

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. The utilization of this older cultivar and several other mutations from the French type represents 98% of the total dried plum acreage in California. This monoclonal situation with its genetic similarities lends itself to vulnerability of widespread disease and pest outbreaks and state wide yield decline due to the effects of weather that can negatively effect fruit set and/or fruit retention. In addition to the risks of monoculture, the entire industry needs to harvest and dehydrate the crop within a few weeks since the single cultivar matures around the same time. 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 industry will also benefit from the development of new dried plum varieties that have cost saving characteristics in tree structure, processing qualities, and tolerance to pest and disease. Introducing new dried plums that differ in flavor or color to French could promote a broadening of the consumer base.

The Dried Plum (*P. domestica*) Development and Evaluation program has enlarged the germplasm and bred new generations of progeny through traditional horticultural breeding methods since its conception in 1985. Through over twenty years of evaluation and selection, the breeding program has increased the variability 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 is now in a very productive period for producing new cultivars that are specifically adapted for California growing conditions and markets.

The successful development of the Sutter Prune cultivar came from the earlier stages of the breeding program. Sutter is a productive, high quality drying plum that matures ten to fourteen days ahead of Improved French. The fruit of Sutter is large, medium dark purple and covered with a medium waxy bloom. The fruit resembles French prune in shape and develops about 2 degrees more soluble solids than French when compared at the same location. The tree form and vigor of Sutter is similar to French and is a regular bearer. It is similar to French with the exception that it should be harvested at around 5-6 lbs pressure rather than at the standard 3-4 lbs. Sutter is self-compatible and is able set a heavy crop without additional pollination. Sutter has been successfully propagated on Marianna 2624 and 40, Myrobalan 29C and Myrobalan seedling rootstock. Sutter has been successfully test processed using both the Ashlock and the Sunsweet pitters. Fruit of the new cultivar dries into a very high quality dried plum. Although the external appearance of the Sutter is similar to French, the dried flavor is lighter, sweeter, more fruity and complex. The Sutter cultivar was released from this program in the year 2000 and is now becoming established in the California industry.

Muir Beauty (UCD # D6N-72) is an excellent dried plum that was released as a cultivar in 2004. In the history of our testing group's November meetings, it has never been ranked less than 6th from the top in any of the taste tests. Its flavor and texture were also selected over French and Sutter at a tasting done at a local county fair this year. The fruit of Muir Beauty matures in early August about 15 to 20 days before the industry standard, Improved French, when grown at the same location. The fruit is large, oval in shape, without a neck. The skin is a purple-rose color with a grayish, moderately thick, waxy bloom. The fresh fruit flesh color ranges from a dark gold to a golden-orange. The dried fruit is large, shiny black, with larger but fewer wrinkles than Improved French. The dried flesh retains the golden color of the fresh fruit. The pit of Muir Beauty is medium size and varies from semi-free to freestone. Although the pit is more free than Improved French preliminary commercial pitting tests have had marginal results, so pitting this variety will likely require special handling. In organoleptic tests, Muir Beauty is described to have a thick, meaty fruit texture with a pleasant well-balanced fruity flavor. The tree is a vigorous grower with an upright form and is a very productive, regular bearer. Muir Beauty has been grown successfully on the plum rootstocks, Marianna 2624 and 40, Myro 29C and Myrobalan seedling. More recently it has shown to be compatible with the peach rootstock, Nemaguard. The tree is more precocious than Improved French, flowering and fruiting at an early age. Muir Beauty is self-compatible and is able to set a heavy crop without additional pollination from another cultivar. It is recommended that growers thin this cultivar every year. It consistently sets a high crop and can develop alternate bearing without proper thinning.

We have recently discovered and are evaluating dried plum selections that include a wide variety of flavors and dried fruit characteristics that are superior to the commonly produced French cultivar. We believe these new dried plums have the potential of revitalizing consumer interest for California dried plum products.

In the last three out of five years 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 fruit set and since the California industry is based on a single cultivar, the weather conditions during a specific period affect most of dried plum orchards in the same way. Because of this we have begun to evaluate our seedlings and selections for differences in bloom date so that with new cultivars we can 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

- 1.) To develop new dried plum varieties, through traditional horticultural breeding methods, with the following characteristics:
 - A) Earlier/late bloom and fruit maturity dates than "Improved French" dried plum
 - B) Tree characteristics that reduce labor cost involved in producing dried plums.

- C) Increased fruit quality and improved fruit characteristics that increase efficiency and quality of drying and processing.
 - D) New specialty traits; with the dried product being equal or improved in quality to “Improved French”, but differing in taste or color.
 - E) Tolerance/resistance to disease.
- 2.) Test and evaluate advanced selections resulting from the current breeding program at UC and grower locations in the Sacramento and San Joaquin Valleys.

PROCEDURES

Breeding methods, pollination and seedling cultivation, and selection evaluation have not been modified this year. They are 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.

Levels of Testing

Field testing and evaluation of dried plum selections developed within this program are being carried out at four levels. This testing procedure was not modified since 2006 but is reported as a reference for the result section of the report.

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 Kearney and at the Wolfskill Experimental Orchard in Winters, CA.

