The fruit does not soften very quickly, and can be harvested earlier, but the longer the fruit hangs on the tree, the lower the dry away ratio will be. In both 2010 and 2011 the fruit was tested for its sugar ratio, it has comparable levels of sorbitol to Improved French but also has more sucrose than Improved French (suggesting it will have better flavor).

The fruit is slightly larger than Improved French, with an average count per pound of 37. It usually blooms 0-5 days before Improved French, the Kearney tree was caged this last spring and did self-pollinate. This selection is unique in the fact that it could spread harvest time of dried plums to after Improved French. More trees are being propagated to further test this promising selection. Both older selection trees at Kearney and Winters are on M40. This year G16N- 19 was grafted on to Marianna 2624, Nemaguard and 29C; it will be grafted on to Myrobalan in January.

F11S- 38 is a self-pollinating, good statured tree with round yellow fruit. This year it bloomed 6 days before Improved French, historically it blooms 1-2 weeks before Improved French. The fruit harvests about 3-4 weeks before Improved French. This tree is unique in the fact that most of the fruit will partially dry on the tree before being removed. This gives the fruit a low dry away ratio ranging from 1.7-2.5. This characteristic could save growers in transportation costs and in drying costs. This is due to the fact that there is less water to be removed from the fruit upon dehydrating, and since the fruit is partially dried upon transport, more fruit can be transported at one time. Additionally less drying time would be needed per fruit. This tree is unique in that as the fruit matures, the weights, pressures and dry away ratios decrease while the sugars increase. Extra trees were propagated for further testing so the harvest time, drying time, tree structure and ability to be mechanically harvested can be thoroughly evaluated over the next few years. Another unique quality of this selection is the toughness of the fruit without compromising good taste. Its tough skin and flesh looks to be sturdy enough to withstand the challenge of mechanical harvesting and processing when the fruit has partially dried on the tree. Despite the overwhelming potential for this tree, it harvests a full month before Improved French. The harvest date and the small size will likely prevent this tree from being promoted any further in this program. We will continue to monitor this tree as well as the grower trials in the small chance the industry changes its mind about the unfortunate harvest date.

G5N- 35 is a small statured tree that has fruit very similar to Improved French. It blooms anywhere between one day before and three days after Improved French. The Winters block tree was caged to test for self pollination, and it had a great fruit set, showing it will self-pollinize. In the selection blocks it is grafted on Marianna 2624 and M40 rootstocks. Last fall it was budded onto 29C to insure compatibility and to more thoroughly evaluate tree structure. The budded trees look healthy, but still have the shorter internodes like the other trees. It is a good example of a tree that would need significantly less pruning than an Improved French tree. The fruit has a pleasant dry appearance and tough skin. The fruit is purple, and French shaped, it harvests the same time or a few days after Improved French. It had no heat related damage at Kearney and had a pressure of 3.8 PSI with a sugar of 21.7 degrees brix. It still has a good flavor while having low brix, this is likely due to it's high sucrose content. While this tree continues to look promising, the industry is hesitant to embrace such a different tree structure. So the trees we have in the selection block and in grower's orchards will continue to be evaluated, but we will not heavily promote this tree until the industry is convinced of its merit.

G39N- 57 is a great tasting, early harvesting fruit with a very small pit. Its parents are Muir Beauty and D2N-76 (top item from 2007-2010). It looks to have inherited the excellent taste and high sucrose of Muir Beauty and the good drying qualities and high sorbitol of D2N-76. It harvests early, usually about 2 to 3 weeks before Improved French, but this year it was a full

month earlier. It has an extremely small pit and thick meaty flesh. It had a low dry away ratio of 2.4 when harvested at Winters with a pressure of 6.3 PSI. It was one of the top 3 items selected in our December tasting for the last two years. Harvest for this tree needs to be monitored closely, if a grower waits too long to harvest, the fruit will fall from the tree. Between the possibility for fruit drop and the early harvest, the potential for this tree might be limited. Despite these factors, this tree is still a good candidate for grower trials. The small pit, good dried quality and low dry away ratio may be too good to pass up.

