

## 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 the vast majority of the total dried plum acreage in California. This monoclone situation with its genetic similarities lends itself to vulnerability of widespread disease, 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 a monoculture system, the entire industry harvests and dehydrates the crop within a few weeks since the one cultivar matures at 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 such as tree structure, processing qualities, and tolerance to pest and disease. Introducing new dried plums that differ in flavor or color could 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-five 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 potential new cultivars that are specifically adapted for California growing conditions and markets.

We have recently discovered and are evaluating new dried plum selections that include a wide variety of flavors and dried fruit characteristics that are superior to the commonly produced Improved French cultivar. We believe these new dried plums have the potential of revitalizing consumer interest for California dried plum products. Conversely, we acknowledge that many of these new characteristics are not necessarily conducive to traditional processing methods. The program intends on introducing some of these unique dried plums to the industry while aggressively pursuing new selections that are easily processed and mix well with Improved French.

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 statewide industry suffered with poor crops during those years of heat during bloom. Because the critical time of pollination is so important we have begun to evaluate 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**

- 1.) To develop new dried plum varieties, through traditional horticultural breeding methods, with the following characteristics:
  - A) Increased fruit quality and improved fruit characteristics that increase efficiency and quality of drying and processing.
  - B) Earlier/later bloom and fruit maturity dates than “Improved French” dried plum
  - C) Tree characteristics that reduce labor cost involved in producing dried plums.
  - 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 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. 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 in the selection blocks prior to advanced testing with growers.

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.

Level 4 testing involves the planting of small 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 40 acres. At this level, thorough tests on process-ability and acceptability in the commercial market is conducted. This will then determine the commercial value of the item.

#### 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 release 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, 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, 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 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 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 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 have taken place in the testing group, it is now clear that in order for the California Dried Plum industry to take full advantage 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 of 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 large 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 growers and processors to have clear communication regarding the acceptability of new cultivars. This will allow the industry as a whole to take full advantage of new cultivars while avoiding plantings of unwanted items. In the next couple of years we will continue to work toward enhancing our advanced testing protocols to accomplish quicker establishment of larger (10-40 acre) test plantings to accomplish this goal.

## 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 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.

Table 1. Bloom data for the 2010 top selections.

<b>Cultivar</b>	<b>Full Bloom Date (90%)</b>	<b>Days in Bloom</b>	<b>Days from French 2010</b>	<b>Average Days from French</b>
<b>French</b>	3/22	5	-1*	0
<b>Sutter</b>	3/22	6	0	0
<b>Muir Beauty</b>	3/17	10	-5	-6.5
<b>Tulare Giant</b>	3/17	12	-6	-5
<b>F13S-46</b>	3/19	7	-3	-4
<b>F9N-21</b>	3/19	6	-3	-4
<b>F11N-34</b>	3/16	12	-6	-7
<b>F2N-32</b>	3/22	11	0	-2

\* 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 as a pollenizer for Tulare Giant 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

The harvest date for Muir Beauty was about 10 days before French at the two UC locations. The harvest date for our Winters location was August 6<sup>th</sup> with a pressure of 3.6 PSI and a brix ° of 21.2. At Kearney the harvest date was August 9<sup>th</sup> with a pressure of 3.7 PSI and a brix ° of 22.9. Full bloom of Muir Beauty occurred in mid March. Muir Beauty bloomed on the same day as Tulare Giant this year with their overlap extending over 10 days.

Commercial 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. It is suspected to need more drying time than French. More research is needed to determine if rehydration cook times or sorbate applications can be adjusted to compensate for the larger fruit size and less fibrous flesh texture of this cultivar. Until those issues are resolved, the recommended use for this dried plum is as a whole natural product.

### Sutter

Sutter's bloom overlapped with French but was extended prior to and past French bloom by about a day. Sutter harvest was about 8-12 days before Improved French. At all locations Sutter had comparable sugars to French. The Sutter variety provides the dried plum industry a cultivar with an early harvest date and high soluble solids. At Winters, it harvested on August 23<sup>rd</sup> with a pressure of 5.1 PSI and 28.9 °Brix. At Kearney it harvested on August 27<sup>th</sup> with a pressure of 5.4 PSI and brix ° of 25.1.

