

## 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 negative weather. 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. There is also the possibility of broadening the consumer base by the introduction of new dried plums that differ in flavor or color to French.

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 entering what is expected to be 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 seven to ten 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. Sutter is self-compatible and is able set a heavy crop without additional pollination. Sutter has been successfully propagated on Marianna, 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. The fruit of Muir Beauty matures in early August about 10 to 15 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. Limited pitting tests have resulted in easy pit removal. In taste 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 plum rootstocks, Marianna and Myrobalan. The tree is more precocious than Improved French, flowering and fruiting at an early age. Muir Beauty is self-compatible and is able set a heavy crop without additional pollination.

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 the California dried plum industry.

## **PROGRAM OBJECTIVES**

- 1.) To develop new dried plum varieties, through traditional horticultural breeding methods, with the following characteristics:
  - A) Tree characteristics that reduce labor cost involved in producing dried plums.
  - B) Increased fruit quality and improved fruit characteristics that increase efficiency and quality of drying and processing.
  - C) New specialty traits; with the dried product being equal or improved in quality to “Improved French”, but differing in taste or color.
  - D) Tolerance/resistance to disease.
  - E) Earlier/later fruit maturity dates than “Improved French” dried plum.
- 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 in 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 at 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 are developing a new strategy for the final evaluation and future release of dried plum/prune cultivars derived from the breeding program. We have 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.

## RESULTS

The weather this year greatly affected what was observed in the orchards. It was considered a very unusual year all around. Over the winter, California valleys had an adequate amount of accumulated chilling hours. This chilling satisfied the chilling requirements for all of our selections and seedlings. By early March, we were expecting an early to normal timed bloom but the weather became cold and wet. This cold spell lasted well into April. The effect on bloom was that all the dried plum trees bloomed very late and flowering of individual trees was very spread out. Some of the items including Improved French bloomed two weeks past their normal mid-March bloom time with open flowers on the tree from 7 to 10 days. This did not seem to strongly affect the final fruit set of Improved French or any other item in our program. What was noticed was that the first flowers to be pollinated seemed to be the ones that set fruit. The flowers that opened at the end of the extended bloom did not set fruit. This was helpful because it produced a crop that had a similar pollination date. Therefore the fruit grew in a synchronized manner and had a comparable fruit size through out the canopy.

The wet spring promoted russet scab on many items in our program and scoring of the severity of the disease was done at all locations. The 30 days following bloom were more in the normal range of temperatures which allowed for the number of days between bloom and harvest to be normal (160 days on average see related studies for more information).

The high temperatures in July hit a record for 'number of consecutive days over 100° F' in most of California growing regions. With this heat, the fruit grew rapidly causing fruit cracking in the French cultivar and a few of our selections. It also caused some of the selections to show a high percentage of pit burning and internal heat damage. This allowed us to score selections for these defects and helped to eliminate inferior selections.

The harvest time for all the selections and cultivars in the program was delayed because of the delay in bloom and the cool spring. Though heat during summer was more than adequate, this heat did not hasten maturity date. The last fruit harvested in the program was a late Level 2 selection from Wolfskill on October 3<sup>rd</sup>. Overall the 2006 year can be said to have been unusual yet the data collected helped in the understanding on how the dried plums react at the extremes.

### 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 7-14 days before French at both the UC locations (Table 1). This harvest difference was within the normal range (10-15 days) described previously for this cultivar. Full bloom of Muir Beauty fell near the middle of March leaving 12-20 days, depending on location, in between the full bloom of Muir Beauty and Improved French. Though Muir beauty bloomed slightly earlier than Tulare Giant this year there was an overlap of the two cultivars and Tulare Giant set well at the test locations.