G2S- 8 is a unique item that is consistently excellent every year. It is a large yellow fruit that harvests a week or two after French. This exceptional fruit would be only for growers who are looking for something non-conventional. The fruit is great tasting fresh or dried. It will likely process well, but might be too big for certain pitters. This fruit is an example of some of the more unique items that are in our germplasm. We are willing to cooperate with any grower or packer who is interested in rare items such as this one, so that different facets of the industry can benefit from this program.

Level 2 Testing

Level 2 testing evaluates a selection after it has been promoted from the Davis seedling blocks to the advanced selection blocks at Kearney and Wolfskill. Once the tree has matured and has started growing fruit, the whole tree and fruit characteristics are evaluated. Table 4 shows the harvest data of the top selections this year. Some of our newest Level 2 trees are young grafts and have yet to produce fruit. There are approximately 25 grafted selections at Kearney and Winters that we anticipate seeing fruit on for the first time next year (Table 5).

Table 4. 2013 Harvest data for advanced selections in Level 2 testing. ‘Days from French’ refers to the difference between Imp. French harvest date and the harvest date of the selection at the same location. Harvest date listed is specific for locations where samples were collected.

Selection	Location	Bloom Days from French	Harvest, Days from French	Pressure	Sugar (°Brix)	Dried Ct/lb	Dry Ratio
F11S- 65	Winters	-5	-21	3.3	26.1	61.7	2.8
G12N- 51	Winters	-8	0	1.9	29.2	36.6	2.5
G31N- 27	Kearney	-2	-6	4.3	24.2	48.1	3.0
	Winters	-5	-21	6.2	22.0	46.0	3.0
	Winters	-5	0	3.6	24.7	52.7	2.9
G33N- 27	Winters	-12	-14	4.3	27.8	42.8	2.6
	Winters	-12	0	3.3	32.0	44.4	2.4
G35N- 15	Kearney	-2	-6	2.3	22.2	37.1	3.2
	Winters	-6	-14	2.4	20.6	48.2	3.2
G47N- 31	Winters	-5	-14	3.6	21.0	72.6	3.0
G47S- 49	Kearney	-1	-6	1.6	21.0	48.3	2.7
	Winters	-6	-26	2.8	22.4	56.1	2.8
H1N- 40	Winters	-7	-21	1.9	24.4	60.3	2.9
H1S- 31	Winters	1	-6	3.7	24.2	66.5	3.0
G36N- 65	Winters	-8	-30	4.3	25.6	77.0	2.6
G43N- 1	Winters	-8	-7	2.8	23.7	63.1	2.9

F11S- 65 is a good quality dried product. It is a green round fresh fruit with a small pit. It has had a medium to large crop the last three years and shows great promise. During the growing season, the fruit is fairly astringent until the last week or two before harvest (20-25 days before Improved French). It blooms about a week before Improved French and needs to be tested for its self-pollination capabilities.

G43N- 1 had its first selection block evaluation this year. Both Kearney and Winters trees look quite promising. The tree in Winters was grossly underthinned, but still produced great tasting, good looking fruit. The fresh fruit is deep yellow with a rose colored blush. It has a low dry away ratio and good size. The tree at Kearney had a normal fruit set and it produced a dry away of 2.7 and a 45 count per lb on August 8th.

G31N- 27 is a great fruit that looks to ripen slowly. This slow ripening could provide flexibility for growers in harvest time. The tree at Kearney was harvested at 6.2 lbs & 21.6 brix, then two weeks later harvested at 4.3 lbs & 24.2 brix. Of course the longer you leave the fruit on the tree, the lower the dry away ratio will be as the flavor of dried fruit increases. In 2012, there were a few weak pits seen in the fruit of this tree. After a bulk evaluation of over 30 fruit, no weak pits were observed in 2013. This potential weak pit problem will continue to be monitored before this tree gets promoted any further.