Level 2 testing occurs in the selections blocks at Kearney and Wolfskill. Depending on the perceived potential of the individual selection, from two to four trees of any one selection are established on commercial rootstocks. This level of testing is concerned with fruit characteristics and whole tree characteristics. 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. Most individual selections are re-fruited in the selection blocks prior to advanced testing with growers.

Level 3 testing involves the establishment of advanced selections in grower orchards in various dried plum growing locations. Testing at this level is still somewhat preliminary since these plantings are the first level at which selections are established on varying soil types and in varying climatic regions. Again, depending on the perceived value of the individual item, from two to fifty 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.

Level 4 testing involves the planting of small test acreage, usually of a single targeted selection. The size of these Level 4 tests depends on the apparent potential of the individual selection and

the level of risk that the cooperating grower wishes to assume. Planting size ranges from twenty-five to several hundred trees. Commercial value of an item can be established in test markets with the expanded production of Level 4 testing.

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 past twenty years the University of California has been conducting the dried plum/prune breeding and evaluation program that has been jointly supported by 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 has made substantial progress toward that goal with the release of Sutter and Muir Beauty, which have the potential to be harvested up to two weeks earlier than Improved French while also improving dried product quality.

The process used in the final evaluation and release of these two cultivars 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, assuming 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 and will ultimately sort out the value of Sutter and Muir Beauty to the California industry in the long run, 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.

International patent law basically forces the University (or any plant breeder) to start the process of making the cultivars it releases available to the rest of the world within 5 years after release in the United States. Under the current system it may take up to ten years for the California industry to decide whether a newly released cultivar warrants widespread planting and so by the time that decision is made in California, the cultivars would also be made available in other countries. Thus it is apparent that continuing to use the traditional model to release cultivars will not allow California growers to take full advantage of the new cultivars that are developed in the dried plum breeding program. In addition, one could argue that there are considerable opportunity costs for the California industry to continue to plant old cultivars if improved cultivars are available but not accepted into the marketplace in a timely manner.

Therefore we have developed a new 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 will help develop a better strategy 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, 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 advantage of this strategy will be that at the time a cultivar is released, the California industry will be in a position to take advantage of a 10+ year window of opportunity before other countries could effectively grow the cultivar (five of those years would come from a delay in registering a patent in foreign countries and an additional 5+ years would come from the time it would take for any foreign country to import, propagate and field test the cultivar under their conditions).

The advantage for participation in this testing group will be that growers and processors will gain first-hand information on all new selections in the program on which to base future planting/marketing strategies, participate in test plantings as well as 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.

However, based on the discussions that we have had during the meetings of the testing group it is now clear that in order for the California Dried Plum industry to take full advantage of the results of the breeding program more emphasis must be placed in getting significant commercial field testing in place earlier in the evaluation process of advanced selections. Currently, even after growers show substantial interest in planting a new selection, they are hesitant because of uncertainty about their acceptability by processors. Similarly, processors are hesitant to commit to accepting the fruit from new cultivars until they have test processed significant amounts of fruit. Based on this “Catch 22” situation we believe that we need to increase efforts to “spread the risk” of developing test plantings of new selections to enable earlier decisions by processors regarding the advisability of planting new selections. We believe that it is in the best interest of the industry and processors to be able to give clear “up” or “down” signals regarding the acceptability of new cultivars as early as possible to take full advantage of introducing new cultivars into the industry and avoid the planting of cultivars that may not be favored by processors. In the next couple of years we plan to work toward enhancing our advanced testing protocols to accomplish quicker establishment of larger (2-10 acre) test plantings to accomplish this goal.

RESULTS

Bloom Data

The importance of bloom data has grown in the last 5 years 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 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 programs 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. This year bloom was successful for most prune growing areas.

Bloom data, including date of full bloom (90% flowers open), amount of bloom, and the first and final day of bloom has 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. Figure 1 shows a more visual presentation of the top selections' timing and extent of blooming in 2008. Note the number of items that bloom before French.

Table 1. Bloom data for the 2008 top selections.

Selection	Average number of days different than French full bloom date	Range for number of days different than French full bloom date
Muir Beauty	-7.3	-17 to -3
Tulare Giant	-5.3	-13 to -2
Sutter	-0.5	-4 to 2
French	0.2*	-2 to 3 *
G3S- 2	-8.8	-13 to -3
G1S-83	-7	-7
D2N- 76	-6.3	-16 to -3
D15N- 80	-6.3	-15 to -3
D18S- 12	-6.1	-13 to -3
F2S- 20	-4.5	-7 to -2
D18S- 50	-3.3	-8 to 0
D10S- 8	-2.9	-7 to 0
E3N- 42	-2.8	-6 to 0
D18S- 7	-2.8	-7 to -1
F13S- 46	-1.8	-4 to 0
D6N-103	-1.0	-4 to 3

* within orchard variation

Level 4 Testing

Level 4 testing evaluates the commercial value of advanced selections and looks at the potential markets for the item. The program is evaluating three items at this level. The first is Muir Beauty (UCD # D6N-72), the cultivar that was released in January 2004. The second is the dried plum cultivar, released in 2000 Sutter. The third is Tulare Giant, a fresh market cultivar released in 2000.