Table 1. Muir Beauty 2006 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	8/23	4.0	20.5	37	Medium
	French	8/30	3.4	20.7	55	Medium
Winters Research Orchards	Muir Beauty	8/22	4.1	26.4	32	Medium
	French	9/5	3.3	24.8	40	Medium
Yolo County	Muir Beauty	8/29	6.0	23.9	n/a	Light
	French	No French comparison				

Sutter

Sutter was released from this program in 2000 and several growers have taken the opportunity to plant acreage of Sutter. The California acreage is small but growing and in the next few years the first crops will be harvested and sent to the processors.

Though the bloom was late for both Sutter and French, the weather at bloom time did not prevent a healthy fruit set for either cultivar. The fruit set for Sutter at all of the UC locations varied this year depending on the crop size the trees carried the year before. The medium set trees in 2005 returned with a medium to heavy set crop in 2006 at both UC orchard locations. In 2005, the heaviest set Sutter trees were at Wolfskill and the fruit was allowed to remain on the trees until late after the other Sutter trees had been harvested. These same trees in 2006 had a much lighter bloom and lighter set compared to their medium set counterparts. This result of a light set following a heavy set is a normal occurrence in other prune cultivars including Improved French. Managing fruit thinning annually can reduce this biennial bearing habit. French set a medium to heavy crop this year at Kearney and Wolfskill.

Maturity for Sutter compared to French did not show its usual 7-10 day difference this year at all locations (Table 2). At Kearney, Sutter and French matured through out the season at the same rate, ending with the identical harvest date. Though the harvest date was the same, the soluble solids (Brix) of Sutter were higher than French. In Winters, the maturity dates for the two

cultivars were close to their normal spread but the younger trees (fifth leaf) of both cultivars matured a week later than the mature trees. In addition, the soluble solids on the younger trees were the same for both cultivars (Table 2). This similarity in soluble solids has never been seen in previous years. Sutter usually has been harvested with at least 2° Brix higher than French. The reasons for these abnormalities in harvest data this year were probably due to the cool spring weather after bloom. The likely explanation for this was that the fruit growth rate that occurs in the days after bloom probably differed for these cultivars at different temperatures. In future years, it will be interesting to see if similarities in the time of harvest and level of soluble solids occur again.

Table 2. Sutter 2006 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	8/30	3.9	24.1	42	Medium
	French	8/30	3.4	20.7	55	Medium
Winters Research Orchards	Sutter (mature)	8/22	4.1	26.4	37	Medium
	French (mature)	9/5	3.3	24.8	40	Medium
	Sutter (young)	9/5	5.6	25.4	40	Medium
	French (young)	9/13	4.8	25.9	42	Medium
Yolo County	Sutter	8/29	8.5	22.7	n/a	Medium
	French	No French comparison				

### 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 bloomed later than usual this year but Muir Beauty's bloom still over-lapped it adequately at our locations. The harvest was also later than usual with the first harvest at Kearney being near the middle of July and the last pick possible near the first of August. The soluble solids ranged between 17.5-20.0° 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, 6-21-56, E13S-60, D6S-87 with the addition this year of D10S- 8, D18S-7 and D2N-76. Harvest data are shown in Table 3.

Table 3. Level 3 selection performance for 2006 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.

<b>Selection</b>	<b>Harvest Date</b>	<b>Days from French</b>	<b>Soluble Solids (Brix)</b>	<b>Fruit Size (ct/lb)</b>	<b>Crop size</b>
D6S-87*	8/24/06(W)	-12	24.0	42	Medium
D18S-7	8/31/06(W)	-5	26.8	31	Light
D2N-76	8/31/06(W)	-5	26.0	38	Light
French	9/5/06(W)	0	24.8	40	Medium
D10S- 8	9/6/06(K)	7	24.1	43	Medium
E13S-60*	9/14/06(W)	9	28.8	41	Light
6-21-56	9/14/06(W)	9	31.2	29	Light
D6N-103	9/20/06(W)	15	26.3	29	Medium

\* These items have shown high susceptibility to russet scab in 2005 and 2006 and will be removed from the Level 3 testing as of this year.

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 Improve French is a compatible pollinizer of D6N-103.