G47N- 31 looks very similar to Improved French. It has a small pit, great skin quality and harvests 2 weeks prior to Improved French. This was the first year this selection was evaluated in the selection block, so we still have a lot to learn. The fruit was a little damaged by the high heat in late June so we will continue to evaluate this selection for sensitivity to heat.

Table 5. Seedling block data from 2012 of items to look for next year that are new to the selection block and have not yet produced fruit since propagation.

Selection	Harvest Days from French	Count per lb	Dry away ratio	Dried Skin Color	Skin Quality (1-4)*	Average Flavor (1-4)*
G19S- 31	1	52.13712	3.0	Black	4	4.0
G26N- 8	1	42.15547	2.9	Dark Brown	4	3.7
G30N- 24	-27	76.83814	2.8	Brown	3	3.0
G35S- 40	-27	80.48622	3.1	Dark Brown	3	2.7
G37N- 17	-27	64.93541	3.0	Brown	3	3.2
G37S- 45	-27	61.10578	2.8	Dark Brown	3.5	4.3
H5N- 14	-27	50.84522	2.3	Red	4	4.0
H5N- 83	-27	94.59959	3.1	Dark Brown	2.5	2.8
H13S- 65	-22	51.28563	2.9	Dark Brown	4	3.3
H16N- 83	-22	50.98782	3.1	Dark Brown	3	3.0
G41N- 27	-20	67.36528	3.0	Dark Brown	3	3.3
G43S- 15	-14	51.70489	3.0	Dark Brown	3.5	4.3
G47S- 4	-14	56.93635	3.1	Dark Brown	4	3.0
H17S- 23	-13	48.09713	3.0	Black	3.5	2.7
H19S- 47	-13	69.28076	3.3	Dark Brown	3.5	3.0
H20S- 58	-13	37.83882	2.8	Red	3.5	4.2
H10N- 38	-9	53.91544	3.1	Dark Brown	3	3.0
H10N- 88	-9	46.56086	2.5	Dark Brown	3.5	4.0
G27N- 31	1	56.25959	3.0	Black	3.5	4.7
H11N- 38	6	66.24755	2.9	Red	3	3.5
H13S- 58	6	63.63027	2.6	Mahogany	3.5	4.0
H17S- 2	6	46.22603	2.5	Dark Brown	3	3.0
H21S- 81	6	67.19895	2.8	Red	3	2.8
H6S- 3	6	69.78352	3.0	Mahogany	3.5	2.8
H7S- 61	6	53.1743	2.8	Mahogany	3	3.0
H8S- 75	6	52.33764	2.7	Black	3	3.3

*1-4 Ranking= 1 = worst, 4 = best

There are three Level 2 selections that could be great items for the fresh market (Table 6). They vary in color, shape, flavor and harvest date. Growers interested in unique fresh items are welcome to test these trees in their own orchards. G25N- 16 is interesting because it does not appear to soften, and is a yellow green color. F9N-33 is a beautiful deep purple, almost blue plum. In 2013 it had great looking fresh fruit despite its different harvest dates in each location. G40N- 28 harvests earlier than Tulare Giant and has much higher brix, but it has too many defects such as gum pockets, misshapen fruit and uneven ripening. These defects do not meet our standards for grower trials; because of this, we will now use this item exclusively for breeding.

Table 6. Harvest data for fresh market items. Most trees were not adequately thinned for accurate fresh fruit size evaluations.

Item	Location	Skin Color	Shape	Date	Grams/fruit	Press.	Degree Brix	Comments
Tulare Giant	Winters	purple	Oval	7/2/13	30.1	6.3	17.6	Winters location ripened earlier than Kearney
	Kearney	light purple	Oval	7/10/13	42.5	7.4	14.5	
G40N- 28	Winters	light purple	Long French	6/28/13	41.1	6.0	22.9	To be used for breeding
F9S- 33	Winters	dark purple	Large French	7/8/13	49.0	7.4	25.2	Unusually early at Winters
	Kearney	dark purple	Large French	7/25/13	54.6	6.0	24.0	heavily thinned
G25N- 16	Winters	green/yellow	Oval	9/3/13	38.1	4.4	33.0	large yellow, great flavor, very late harvest
	Kearney	green/yellow	Oval	8/30/13	55.2	6.0	24.0	