Muir Beauty (D6N-72)

Muir Beauty dried plum set a good crop on the mature trees at Kearney and Wolfskill. The harvest date for Muir Beauty was 22-23 days before French at the UC locations (Table 2). This difference in harvest date was a little greater than in previous years. Full bloom of Muir Beauty occurred in early to mid March overlapping with the beginning bloom of French and Sutter. Muir Beauty bloomed a day earlier than Tulare Giant this year with their overlap extending over five days.

Commercial level drying, pitting and handling tests of Muir Beauty indicated that the fruit will be difficult to process using the standard practices used for Improved French. More research is needed to determine if in rehydration cook times can be adjusted to compensate for the larger fruit size and less fibrous flesh texture of this cultivar.

Table 2. Muir Beauty 2008 harvest dates and fresh fruit data compared to French harvest data.

Location	Selection	Harvest Date	Internal Pressure (PSI)	Soluble Solids (Brix)	Fruit Size (ct/lb)	Crop Size
Kearney Ag. Center	Muir Beauty	8/5	4.1	21.3	37	Medium
	French	8/28	4.1	22.7	59.6	Medium
Winters Research Orchards	Muir Beauty	8/11	3.7	24.3	31	Light
	French	9/2	3.2	31.2	47	Light

Sutter

Sutter's bloom overlapped with French but was extended prior to and past French bloom by about a day. Sutter harvest date compared to French showed its traditional 7-10 day difference at the Winters location. At Kearney the difference was less; Sutter harvested only a few days before French. As usual, Sutter at all locations had higher soluble solids than French (Table 3). Though the Sutter variety does not reduce the risk of high temperatures at bloom it does provide the dried plum industry a cultivar with an earlier harvest date and high soluble solids.

A separate study to identify the optimal harvest time of Sutter indicated that Sutter should be harvested when fruit flesh pressures are between 5-6 PSI rather than waiting until pressures are at 3-4 PSI. (See report "Sutter Harvest Parameters and Drying Trial" by DeBuse et al.). When this

recommendation was followed commercial drying, pitting and handling of Sutter had excellent results.

Table 3. Sutter 2008 harvest dates and fresh fruit data compared to French harvest data.

Location	Selection	Harvest Date	Internal Pressure (PSI)	Soluble Solids (Brix)	Fruit Size (ct/lb)	Crop Size
Kearney Ag. Center	Sutter	8/19	5.33	23.4	67	Medium
	French	8/28	4.1	22.7	59.6	Medium
Winters Research Orchards	Sutter	8/20	5.52	26.8	63	Light
	French	9/2	3.2	31.2	47	Medium

Tulare Giant

The results of the 2003 pollen self-compatibility experiment showed that Tulare Giant is only partially self-fertile. Without a pollinizer the cultivar did set a minimal amount of fruit but the reduced set could not be considered an economically profitable crop. Thus, Tulare Giant requires another *Prunus domestica* cultivar as a pollinizer to set an economic crop. Muir Beauty is the recommended pollinizer for Tulare Giant. Muir Beauty's bloom time overlaps Tulare Giant's bloom time quite well and with a large quantity of flowers it makes a very good pollinizer. A pollen compatibility test was done in 2004 proved that Muir Beauty used as a pollinizer sets a very heavy crop on Tulare Giant. Hand thinning is recommended to reduce the final crop size to a commercial level. Studies have not been done to determine the best planting ratio of pollinizer to main variety but our best guess is every third tree in every third row.

Tulare Giant and Muir Beauty bloom overlapped quite well this year with Muir Beauty overlapping the first 5 days of Tulare Giant bloom and French overlapping the final two days of bloom. The harvest was normal with the fruit at Kearney Ag Center maturing on July 16 (7.3 PSI) and on July 9 (6.9 PSI) at Wolfskill. The soluble solids ranged between 16.3-19.2 ° Brix.

Level 3 Testing

Level 3 testing is the evaluation of selections that are being grown and tested in grower's orchards. The selections that are now at Level 3 testing are D6N-103, D18S-50, D10S- 8, D18S-7, D18S-12, G1S-83, F13S-46, F11N-27 and D2N-76. One item has been removed from this level this year. Selection F13N-24 had been a promising selection but was removed due to a high level of double fruit (>50%) observed in early summer.

Harvest data for the rest of these selections are shown in Table 4.