In 2008 a study was conducted in order to identify the optimal harvest time of Sutter. This research 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. When this recommendation was followed in the past commercial drying, pitting and handling of Sutter had excellent results for some processors. However, in 2010 there were substantial problems with the handling of Sutter by some processors and additional plantings are not being recommended at this time.

### 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 *P. 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 10 of the 12 days of Tulare Giant bloom. The harvest was normal with the fruit at Kearney Ag Center maturing on July 30 (6.7 PSI) and on July 20 (6.4 PSI) at Wolfskill. The soluble solids were both 18 ° Brix.

### Level 3 Testing

Level 3 testing is the evaluation of selections that are being grown and tested in grower's orchards. The top selections that are now at Level 3 testing are D6N-103, F9N-21 and F13S-46. A few additional items that are still being grown by cooperators will still be monitored for use in niche markets but have been deemed unusable for the main commercial market. Harvest data for the level 3 selections are shown in Table 2.

Table 2. Level 3 selection performance for 2010 at university selection blocks. 'Days from French' refers to the difference between the 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	Bloom days from French	Harvest days from French	Pressure	Sugar ° Brix)	Dried Count / lbs	Dry ratio	Comments
<b>F9N- 21</b>	Kearney	-4	-27	4.6	25.7	45	3.0	Will start to dry on tree, self pollinating. We need more data on processability
<b>F13S- 46</b>	Kearney	-4	-20	3.1	23.5	38	3.1	Yellow fruit, not self pollinating. Processing trials have been promising
<b>D6N-103</b>	Winters	-2	-5	4.7	23.6	46	3	Great tasting, great looking dried fruit. Not self pollinating Can be sold fresh or dried, large fruit size
<b>D2N-76</b>	Kearney	-6	-20	3.9	24.1	33	2.9	Excellent dried qualities, similar to French. Self Pollinating. Tree structure is a concern

F9N-21 is particularly interesting because it develops sugar early and remains firm for more than three weeks until it falls off the tree. The tree size is smaller than a standard tree, nursery trees will be propagated in 2011 to get an accurate sense of how dwarfing this tree might be. This tree might be able to decrease labor costs by reducing the need for excessive pruning in the orchard. It has consistently produced a heavy crop for the last 3 years and was shown to be self pollinating in 2010. Its fruit develops color in late June, and becomes sweet around the 2<sup>nd</sup> week in July, after that it continues to increase sweetness and reduce astringency. As seen in Table 3, it will stay firm for about one month on the tree. This makes the harvest date hard to predict. The fruit will start to fall off the tree after the first week in August. In past year's dried evaluations, F9N-21 has shown processing promise because it has substantial flesh and durable skin. However in 2010 it had weaker skin quality. This will be monitored in future years. Its sugar content can be as high as 27-30° Brix and it has a small, free pit. This selection should be a good option for growers who would like to spread out the harvest season.

Table 3. The fresh harvest data for F9N-21 for the last 4 years. The °Brix increases, but the pressure says firm.

Harvest date	Location	Grams/ Fruit	Pressure	% Brix
7/27/07	Kearney	41.9	3.9	22.2
7/3/08	Winters	32.9	6.1	19.2
7/8/08	Kearney	32.0	4.0	21.0
7/16/08	Kearney	29.7	5.5	22.7
7/22/08	Kearney	30.2	5.7	24.5
8/4/08	Winters	33.5	4.5	30.3
8/19/08	Kearney	31.6	5.9	28.7
6/30/09	Kearney	29.8	_6.9	20.6
7/9/09	Winters	18	6.4	24.2
7/10/09	Kearney	30.3	5.8	23.2
7/13/09	Winters	30.9	5.9	24.5
7/14/09	Kearney	33.1	5.8	24.8
7/20/09	Winters	28.6	5.1	24.9
7/23/09	Kearney	30.5	4.7	26
7/27/09	Winters	31.7	5.7	29
7/31/09	Kearney	29.4	4.9	27.7
8/3/09	Winters	27.6	6.6	31.3
8/12/09	Kearney	26.6	3.4	29
7/20/10	Winters	36.3	4.6	21.5
7/23/10	Kearney	29.4	4.2	16.4
7/26/10	Winters	33.3	5.5	21.5
7/30/10	Kearney	31.3	4.6	22.3
8/2/10	Winters	36.1	4.3	26.5
8/6/10	Kearney	31.7	4.6	25.7
8/9/10	Winters	34	3.9	25.5