Level 1 Testing

Level 1 testing evaluates the young seedling selections at Davis with fruit quality being the primary selection criteria at this level. The seedlings set nice, medium-sized crops this year with little need for thinning. Around 165 samples were taken from the Level 1 seedling block for fresh evaluations. Of those around 116 samples were dried and processed for the rehydrated in-house tasting evaluation in October. Thirty-seven of the 116 items were chosen to be grafted into the selection blocks. Table 7 shows the harvest data of the top 24 seedlings evaluated at Level 1. The selections listed in Table 7 will be grafted into both selection orchards for further potential cultivar evaluation. The items selected this year have drastically lower dry away ratios than we have seen in the past. This is an example of how our program has shifted its focus to only selections that can save growers money. Table 8 describes the 13 promising germplasm seedlings that were selected from the seedling block for breeding. These germplasm selections all contain fruit traits that are comparable or superior to the breeding germplasm currently used in Winters and Kearney.

Table 7. 2013: Harvest data for advanced selections in Level 1 testing at Davis.

Harvest date	Seedling location	Harvest from French	Skin Color	Press.	Degrees Brix	Count/ lb	Dry ratio
7/12	H21N-101	-33	Purple	2.4	25.8	58.0	2.8
7/24	H12S- 70	-28	Light purple	3.5	22.8	66.7	3.0
7/24	H9S- 27	-28	Red	4.5	24.4	64.0	2.8
7/29	G39S- 70	-21	Green	4.9	29.2	51.9	2.5
8/9	G37S- 38	-10	Red	2.4	24.7	54.4	3.1
8/13	H18N- 42	-6	Red	2.6	25.5	51.6	2.8
8/13	G48S- 67	-6	Red	2.6	23.5	57.2	2.9
8/13	H18S- 32	-6	Red	4.2	22.1	92.9	3.3
8/13	H18S- 4	-6	Light Purple	3.7	23.9	57.9	2.7
8/16	H15N- 28	-3	Red	3.6	27.9	47.5	2.7
8/16	H15N- 56	-3	Purple	2.6	29.8	38.3	2.5
8/16	H4S- 37	-3	Red	5.3	24.2	65.1	2.7
8/20	G37S- 64	1	Light Purple	4.1	25.5	50.6	2.6
8/20	G45N- 7	1	Light Purple	6.7	29.6	43.0	2.4
8/20	I6N- 83	1	Light Purple	6.5	29.8	52.6	2.6
8/21	H1N- 47	2	Light Purple	6.0	25.9	43.9	2.7
8/21	H4N- 1	2	Yellow	3.5	32.3	54.7	2.3
8/21	H4S- 5	2	Light Purple	2.1	32.2	53.1	2.8
8/23	H11N- 42	4	Light Purple	2.3	28.1	52.2	2.6
8/23	H12N- 20	4	Dark purple	6.5	291.0	53.5	2.4
8/23	H12N- 44	4	Red	8.0	26.1	35.2	2.8
8/29	H15N- 92	8	Purple	4.2	30.5	44.5	2.4
8/29	H15S- 26	8	Purple	6.1	33.2	53.2	2.2
8/29	H21N- 77	8	Yellow	1.9	26.3	49.4	3.0

Table 8. Level 1 seedlings with premium traits for germplasm improvement.