Table 4. Level 3 selection performance for 2008 at university selection blocks. The location designation after harvest date indicates W (Wolfskill), K (Kearney). ‘Days from French’ refer to the difference between 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	Harvest Date	Days from French	Pressure (PSI)	Soluble Solids (Brix)	Fruit Size (ct/lb)	Crop Size
G1S- 83	7/28 (W)	-37	8.2	20.7	60.2 g/frt	Light
G1S- 83	8/5 (K)	-22	8.1	19.6	65.8 g/frt	Medium/Light
F11N-27	8/4 (W)	-30	3.0	28.2	36.2	Light
F11N-27	8/5 (K)	-22	3.3	31.9	---	Light
F13S- 46	8/4 (W)	-30	4.8	24.6	---	Medium
F13S- 46	8/5 (K)	-22	3.0	21.9	40.29	Medium
D2N- 76	8/5 (K)	-22	3.2	22.2	51.5	Medium
D2N- 76	8/11 (W)	-23	3.5	25.7	54.6	Medium/Heavy
D18S- 12	8/11 (W)	-23	3.3	23.5	28.22	Medium
D6N-103	8/15 (W)	-20	5.5	22.6	23.2	Medium/Light
D18S- 7	8/20 (W)	-15	3.6	28.6	37.3	Medium
D10S- 8	8/25(W)	-10	3.9	27.2	38.38	Medium
D10S- 8	8/28(K)	0	2.6	25.4	46.6	Medium
D18S-50	9/8 (W)	4	3.2	27.8	25.3	Medium

G1S-83 is a large sweet prune that might do well in a specialty fresh market. It has an appealing shape similar to French, but is not recommended for drying. It has a red blush color and will stay firm on the tree for a few weeks. In early August of 2008, it had a Brix of around 20 when over 8 lbs pressure at both our Winters and Kearney orchards. 2008 was its first year in our test orchards, so all information on this fruit is relatively new. We hope to see more information about this fruit in future years.

F13S-46 is an attractive yellow fruit with a pink blush. It has a similar shape as French and harvests about 3 to 4 weeks before French. It blooms about 4-0 days before French but self compatibility of the trees had not yet been tested. It has a medium to small sized pit. It dries to make a very sweet, pleasant tasting prune that was rated in the top 10 best tasting prunes in the 2007 Fall Tasting meeting.

F11N-27 is a light purple, oval fresh fruit. It harvested about 20 days before French, and blooms about 5 days before French. In 2008, both in Kearney and Winters the F11N-27 trees had a light

crops and very high sugar. It has only been evaluated one year but has shown to have a quality dried fruit. It was ranked in the top 5 fruit in the November 2008 tasting. As of now, the pollination of this tree is unknown.

D2N-76 harvests earlier than French in normal years by about a week or more. The dried plum looks and tastes very similar to French. The pit is small and semi-free. This would be a very good dried plum to mix with French at processing. Some grower trials are starting to produce and the growers seem pleased with the fresh and dried fruit. One concern for this variety is the tree growth habit.

D18S-12 is a large round prune that is a sibling of D18S- 7. They are similar in shape and size but D18S-12 has a darker purple fresh color and a thinner skin. The dried flavor is exceptional and the texture soft and gooey. Due to its distinct flavor that varies from the French taste, this dried plum would be better suited for a gourmet market where flavor is desired above appearance. It was caged for pollination evaluation this year and was shown to be self fertile.

D6N-103 is a high sugar prune that looks very similar to French in shape and color. The dried fruit is a shiny dark brown appearance with a meaty flesh. It is a larger prune than French and may do very well in a specialty “Gourmet” market. This year two pollen isolation cage experiments were done. The first repeated last year’s trial with the exclusion of all pollen. The results showed that D6N-103 is not self compatible and requires a pollinizer. The other isolation cage experiment had additional pollen added from Improved French in the form of bouquets. The tree in this cage set a full crop showing that Improved French is a compatible pollinizer of D6N-103. We noticed a significant amount of split pits in 2008, we suspect this might be due to a late frost in the spring, but we will continue to monitor split pits in this variety.

D18S-7 is a rose colored fresh fruit that creates a shiny brown dried fruit. The flavor of the dried plum is smooth, sweet with a slight baked flavor. D18S-7 has had high dried flavor ratings for the last four years. It usually blooms 7 to 1 days before French and was shown to be self fertile in 2007. The harvest date is earlier than French but varies from year to year. New grower trials will clarify the harvest date in the coming years.

D10S- 8 is a round purple colored fresh plum. With the exception of 2007, this fruit has harvested before French. The dried plum is very sweet with soluble solids ranging between 24-27 Brix and the dried fruit has a very sweet taste. The first pollination isolation experiment was done in 2007 and revealed D10S- 8 as not self fertile. Further studies will be done to verify this and test pollinizer for compatibility.

D18S- 50 is a super sweet dried plum that usually harvests about 6 to 12 days after French. It is a long oval plum with a longer pit than Sutter or French yet the pit is very free and may not be a hindrance to processing. The flavor is very sweet and fruity with the dried appearance being very shiny. This dried plum could lengthen the dried plum harvest and contribute a high quality and high sugar product to the industry.

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. Whole tree and fruit characteristics are evaluated. Table 5 shows the harvest data of the top selections this year.