F13S-46 bears an attractive, yellow fruit that has a shape similar to Improved French. It harvests about 3 weeks before French. F13S-46 blooms about 4 days before Improved French but it's flowers are not self-compatible, and it's compatibility with Improved French pollen is still under test. F13S-46 has a medium to small sized pit. It dries to make a very sweet, pleasant tasting prune and has received very high ratings in our fruit tasting events. Preliminary pitting tests by a commercial processor were successful. It will continue to be monitored for its processing ability.

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 market. It is versatile in the fact that it makes a great fresh pack plum as well. It would be ripe for fresh picking a week or two after Tulare Giant. D6N-103 is not self-compatible and requires Improved French as a pollinizer. This cultivar has a tendency to have around 10% split pits. This might prevent it from moving any further in the program. The

future of this selection depends on grower input, fresh pack growers are positive about it, but hesitate because of market conditions and the split pit issue. With correct thinning, this selection could easily fit into the fresh or the dried commercial market. It's sugar profile is similar to Improved French.

### 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 4 shows the harvest data of the top selections this year.

Table 4. 2010 Harvest data for advanced selections in Level 2 testing. 'Days from French' refers 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	Location	2010 Bloom Date from French	Harvest days from French	Pressure	Sugar (°Brix)	Dried Count per lbs	Dry ratio	Comments
F2N- 32	Winters	-1	-19	4.8	23.9	43	2.8	Great tasting, great looking dried fruit. Self Pollinating. Blush
F11N-34	Winters	-6	-20	7.4	22.5	51	2.9	Tastes wonderful dried. Small, free pit. Preharvest drop might be a problem
E11N- 29	Winters	-4	-13	2.7	27.8	53	2.8	Good skin quality. Needs more data. Yellow
G3N- 16	Winters	-9	-6	4.2	24.6	53	2.8	Good skin quality. Needs more data
E12S- 56	Winters	-4	-6	4.3	24.2	60	2.9	Good dried characteristics
G2N- 24	Winters	-3	-6	4.9	27.0	32	2.9	Large size, good dried characteristics

F2N-32 is a yellow with a heavy rose blush, French-shaped plum. It bloomed 3 days before Improved French and was harvested about 3 weeks before Improved French. It's pollen is self-compatible and has had excellent dried scores the last two years of tasting. It produced an excellent tasting dried product that has durable skin and flesh, making it a good candidate for processing. Pre-harvest drop is a concern and will be monitored in 2011.

F11N- 34 is a French shaped prune with yellow skin with a rose blush. It bloomed about a week before Improved French and was harvested 3 weeks before French. It has great dried fruit characteristics and tree structure. Fruit pressure uniformity at harvest is a concern and will be monitored in 2011.

E11N-29 is a new selection that is yellow when fresh. It is a great example of the program's new selections that have great dried fruit characteristics and more importantly great skin characteristics. This fruit has a great sturdy skin that will most likely go through processing with ease. 2010 was the first year of evaluations for this selection, so there is still much to be learned about this tree.

G3N-16 was selected due to its tough skin. It is a good example of what this program is looking for in regards to processability. The pit was a little large this year, so we will be monitoring that in 2011. This is the first year that fruit from this selection has been evaluated in the selection block.

E12S-56 is a yellow fresh plum. When it dries it has a nice dark brown color. The main concern with this selection is its dried shape. It has a distinct pear shape that might not be acceptable for commercial processors. It has a small dense pit with a meaty flesh.

G2N-24 is a new selection that has a great dried flavor. It dries well with a thick skin and substantially dense flesh. It is another good example of a fruit that should withstand processing. It is a large fruit, so acceptability in the industry will need to be tested.