6-21-56 is a beautiful, shiny dried fruit with remarkable flavor, scoring among the top choices for flavor in the last three years. In 2006, mature trees at both research locations were showing signs of pre-harvest drop before fruit maturity. This may have been intensified by the high temperature in July but it needs to be carefully evaluated in the coming years. In grafting experiments this year, this selection showed that it is incompatible with peach rootstock. It is graft compatible on M2624, M40, and Myro 29C rootstocks.



D6S-87 and E13S-60 are both high quality dried plums but in the last two consecutive years they have shown high levels of russet scabs at all our locations. Because of this susceptibility these two selections are being withdrawn from further Level 3 testing. The trees located in growers' orchards will continue to be monitored but no additional trees will be grown.

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. 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.

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.

D10S- 8 is a round purple colored fresh plum. In previous years, it has harvested before French but this year the harvest date fell after French. The dried plum is very sweet with soluble solids ranging between 24-27 Brix and the dried fruit has a very sweet taste.

### 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. 2006 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.

<b>Selection</b>	<b>Harvest Date</b>	<b>Days From French</b>	<b>Soluble Solids %</b>	<b>Fruit Size (ct/lb)</b>	<b>Crop Load</b>
D4N-101	8/15/06(W)	-21	25.6	40	Medium
E7S-63	8/31/06(W)	-5	25.3	42	Light
D12N-65	8/30/06(K)	0	19.0	61	Medium
E5S-93	8/30/06(K)	0	26.4	29	Medium
F2S-20	9/5/06(W)	0	22.8	34	Medium
French	9/5/06(W)	0	24.8	40	Medium
D13N-53	9/14/06(W)	9	25.1	41	Light
D18S- 12	9/14/06(W)	9	24.3	28	Light
D18S-50	9/14/06(W)	9	28.8	28	Medium
E4S-90	9/20/06(W)	15	25.9	27	Medium
D7N- 33	9/27/06(W)	22	27.7	42	Medium

The two outstanding Level 2 dried plums this year are D18S-12 and D18S-50. D18S-12 makes a wonderful dried plum that easily could be placed in a "Gourmet" type market, where its

distinctly different flavor and texture could entice new consumers to the dried plum market. D18S-50 is a super sweet dried plum that usually harvests about a week after French. This dried plum could lengthen the dried plum harvest and contribute a high quality and high sugar product to the industry. Both of these cultivars will be placed in Level 3 testing next year.

### 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. Russet scab was observed and selected against in many of the seedlings. Table 5 shows the harvest data of the top seedlings evaluated at Level 1 this year. All of these seedlings will be promoted to Level 2 testing in 2007.

Table 5. 2006 Harvest data for advanced selections in Level 1 testing at Davis.

<b>Selection</b>	<b>Harvest Date</b>	<b>Days From French</b>	<b>Soluble Solids %</b>	<b>Fruit Size (ct/lb)</b>	<b>Crop Load</b>
F11N-35	7/21/06	-52	20.7	61	Light
F8N- 62	7/29/06	-44	25.8	46	Medium
F11N-34	8/14/06	-28	24.2	60	Medium
F10S-60	8/18/06	-24	23.8	50	Medium
F2N- 32	8/18/06	-24	24.1	45	Light
F9S- 88	8/18/06	-24	27.8	36	Medium
E1N- 34	8/25/06	-17	26.8	49	Medium
E1N- 35	8/25/06	-17	26.5	47	Light
E13N-39	8/29/06	-13	22.5	35	Medium
F3S- 5	8/29/06	-13	26.0	57	Light
F6N-39	9/2/06	-9	24.9	86	Medium
E10S-78	9/11/06	0	27.1	37	Light
E1N- 49	9/18/06	7	25.8	49	Light
E6N- 30	9/18/06	7	23.3	47	Medium

### Program Inventory

All the seedling blocks are located in the UC Davis campus research orchards. In the summer of 2006, 1,392 seedling trees were discarded after evaluation of the seedlings showed negative fruit or tree characteristics. Evaluation of all the remaining trees in Block 'E' was finalized this year and the block will be removed. The 2005 seed collected from controlled pollinations made in spring of 2005 were grown over the summer in pots at Duarte Nursery. The young trees were planted in November 2006 into our seedling blocks at Davis. This added 1,544 new seedlings to block 'H' (Table 6). Ninety-four fruit samples were processed for the advanced rehydrated tasting evaluation in October with 56 of the samples coming from Level 1 seedlings.