Table 5. 2008 Harvest data for advanced selections in Level 2 testing. The location designation after the harvest date indicates W (Wolfskill), K (Kearney). 'Days from French' refer to the difference between 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	Harvest Date	Days From French	Soluble Solids %	Fruit Size (ct/lb)	Crop Load
G3S- 2	7/9 (W)	-56	20.8	53	Medium
F9N-21	8/4 (W)	-30	30.3	42	Medium
F2S- 20	8/4 (W)	-30	22.7	--	Medium
D15N- 80	8/11 (W)	-23	24.0	54	Medium
E3N- 42	8/11 (W)	-23	29.6	45	Medium
E2N-20	8/15 (W)	-20	22.4	25.4	Medium
E4S-90	8/25 (W)	-9	28.2	31.4	Medium
French	9/4 (W)	0	31.2	47	Medium
E6N-30	9/2 (W)	-2	26.8	--	Light
E11S-47	9/22 (W)	+19	26.2		Light

Of these selections F9N-21 is particularly interesting because it remains firm and crunchy until it falls off the tree. On the 3rd of July it had a pressure of 6.1 lbs and 19.2 brix. And then it slowly dropped pressure for the next month. On the 4th of August it had a pressure of 4.5 lbs and 30.3 brix and at that point, much of the crop was dropping. This trait might allow for a flexible harvest time. It is unclear if this selection will be suitable for the industry, but its fruit maturation characteristics will be a good trait to have in the germplasm.

D15N- 80 is a French dried plum look-alike but blooms earlier and matures earlier than French. It has moderate soluble solids but seems to hold on to the tree very well as it matures so that harvesting around 3 lbs pressure should not be a problem, thus allowing time to maximize soluble solids.

E6N-30 is a great high sugar prune for drying. When dehydrated it looks very similar to French. It is an attractive dark purple plum that has high sugar content. It was one of the top selections from the 2006 Fall tasting meeting. 2008 was our first year of observing it in the selection blocks. It bloomed 2 days after French in the spring, and harvested with French in the fall. On September 2, 2008 it had a pressure of 4.8 lbs and a brix of 26.8.

E11S-47 is a light colored prune when fresh, and a deep attractive mahogany when dried. It harvests extremely late, and is a good example of the program's diverse germplasm. It has a

wonderful fresh and dried flavor. It still needs further evaluation before moving it to Level 3 but we are hopeful that it will provide an option to extend the harvest season.

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 of thinning. Table 6 shows the harvest data of the top seedlings evaluated at Level 1 this year.

Table 6. 2008 Harvest data for advanced selections in Level 1 testing at Davis.

Item ID	Days from French	Fruit Size (ct/lb)	Brix	Why of Interest:
G4N-23	-60	56	21.9	harvest date and dried taste
G35S-52	-59	61	24.5	pit characteristics, harvest date
G3N-23	-47	44	22	dried appearance and taste
G36N-62	-45	69	20.4	dried appearance and taste
G2S-78	-27	67	21.7	dried appearance and pit quality
G5N-35	-17	86	26.7	dried appearance and pit quality
G10N-18	-4	54	24.2	dried flavor and fresh flesh quality
G9S-28	-4	62	25.2	dried appearance and pit quality
G13S-45	-4	69	29.8	sugar content, fruit quality
G16N-19	-3	48	26.5	dried appearance and fruit quality
G36S-57	11	41	27.1	dried flavor and flesh quality
G37S-32	11	42	24.1	dried flavor and tree structure

Program Inventory

All the seedling blocks are located in the UC Davis campus research orchards. In the summer of 2008, 592 seedling trees were discarded after evaluation of the seedlings showed negative fruit or tree characteristics. The 2007 seed collected from controlled pollinations made in spring of 2007 were grown over the summer in pots at Duarte Nursery. These young trees were planted in October 2008 into our seedling blocks at Davis. This added 2,133 new seedlings to blocks 'H' and 'I' (Table 7). One hundred and twenty fruit samples were processed for the advanced rehydrated tasting evaluation in October with 74 of the samples coming from Level 1 seedlings.

Table 7. Seedling block inventories for 2008 located in the Davis UC research orchards.

Block	Acres	Year Planted	Seedlings Planted	Seedlings Remaining	Advanced Selections
F	2.4	2000-2001	2,240	209	27
G	8.0	2001-2005	6,756	5,257	29
H	4.0	2005- 2008	4,083*	4,083	
I	?	2008-cont.	602*	602	
Seeds		2008	(~ 324) [♦]		
Totals	14.4		13,681 ^Δ ,	10,151	56

*includes 2008 October planting

[♦]number of seeds in stratification for 2009 planting

^Δnot including seeds

The inventories of selections at each level of testing are shown in Table 8. The numbers in this table represent the number of unique selections and not the number of trees. The “breeding population” category incorporates selections from our program and cultivars collected from other programs. The selections in the breeding population have some negative characteristics that do not allow them to become cultivars but show other positive characteristics that may make them important parents for future generations.

Table 8. Number of unique selections in the dried plum program and their level of testing including the breeding population.

Level of Testing	Number of Items	Number of new 2008 additions
Level 1	8,018	2,133 (~ 324 seeds)
Level 2	63	12
Level 3	9	3
Level 4	3	0
Breeding Population	137	11

Disease Screening

This year the warm spring weather with little rain at bloom time did not promote disease in any of our test orchards. No data was collected on russet scab or brown rot. If an item showed either of these diseases it was noted and the item was marked as more susceptible than the general population.