### 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. One hundred and thirty samples were processed for the advanced rehydrated tasting evaluation in October with 57 of the samples coming from Level 1 seedlings. Table 5 shows the harvest data of the top seedlings evaluated at Level 1 this year. The selections listed in Table 5 will be grafted into both selection orchards for further evaluation.

### Program Inventory

All the seedling blocks are located in the UC Davis campus research orchards. In the summer of 2010, over 1,000 seedling trees were discarded after evaluation of the seedlings showed negative fruit or tree characteristics. The 2009 seed collected from controlled pollinations made in spring of 2009 were germinated in winter 2010, and grown over the summer in pots at Duarte Nursery. These young trees were planted in October 2010, into our seedling blocks at Davis. This added around 570 new seedlings to the 'I' block (Table 6).

The inventories of selections at each level of testing are shown in Table 7. 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 permit them to become cultivars but show other positive characteristics that may make them important parents for future generations.

Table 5. 2010 Harvest data for advanced selections in Level 1 testing at Davis.

Date tested	Days from French	Selection	Pressure	Sugar (°Brix)	Dried Count/lbs	Dry ratio	Comments
7/28	-42	H6S-40	4.8	22.6	71	3.1	Great tasting dried, nice small pit
7/28	-42	H6S-27	4.2	21.3	68	3.2	Small pit
7/29	-41	G37S-72	3.5	23	55	3.0	Free pit when dried. Prune taste
8/3	-37	G41N-14	2.9	22.7	47	3.5	great dried taste
8/3	-37	G41N-9	3.3	20.9	54	3.4	good dried characteristics
8/3	-37	G37S-14	2.5	23.2	67	2.9	unique dried flavor, small free pit
8/12	-28	H6S-36	4.2	23.1	61	2.6	Nice small, free pit
8/19	-19	G12N-51	6.1	23	63	2.8	Small pit, nice dried appearance
8/24	-16	G47N-31	4.6	22.5	64	3.2	small pit
8/24	-16	G47S-49	3.2	22.1	65	3.4	great dried characteristics
8/24	-16	G47N-28	6.3	24	40	2.8	overall good characteristics
8/24	-16	G43N-1	2.3	24.9	56	2.9	Nice small pit
8/25	-15	G36N-65	4.3	28.4	67	2.5	good dried characteristics
9/8	-2	H7N-71	3.2	26	48	2.7	great dried taste

Table 6. Seedling block inventories for 2010 located in the Davis UC research orchards.

Block	Acres	Year Planted	Seedlings Planted	Seedlings Remaining	Advanced Selections
G	7	2001-2005	6,756	3,302	49
H	4	2005- 2008	4,083	3,964	5
I	2.6	2008-cont.	1463*	1,463	
Seeds		2010		(1,619)*	
Totals	13.6		12,302	8,735 <sup>Δ</sup>	54

\*includes October 2010 planting

♦number of seeds in stratification for 2011 planting

<sup>Δ</sup> not including seeds

Table 7. 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 2010 additions
Level 1	8,735	570 (~ 1,619 seeds)
Level 2	59	14
Level 3	5	1
Level 4	3	0
Breeding Population	97	6

#### Disease Screening

This year, cool spring weather with a significant amount of rain promoted less disease pressure than expected in our test orchards. No data was collected on brown rot. Scab presented the only significant disease pressure in our orchards. 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 than Improved French were discarded.

#### Sugar Testing

This year, sugar analysis was started on the program's top selections. Analysis of the soluble carbohydrate content was done to determine if there are differences among the selections and if so, to determine if differences in sugar composition correlate with good processing quality. Preliminary data are shown in Table 8. Four types of sugar and sugar alcohol were analyzed: glucose, fructose, sucrose and sorbitol. Sucrose is composed of one glucose and one fructose molecule. Sucrose is expected to degrade upon dehydration. Sorbitol is a sugar alcohol that acts as a preservative in the dried fruit, is thought to be more resistant to hydrolysis than the other sugars and has significant positive dietary attributes. We were surprised by the large differences in fruit sugar profiles among some genotypes and in future years, we hope to determine correlations between processing success and fresh fruit sugar concentrations.