Harvest date	Seedling location	Harvest date from French	Fresh skin color	Press.	Degrees Brix	Count/lb	Dry ratio
7/23/13	G36N- 26	-27	purple	5.2	23.4	32.9	2.7
7/26/13	I6S- 5	-26	red	5.7	20.1	62.4	2.4
7/26/13	I6S- 16	-26	red	6.3	19.2	66.2	3.3
7/29/13	G37S- 33	-21	purple	5.5	22.1	52.6	2.8
7/30/13	G42S- 1	-20	dark purple	3.7	21.6	58.5	3.6
8/13/13	G43S- 47	-6	dark purple	3.3	19.5	41.8	3.4
8/13/13	G46N- 37	-6	yellow	3.3	23.3	40.8	3.1
8/13/13	H18N- 27	-6	purple	2.2	25.5	93.8	2.9
8/16/13	H4N- 29	-3	yellow	3.9	22.3	69.1	3.1
8/16/13	H8N- 93	-3	purple	3.9	24.0	37.1	2.8
8/16/13	H4N- 6	-3	purple	3.9	24.3	53.9	3.0
8/21/13	H1N- 69	2	yellow/red	3.9	30.0	38.6	2.6
8/21/13	H1N-87	2	light purple	4.5	28.6	62.6	2.3
8/29/13	H6N- 42	8	light purple	3.3	32.0	40.2	2.4

Levels Summary

In 2011 the program was challenged to aggressively pursue reducing grower input costs by reducing the dry away ratio and reducing the costs of pruning through a new cultivar. This program has risen to the challenge by having all of our top Level 2 and Level 3 items have a dry away ratio of less than 3.0. In doing this, the program has bred new potential cultivars that could save California growers money by reducing the cost of dehydration. The Level 3 item F11S- 38 is an excellent example of a selection that could dramatically reduce the cost of drying. In regards to cost savings through pruning less, the Level 3 items G5N- 35 and G16N-19 are great examples of trees that have great potential for doing that.

Program Inventory

All the seedling blocks are located in the UC Davis campus research orchards. In the summer of 2013, over 1,000 seedling trees were discarded after evaluation of the seedlings showed negative fruit or tree characteristics. Many crosses were made in Spring of 2012, the seeds were germinated in Winter 2013, and young seedling trees were grown over the summer in pots at Duarte Nursery. These young trees were planted in early October 2013, into our seedling blocks at Davis. This added around 1,000 new seedlings to the new 'J' block (Table 9). Our G block, was a very large seedling block with over 6,500 trees. The entire block has been thoroughly evaluated and will be removed after winter budwood has been collected.

The inventories of selections at each level of testing were re-inventoried and are shown in Table 10. The numbers in this table represent the number of unique selections and not the number of trees. The "breeding population" category was separated into two categories, breeding and

germplasm. The breeding trees are actively being used for breeding whereas the germplasm items are old selections and cultivars collected from other programs that have negative characteristics that prevent them from being used in breeding. There is value in preserving them in our germplasm trees to keep the species-wide germplasm diversified; they may someday be important parents for future generations.

Table 9. Seedling block inventories for 2013 located in the Davis UC research orchards.

Block	Acres	Year Planted	Seedlings Planted	Seedlings Remaining	Advanced Selections
G	9 ^a	2001-2005	6,756	0	82
H	4	2005- 2008	4,083	2,813	59
I	3	2008-2012	2,656	2,632	1
J	2	2013-cont.	948 ^b	948	
Seeds		2013		(2,700) ^c	
Totals	9		14,443	6,393 ^d	142

^a Will be removed as of February 2014

^b October 2013 planting

^c number of seeds in stratification for 2014 planting

^d not including seeds

Table 10. Number of unique selections in the dried plum program and their level of testing including the breeding and germplasm population.

Level of Testing	Number of Items	Number of new 2013 additions
Level 1	6,393	948 (~ 2,700 seeds)
Level 2	111	24
Level 3 & 4	7	2
Fresh Items	11	2
Breeding Items	79	13
Germplasm Items	107	5

Disease Screening

This year, warm spring weather did not promote very much disease pressure. Therefore no statistical data was collected on brown rot. If we saw any hits of brown rot in the seedling block, the individuals with those hits were rogued from the program. There were very few incidences of scab in our orchards this year, nonetheless, a few selections were evaluated for scab. If an item

showed either scab or brown rot it was noted and the item was marked as more susceptible than the general population. Any genotypes documented as being more sensitive to scab than Improved French were discarded.