Dried Plum/Prune Testing Group

The Dried Plum/Prune Testing Group met in August this year at the Wolfskill Experimental Orchards to discuss possible 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. The group met again in November in Davis to evaluate the top 17 selections (including French as a standard) and discussed their dried product characteristics. Tables 9 and 10 provide details on each of these selection's physical characteristics, fresh and dried. The group's evaluations and ratings for each of these selections are shown in Table 11 which is sorted by 'Average over all' score.

The two top rated dried plums this year was F13N-46 and Sutter. Other dried plums that were ranked toward the top of the list were F11N-27 and Muir Beauty. French has routinely been rated in the lower third of all the dried plums evaluated. It is important to note that even a group of tasters who are very familiar with the Improved French cultivar characteristics prefer new and fruitier flavors above the old standard. Consumers should follow this preference trend when new cultivars are made available to them. This is exciting since it allows for the industry to think about new marketing opportunities and increasing the dried plum consumer base.

Table 9. The characteristics of the fresh fruit of the top 17 dried plum selections shown at the Dried Plum/Prune Testing Group meeting in November 2008.

Show #	Show Type	Selection	Level of Testing	Harvest Date	Bloom days from French	Harvest Days from French	Location	Crop Size	Fresh Skin Color	Fruit Shape	Weight (g/fruit)	Internal Pressure (PSI)	% Soluble Solids (Brix)
1	Top 5	G3N-2	2	7/8/08	-10	-51	Kearney	Medium	Light purple/green	Oval	35.6	2.94	20.5
2	Top 5	F11N-27	2	8/11/08	-8	-24	Winters	Light	Rose	Oval	32.7	1.58	36.7
3	Top 5	E3N-42	2	8/15/08	-5	-20	Winters	Medium	Purple	Oval	33.7	3.13	27
4	Top 5	E2N-20	2	8/15/08	-8	-20	Winters	Medium	Purple	Oval	59.3	4.62	22.4
5	Top 5	F13S-46	3	8/19/08	-1	-9	Kearney	Medium	Yellow	Oval	36.7	3.22	23.8
6	Level 3	D2N-76	3	8/15/08	-8	-20	Winters	Medium	Light purple	Round	34.3	4.67	28.5
7	Level 3	D18S-12	3	8/20/08	-9	-15	Winters	Light	Rose	Irregular/Round	42.7	3.84	22.9
8	Level 3	D18S-7	3	8/20/08	-7	-15	Winters	Medium	Rose	Oval	38.5	3.36	28.6
9	Level 3	D10S-8	3	8/25/08	-4	-10	Winters	Medium	Rose	Oval	37.0	3.93	27.2
10	Level 3	D18S-50	3	9/8/08	-4	4	Winters	Light	Blue/Purple	Oval	40.6	4.61	28.3
11	Misc.	F9N-21	2	8/19/08	-4	-9	Kearney	Medium	Blue	Oval	31.6	5.94	28.7
12	Misc.	E7S-37	2	7/14/08	-8	-52	Winters	Medium	Light purple/green	Oval	23.8	4.4	22
13	Misc.	G3N-23	1	7/23/08		-47	Davis	Medium	Rose	Round	38.9	--	22
14	Misc.	G4N-23	1	7/10/08		-60	Davis	Medium	Rose	Oval	26.5	3.63	21.9
15	Misc.	G10N-18	1	9/4/08		-4	Davis	Medium	Blue	Oval	31.7	4.31	24.2
16	Misc.	G10S-29	1	7/24/08		-46	Davis	Medium	Light Purple	Oval	33.3	2.82	20.4
17	Misc.	G37S-32	1	9/18/08		11	Davis	Heavy	Rose	Round/Oval	41.0	2.31	24.1

Table 10. The characteristics of the rehydrated dried fruit of the top 17 dried plum selections shown at the Dried Plum/Prune Testing Group meeting in November 2008. (Average flavor score by Bradley, DeBuse, and DeJong is on a rating scale of 1-5 with 5 being the best.)