Table 8. Results from the preliminary soluble carbohydrate analysis. All individual sugar results are a percentage of the total.

Selection	Total Fresh Sugar	Fresh Glucose	Fresh Fructose	Fresh Sucrose	Fresh Sorbitol	Total Dried Sugar	Dried Glucose	Dried Fructose	Dried Sucrose	Dried Sorbitol
		% total	% total	% total	% total		% total	% total	% total	% total
<b>Muir Beauty</b>	23.8	21.85	5.88	50.0	22.2	55.2	31.0	18.5	21.7	28.8
<b>D18S-12</b>	23.4	16.24	3.85	44.4	35.4	59.3	17.4	9.1	30.4	43.2
<b>D6N-103</b>	25.2	36.51	11.51	18.2	33.7	55.8	41.8	20.3	4.7	33.3
<b>F9N-21</b>	25.6	31.25	11.33	18.3	39.0	61.6	36.4	19.8	4.1	39.8
<b>French</b>	21.2	35.38	11.32	20.7	32.5	56.8	38.9	15.3	3.0	42.8
<b>D2N-76</b>	23.2	29.31	8.62	20.6	41.3	57.5	37.0	17.6	7.5	37.9

### 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. The group met again in November in Davis and evaluated the dried fruit of the top selections (including French as a standard) and discussed their dried product characteristics. Tables 9 and 10 provide details on the fresh and dried characteristics of each of the selections tested. The group's evaluations and ratings for each of these selections are shown in Table 11 which is sorted by 'Flavor' score.

As shown in Table 11, the test panel's, top two dried plums were F2N-32 and E12S-56. F2N-32 is a promising level 2 item that the program is continuing to monitor. E12S-56 is a yellow pear shaped fruit. We have concerns that the shape of the fruit may be too oblong, so input from processors is needed to determine if it would be accepted in the marketplace. The two rated at the bottom of the taste panel were French and F13S-46. This was surprising because F13S-46 was rated number one by the testing group panel in 2009 and 2008. This is a good example of how cultivars can change from year to year. It is possible this specific cultivar did not attain the same flavor as it had in past years due to the unusual cool spring and summer. 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 selections shown at the Dried Plum/Prune Testing Group meeting in November 2010.

<b>Selection</b>	<b>Level of Testing</b>	<b>2010 Bloom Date from French</b>	<b>Location</b>	<b>Harvest days from French</b>	<b>Fresh Weight</b>	<b>Pressure</b>	<b>Sugar (°BRIX)</b>	<b>Fresh Skin color</b>
<b>F9N- 21</b>	3	-4	Kearney	-27	31.7	4.6	25.7	Purple
<b>F2N- 32</b>	2	-1	Winters	-19	27.2	4.8	23.9	Blush
<b>F11N-34</b>	2	-6	Winters	-20	29.9	7.4	22.5	Blush
<b>F13S- 46</b>	3	-4	Kearney	-20	39.2	3.1	23.5	Yellow
<b>E11N- 29</b>	2	-4	Winters	-13	25.9	2.7	27.8	Yellow
<b>French</b>	4	--	Kearney	--	23.4	4.4	22.5	Purple
<b>G3N- 16</b>	2	-9	Winters	-6	24.3	4.2	24.6	Purple
<b>E12S- 56</b>	2	-4	Winters	-6	21.9	4.3	24.2	Blush
<b>G2N- 24</b>	2	-3	Winters	-6	47.8	4.9	27.0	Purple
<b>G41N-14</b>	1	--	Seedling block	-37	40.9	2.9	22.7	Purple
<b>G12N- 51</b>	1	--	Seedling block	-19	21.6	6.1	23	Purple
<b>H7N- 71</b>	1	--	Seedling block	-2	26	3.2	26	Yellow
<b>Sutter</b>	4	-1	Kearney	-6	27.6	5.4	25.1	Purple
<b>Muir Beauty</b>	4	-6	Kearney	-20	40.5	3.6	21.2	Purple
<b>Stanley</b>	4		Winters	-6	36.1	4.5	21.4	Purple/ Blue

Table 10. The characteristics of the rehydrated dried fruit of the top 12 dried plum selections shown at the Dried Plum/Prune Testing Group meeting in November 2010. (Average flavor score by Castro, DeBuse, and DeJong prior to the November meeting is on a rating scale of 1-5 with 5 being the best.)