Sugar Testing

Sugar analysis has been a focus of this program in the past. Four types of sugar and sugar alcohol were analyzed: glucose, fructose, sucrose and sorbitol. Sucrose is composed of one glucose and one fructose molecule. Sorbitol is a sugar alcohol that acts as a preservative in the dried fruit, and has significant positive dietary attributes. We know that upon dehydration, most of the sugars degrade. While glucose and fructose degrade, sucrose hydrolyses to make more glucose and fructose. Sorbitol is reduced a lot less and remains relatively consistent between drying and processing. We have observed differences in fruit sugar profiles between some genotypes, most notably many of our selections have higher sucrose than Improved French. Despite these unique sugar profiles and the sugars degrading upon dehydration, these changes within the fruit do not seem to influence whether the fruit has a better ability to be processed. This is a positive result, meaning that the high levels of sucrose in our germplasm can continue to provide excellent flavor without inhibiting the fruit's ability to be processed.

As of now, we will continue to test our top items for their sugar ratios. Our objective is to maintain the superior flavor in our selections while also making sure the sorbitol is as high as or higher than the industry standard. In future years, we anticipate testing potential releases over several years to insure the industry can maintain its claims on the digestive health of dried plums.

Dried Plum/Prune Testing Group Evaluations

The Dried Plum/Prune Testing Group met in August this year at the Wolfskill Experimental Orchards to discuss strategies for testing and to tour the program's orchard. The group looked at fresh fruit and tree characteristics of top selections and discussed their potential as cultivars. As in 2011 and 2012, the November meeting was moved to combine with the Dried Plum Research and Workgroup meeting. This was done to help reduce travel for those located far from Davis. The workgroup evaluated our top 13 selections and the results of this tasting will be located at the end of this document (Table 13). Tables 11 and 12 provide details on the fresh and dried characteristics of each of the selections chosen for taste testing.

Table 11. The characteristics of the fresh fruit of the selections shown at the Dried Plum/Prune Testing Group meeting in December 2013.

Meeting tasting #	Selection	Dried Count/ lb	Dry ratio	2013 Harvest date from French	2013 Bloom date from French	Fresh Color	Pressure	Degrees Brix
1	F11S- 38	63.0	1.7	-30	-6	Yellow	3.9	33.4
2	G5N- 35	66.3	3.0	8	-1	Purple/ Red	3.8	21.7
3	G16N- 19	36.4	2.8	6	-5	Light Purple	5.1	26.9
4	G39N- 57	47.5	2.4	-30	-7	Light Purple	6.3	24.6
5	G43N- 1	63.1	2.9	-7	-7	Yellow/ Red	2.8	23.7
6	G33N- 27	42.8	2.6	-14	-12	Red	4.3	27.8
7	G36N- 65	77.0	2.6	-30	-8	Green / Yellow	4.3	25.6
8	G47S- 49	56.1	2.8	-26	-6	Red	2.8	22.4
9	G31N- 27	52.7	2.9	0	-5	Light Purple	3.6	24.7
10	H1N- 40	60.3	2.9	-21	-7	Red/ Yellow	1.9	24.4
11	G47N- 31	68.9	3.2	-21	-5	Light Purple	4.1	20.9
12	G2S- 8	33.6	2.9	12	-5	Yellow	5.1	26.5
13	G25N- 16	24.4	2.9	16	-4	Yellow	6.0	24.0
n/a	Imp. French	67.7	3.1			Light Purple	3.4	28.4

Table 12. The characteristics of the rehydrated dried fruit of the top 2013 dried plum selections shown at the Dried Plum/Prune Testing Group meeting in December 2013. (Average flavor score for Castro, DeBuse, and DeJong is on a rating scale of 1-5 with 5 being the best.)