Show Type	Selection	Dried Count per lbs	Dry Ratio	Color	Surface Wrinkles	Surface Brightness	Shape	Pit Size	Pit Type	Flesh Color	Flesh Quality	Average Flavor Score	Comments
Top 5	G3N-2	46.7	3.45	dark brown	Regular/fine	Dull	French	Medium	acceptable	gold/brown	acceptable	4	
Top 5	F11N-27	36.2	2.06	brown/red	regular/broad	Medium	French/Oval	Small	acceptable	yellow	goeey	5.1	fruity
Top 5	E3N-42	59.1	3.44	red	regular	Bright	French	Small	acceptable	orange/gold	goeey/meaty	4.3	sweet, yummy, fruity
Top 5	E2N-20	25.4	3.19	black/red	regular	Bright	Round/Oval	Medium	acceptable	yellow	goeey	4.1	good, fruity acid
Top 5	F13S-46	40.3	3.31	red/light brown	regular	Bright	Oval	Small	acceptable	orange/amber	goeey	4	Sweet
Level 3	D2N-76	39.1	2.5	red/brown	regular	Bright	Oval	Small	free	orange/amber	meaty	2.8	
Level 3	D18S-12	38.6	3.39	dark brown	Regular/fine	Bright	French/Oval	Medium	acceptable	orange/amber	fibrous/goeey	3.5	low acid
Level 3	D18S-7	37.3	2.85	brown	regular/broad	Bright	Oval	Small	semi-cling	amber	acceptable	3.8	low acid
Level 3	D10S-8	38.4	2.97	red/brown	regular	Bright	Round/Oval	Medium	semi-cling	amber/golden	goeey	4	
Level 3	D18S-50	25.3	2.2	red/brown	regular	Bright	Oval	Medium	semi-cling	amber	acceptable	3.5	sweet acid
Misc.	F9N-21	26.2	2.63	dark brown	regular	Bright	Round	Small	acceptable	orange/gold	meaty	2.8	Acid
Misc.	E7S-37	61.9	3.3	dark brown	regular	Bright	French	Medium	free	brown	acceptable	3.1	acid, unique taste
Misc.	G3N-23	44	3.62	dark brown	regular/broad	Bright	Oval	Medium	acceptable	orange	acceptable	4	dried cherry taste
Misc.	G4N-23	56.7	3.35	black/brown	regular	Medium	French	Large	acceptable	gold	acceptable	4.1	fruity, acid
Misc.	G10N-18	54.1	3.05	dark brown	regular	Bright	French/Oval	Small	acceptable	gold	goeey	4	rich flavor
Misc.	G10S-29	53.5	3.52	black	regular	Bright	Oval	Small	free	yellow	meaty	4.1	slight tip cracks
Misc.	G37S-32	42.4	3.5	mahogany	broad	Bright	Oval	Small	free	amber	goeey	4	gourmet, good

Table 11. The average testing group scores (1=worst, 5=best) given to the characteristics of the top 17 dried plum selection shown at the Dried Plum/Prune Testing Group meeting in November 2008, sorted by 'Average over all'.

Show #	Item	Flavor	Skin color	Skin quality	Fruit size	Pitting quality	Flesh Color	Flesh Texture	Average over all	Flavor Comments	Miscellaneous Comments
5	F13S-46	4.36	3.91	3.55	4.18	2.89	3.60	4.18	3.81	sweet, fruity, honey, apple, pear	skin is lighter than normal, size is slightly larger than standard.
0	Sutter	4.13	3.75	3.75	3.63	3.67	3.88	3.88	3.81	sweet, yet tart	size smaller than normal years
2	F11N-27	4.33	3.73	3.70	4.30	3.00	3.64	3.80	3.79	excellent, slight butter flavor	flesh is a gold honey color with gooey texture
0	Muir Beauty	4.06	3.89	3.33	4.11	3.21	3.89	3.89	3.77	sweet, fruity	amber colored meaty flesh
10	D18S-50	3.27	4.09	3.50	3.89	3.00	4.18	4.18	3.73	average, honey, fig	skin is slightly tough, pit is long and the flesh is amber that melts in your mouth
17	G37S-32	3.75	3.86	3.71	3.86	3.00	3.86	4.00	3.72	butterscotch, date pleasant	skin color is light brown or date colored, and flesh is orange with meaty, firm texture
16	G10S-29	3.71	3.57	3.29	4.00	4.50	3.14	3.43	3.66	different from French	skin is slightly thin and flesh is dark and slightly gooey
7	D18S-12	4.00	3.82	3.60	4.25	2.67	3.55	3.09	3.57	good, fruity, dates, honey, apple	skin is thin and fruit has a large size, flesh is soft and melting
15	G10N-18	3.83	4.00	3.43	3.33	3.33	3.29	3.57	3.54	not normal prune flavor	tough, black skin, average dried fruit characteristics
9	D10S-8	3.50	3.73	3.36	3.68	3.20	3.45	3.45	3.48	good fruity, honey	brown slightly thin skin, fruit is larger than average and has a pleasant gooey texture
6	D2N-76	3.80	3.70	3.70	2.55	3.22	3.60	3.65	3.46	good tangy prune flavor	looks similar to French, good pit and flesh seems tough to firm
8	D18S-7	3.73	3.50	3.18	3.91	3.00	3.36	3.23	3.42	smooth, caramelized, tangy	dried fruit is chocolate colored with the flesh having an amber color and chewy texture.
0	French	3.00	3.88	3.75	3.38	3.17	3.38	3.38	3.42	slight acid	flesh is a carmel color
1	G3S-2	3.96	3.50	3.09	2.67	3.22	3.64	3.82	3.41	sweet, crisp, fruity, dates, apricots	slightly thick skin, small fruit, dark amber flesh and a thick good flesh texture.
11	F9N-21	3.57	3.63	3.63	3.00	3.50	3.00	3.29	3.37	average	dark red firm skin, flesh is dark with a soft texture
4	E2N-20	3.45	3.36	2.82	4.50	2.60	3.10	3.30	3.30	tart, apple apricot	skin is tough and the pit might be too tight, flesh is rich and gooey.
13	G3N-23	3.14	3.57	3.33	2.86	3.50	3.29	3.14	3.26	baked fruit	tough skin, smaller fruit size and very dark flesh
3	E3N-42	3.64	3.40	3.36	2.82	2.67	3.60	3.30	3.26	great flavor, cognac	general appearance is similar to French, dried fruit has a slightly thicker skin, and sticky gooey flesh texture.
14	G4N-23	2.71	3.57	3.43	3.57	3.33	3.14	3.00	3.25	dried cherry, acid	average dried characteristics
12	E7S-37	2.50	3.57	3.57	2.71	3.67	3.00	3.50	3.22	buttery baked fruit flavor	smaller fruit size and pit has sharp tips