Selection	Dried Ct/lb	Dry ratio	Dried Skin Color	Surface Wrinkles	Surface Brightness	Dried Shape	Pit size	Pit Type	Flesh Type	Skin Quality	Average Taste Evaluation
<b>F9N- 21</b>	45	3.0	Dark Brown	Irregular/ Small	Average	Oval/ Round	Med/ Small	Semi Free	Goosey	Average/ Thin	3.3
<b>F2N- 32</b>	43	2.8	Mahogany	Average	Bright	French	Medium	Semi Free	Meaty	Average	4.0
<b>F11N-34</b>	51	2.9	Dark Brown	Average	Bright	Oval	Small	Free	Average	Excellent	4.3
<b>F13S- 46</b>	38	3.1	Light Brown	Average	Good	Sutter	Small	Semi Free	Meaty	Average	4.3
<b>E11N- 29</b>	53	2.8	Light Brown /Red	Broad	Good	French	Medium	Semi Free	Meaty	Excellent	2.5
<b>FRENCH</b>	64	3.13	Dark Brown	Average	Good	French	Small	Semi Cling	Meaty	Excellent	2.3
<b>G3N- 16</b>	53	2.8	Brown	Average	Good	French	Med/ Small	Semi Free	Average/ Goosey	Excellent	2.8
<b>E12S- 56</b>	60	2.9	Red	Average	Good	French	Med/ Small	Semi Free	Average	Average	3.1
<b>G2N- 24</b>	32	2.9	Brown	Average	Good	French	Med/ Small	Semi Cling	Goosey	Average	3.8
<b>G41N-14</b>	47	3.5	Dark Brown	Average/ Broad	Good	Sutter	Medium	Semi Free	Goosey/ Meaty	Average	4.3
<b>G12N- 51</b>	63	2.8	Mahogany	Irregular/ Average	Good	French	Small	Semi Free	Meaty	Excellent	3.5
<b>H7N- 71</b>	48	2.7	Red/ Mahogany	Average	Bright	Oval	Small	Semi Cling	Meaty	Excellent	4.0
<b>SUTTER</b>	58	3	Dark Brown	Average	Bright	Sutter	Med/ Small	Semi Free	Average	Average	3.1
<b>MUIR BEAUTY</b>	38	3.6	Dark Brown	Average / Broad	Good	Oval	Medium	Semi Free	Goosey	Weak	3.5

<b>STANLEY</b>	42	3.1	Dark Brown	Average/ Fine	Average	Oval	Large	Semi Cling	Average/ Goosey	Weak	2.3
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Table 11. The average testing group scores (1=worst, 5=best) given to the characteristics of the selections shown at the Dried Plum/Prune Testing Group meeting in November 2010, sorted by 'Flavor'.