Meeting tasting #	Selection	Count/ lb	Dry ratio	Dried Skin Color	Dried Pit size	Flesh Quality	Skin Quality	Average taste eval
1	F11S- 38	63.0	1.7	Mahogany	Med/ Small	Meaty	Extra Good	2.1
2	G5N- 35	66.3	3.0	Brown	Med/ Small	Meaty	Good	3.3
3	G16N- 19	36.4	2.8	Brown	Medium	Meaty	Good	3.5
4	G39N- 57	47.5	2.4	Dark Brown	Small	Gooney/ Meaty	Good	3.3
5	G43N- 1	63.1	2.9	Red	Small	Average/ Meaty	Good	4.0
6	G33N- 27	42.8	2.6	Brown/ Red	Small	Meaty	Good	3.4
7	G36N- 65	77.0	2.6	Brown	X-small	Stringy/ Meaty	Extra Good	3.0
8	G47S- 49	56.1	2.8	Brown	Small	Meaty	Good	3.8
9	G31N- 27	52.7	2.9	Dark Brown	Medium	Meaty	Good	3.5
10	H1N- 40	60.3	2.9	Dark Brown	Med/ Small	Meaty	Good	3.0
11	G47N- 31	68.9	3.2	Dark Brown	Small	Meaty	Extra Good	2.5
12	G2S- 8	33.6	2.9	Brown	Med /Small	Gooney/ Meaty	Good	3.5
13	G25N- 16	24.4	2.9	Brown	medium	Gooney/ Meaty	Good	3.3
n/a	Imp. French	67.7	3.1	Dark Brown	Med/ Small	Meaty	Good	3

Table 13. The average testing group scores (1=worst, 5=best) given to the characteristics of the selections shown at the Dried Plum/Prune Testing Group tasting in December 2013, sorted by 'Total Rating'.

Meeting Tasting #	Name	Flavor	Skin Color	Skin Quality	Fruit Size	Pitting Quality	Flesh Color	Flesh Texture	Sum	comments
3	G16N- 19	4.3	4.1	4.0	4.7	3.7	4.2	3.9	29.0	excellent flavor, large, Joe's fav.,too soft?
4	G39N- 57	3.4	3.5	3.5	4.3	6.5	3.7	3.6	28.5	mild good flavor, small pit, good prune
9	G31N- 27	4.4	3.9	3.7	3.9	3.7	3.9	3.8	27.3	nice taste, good flavor, nice pit, good flesh
8	G47S- 49	4.0	3.9	3.9	3.8	4.1	3.3	3.8	26.8	good flavor profile, flavor built over time, nice texture
13	G25N- 16	4.1	3.6	3.9	4.1	2.8	3.9	3.9	26.3	tart but sweet, large pit
6	G33N- 27	3.7	4.0	3.7	4.4	2.3	4.2	3.9	26.2	probably a good processor, good taste & skin
12	G2S- 8	4.1	3.6	2.9	4.4	3.8	3.7	3.7	26.2	liquid gold, great flavor, really nice
5	G43N- 1	3.7	3.6	3.9	3.1	4.1	3.7	3.5	25.6	nice, small, honey flavored free pit
2	G5N- 35	2.9	3.3	3.6	2.8	3.9	3.5	3.1	23.2	bland flavor, nice flavor, dull appearance
7	G36N- 65	3.4	3.7	3.1	3.2	2.9	3.6	3.1	23.0	narrow, early harvest
10	H1N- 40	2.9	3.4	3.2	3.3	3.5	3.3	3.1	22.8	flat flavor, pit removed easily, good color
11	G47N- 31	2.7	3.5	3.2	2.9	3.5	3.1	3.3	22.2	sweet but good, small pit, dark flesh
1	F11S-38	2.5	2.9	3.0	2.1	2.6	3.5	3.3	19.9	carmelized, dries on tree

DONATIONS

We would like to thank Duarte Nursery Inc, for the donation of nursery care of the program's seedlings. We would also like to thank Pacific Western Container for donating the tree protectors for the seedling plantings at Davis. Their generosity helps support UC research and the California dried plum industry's goal in developing new dried plum cultivars for California.