RELATED STUDIES

Relationship between accumulated growing degree hours 30 days after full bloom and harvest date for “Improved French” prune

It has been established in peaches, Japanese plums, and nectarines that the accumulated temperatures (GDH or growing degree hours) in the first 30 days after full bloom are highly correlated to the date of harvest (Ben Mimoun and DeJong, 1999). This correlation can be used as a predictor of the future harvest date. To see if a similar relationship exists in dried plums/prune, the harvest dates of French collected at UC’s Wolfskill Orchard (Winters, Yolo County) and Kearney Research and Extension Center (Parlier, Fresno County) over the last eight years were correlated to the associated accumulated GDH 30 days after full bloom for each year. A relationship was found in French prune that is similar to what has been found in the other *Prunus* crops (Figure 2).

This relationship signifies that the spring temperatures in the first 30 days after full bloom govern fruit developmental rates and are a major factor in determining the harvest date in any given year. The relationship can be used as a tool, early in the season, for growers to estimate harvest date for French. This can be easily accomplished, 30 days after bloom, by going to the UC Fruit & Nut Research and Information Center web site-<http://fruitsandnuts.ucdavis.edu>). Once there, select ‘Weather Services,’ then ‘Harvest Prediction Model.’ Select the location of your nearest California Irrigation Management Information System (CIMIS) weather station and enter the date of full bloom. The data that will be shown are the accumulated GDH during the first 30 days after bloom. Using this number, you can extrapolate from the figure below (Figure 2) and estimate how many days there will be from full bloom to harvest for that year. As a resource, this figure will be linked to the page labelled ‘About Growing Degree Hours’ found under ‘Weather Services’.

The prediction of this years Improved French harvest date using this method was estimated at August 27th at Wolfskill, approximately 159 days from full bloom to harvest. For Kearney the harvest date of French was predicted to be about August 28th, approximately 159 days from full bloom to harvest. This estimate was correct for Kearney, but about 7 days early for Wolfskill Actual harvest for Wolfskill was September 4th and for Kearney August 28th. This year, dried plum growers across the state began harvesting before our Wolfskill harvest date.

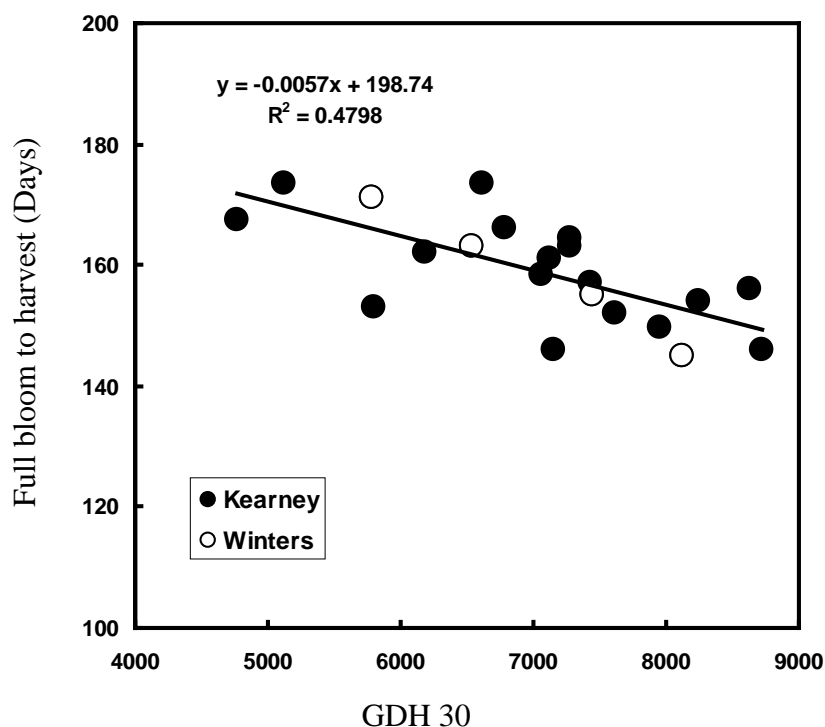


Figure 2. Relationship between growing degree hours (GDH) 30 days after full bloom and the number of days from full bloom to harvest for the cultivar 'Improved French' at Kearney and Winters.

DONATIONS

We would like to thank Duarte Nursery Inc, for the donation of nursery care of the program's 2008 seedlings. We would also like to thank Pacific Western Container for donating the tree protectors for the 2008 seedling planting at Davis. Their generosity helps support UC research and the California dried plum industry's goal in developing new dried plum cultivars for California.

REFERENCES

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