Selection	Flavor	Skin Color	Skin Quality	Fruit Size	Pitting Quality	Flesh Color	Flesh Texture	Comments
<b>F2N-32</b>	4.1	3.5	4.0	3.6	3.4	4.0	4.1	Sweet refreshing flavor, strong, sturdy skin, small partially free pit
<b>E12S-56</b>	4.1	3.6	3.4	2.9	3.6	3.8	3.6	Different baked flavor, thin skin, pear shaped, small good pit, meaty stringy
<b>H7N-71</b>	3.9	3.4	4.0	3.5	2.6	3.6	3.4	Sweet, orange, caramel flavor, tough skin, meaty tough flesh
<b>G2N-24</b>	3.7	4.0	4.0	3.6	2.7	3.5	3.8	Tastes good, tart flavor, thick skin, tight large pit, meaty firm flesh
<b>F11N-34</b>	3.5	3.5	3.6	3.6	4.0	3.3	3.6	Pleasant apple/caramel flavor, tough skin quality, sharp pointed pit, stringy flesh
<b>E11N-29</b>	3.4	3.6	3.8	3.0	3.3	3.6	4.0	Sweet, yummy flavor, tough skin, meaty flavor
<b>G41N-14</b>	3.4	3.5	2.7	3.6	3.3	3.0	2.6	Dried cherry flavor, thin skin, big free pit, stringy gooey
<b>G3N-16</b>	3.3	3.3	3.8	2.4	2.8	2.5	3.1	Average taste, tough skin, large tight pit
<b>F9N-21</b>	3.2	3.2	2.3	3.3	3.0	3.2	2.4	Fruity, acid flavor, Small semi free pit, thin skin, gooey texture.
<b>G12N-51</b>	3.0	3.0	3.0	2.0	2.4	3.4	2.9	Bland dried flavor, thin skin, small pit, firm flesh
<b>F13S-46</b>	2.8	2.9	3.3	3.6	3.0	3.7	3.3	Average Flavor, tough soft skin, meaty gooey flesh
<b>French</b>	2.3	3.3	3.7	3.1	1.6	2.8	2.6	Bland Flavor, tough skin & flesh, not pitable

## 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 (DeBuse et al. 2010) (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 year’s Improved French harvest date using this method was estimated at September 6<sup>th</sup> at Wolfskill, approximately 168 days from full bloom to harvest. For Kearney the harvest date of French was predicted to be September 2<sup>nd</sup> date which was approximately 163 days from full bloom to harvest. This estimate was very close for Winters, but about 3 days early for Kearney. Optimal harvest for both locations was September 5<sup>th</sup>,

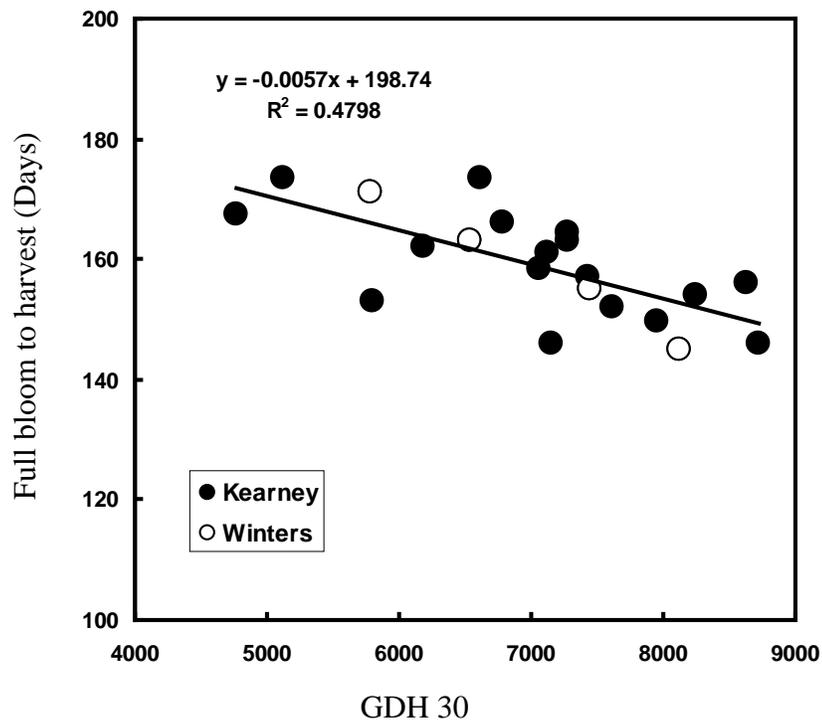


Figure 2. Relationship between growing degree hours (GDH) 30 days after full bloom and the number of days from full bloom to harvest for the cultivar 'Improved French' at Kearney and Winters.

## DONATIONS

We would like to thank Duarte Nursery Inc, for the donation of nursery care of the program's 2010 seedlings. We would also like to thank Pacific Western Container for donating the tree protectors for the 2010 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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