Table 6. Seedling block inventories for 2006 located in the Davis UC research orchards.

<b>Block</b>	<b>Acres</b>	<b>Year Planted</b>	<b>Seedlings Planted</b>	<b>Seedlings Remaining</b>	<b>Advanced Selections</b>
E	2.2	1999-2000	2,100	0	30
F	2.4	2000-2001	2,240	550	23
G	8.0	2001-2005	6,756	5,984	3
H	2.0	2005- cont.	2,002*	2,002	
Seeds		2006	( $\approx$ 1000) <sup>♦</sup>		
Totals	14.6		13,098 <sup>△</sup>	8,536	56

\*includes 2006 November planting

♦number of seeds in stratification for 2007 planting

△not including seeds

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 allow them to become cultivars but show other positive characteristics that may make them important parents for future generations.

Table 7. Number of unique selections in the dried plum program and their level of testing including the breeding population.

<b>Level of Testing</b>	<b>Number of Items</b>	<b>Number of new 2006 additions</b>
Level 1	8,536	1,544 ( $\approx$ 1000 seeds)
Level 2	96	17
Level 3	7	2
Level 4	3	0
Breeding Population	90	4

### Disease Screening

The long cool wet spring created optimum conditions for russet scab in both the Kearney and Wolfskill selection blocks and the Davis seedling blocks. Disease evaluation was done on all selections and cultivars in the blocks throughout the harvest period. No causal agent is known to cause the disease although the industry regularly sprays the trees with fungicide in spring to prevent russetting of the fruit. It has been shown that rain in the first week following full bloom

can induce the russeting. The UC orchard test blocks in the program were not treated to allow russet scab to develop naturally.

The screening methods used to evaluate the disease severity were described by T. Michailides (1991). Individual fruit sampled throughout the season was scored from 0-4 on severity of the disease (0=none, 4=severest). Michailides showed that fruit scoring a 3 or 4 were unmarketable so to evaluate a selection the percent of fruit scoring 3 or 4 was recorded. The total incidence of russet scab was recorded as the percent of fruit that showed any signs of russeting on them.

This years observation's show that over 170 items had 0% of their fruit scored as unmarketable and of these almost 100 showed no presence of scab at all (Figure 1). There were only 22 items that scored higher than 50% of fruit showing incidence of scab and only 3 items that had scab so severe that over 50% of the fruit was unmarketable. These highly susceptible items will be removed from further testing and discarded.

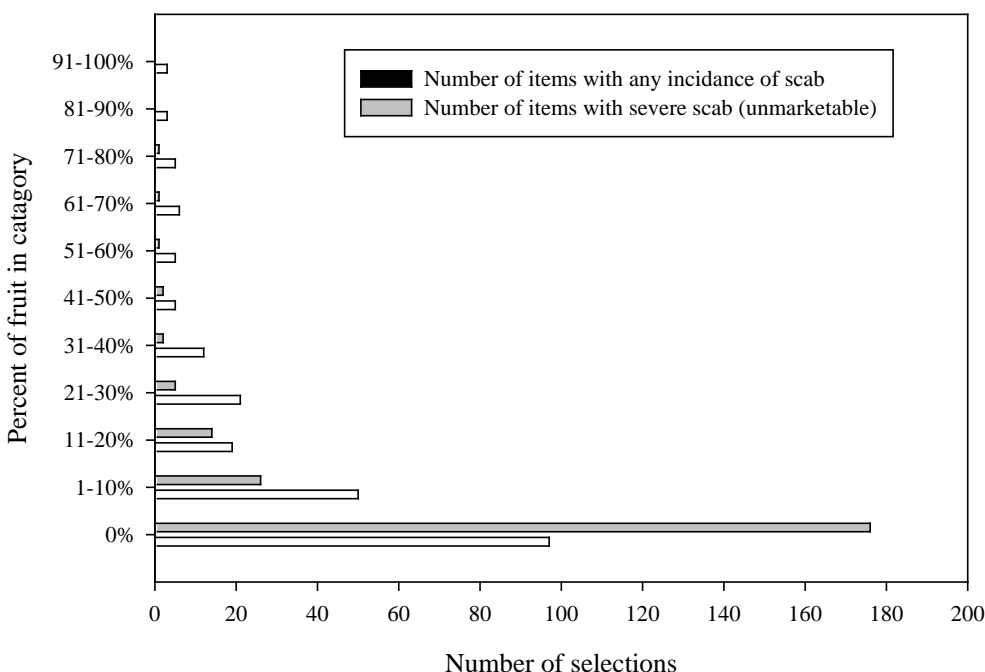


Figure 1. Number of selections scored in the program for russet scab in 2006 placed in categories according to their associated percentage of fruit that showed any incidence of scab (black) or have unmarketable fruit damaged by russet scab (grey).

The results show that there is variation within the germplasm for the presence and severity of russet scab. This may have been due to differing bloom times or genetic characteristics of individual selections conferring resistance or susceptibility to the disease. Since russet scab was able to be scored in two consecutive years at Kearney a correlation between the two years was examined (Figure 2 and 3). The graphs showed that there was a relationship from year to year for many of the items. The scatter in the graph indicates that some items had increased incidence of scab in one year compared the other year. This could was likely due to differences in spring

weather, time of bloom, location or a combination of the three. If an item showed susceptibility to russet scab one year the likelihood of showing it in future years was reasonably high.

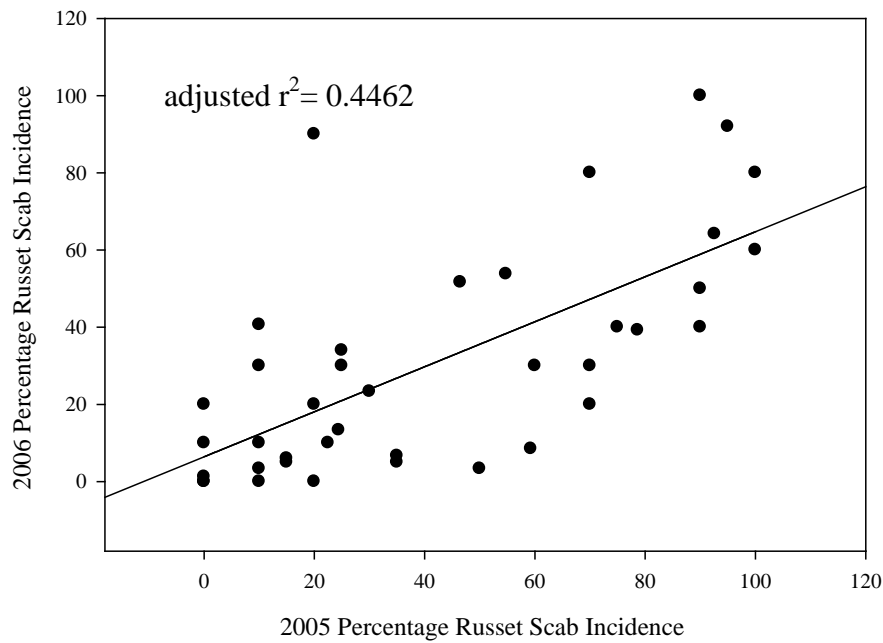


Figure 2. The correlation between the 2005 and 2006 percentage of fruit showing any incidence of scab (scores of 1-4). Each point represents an individual selection.

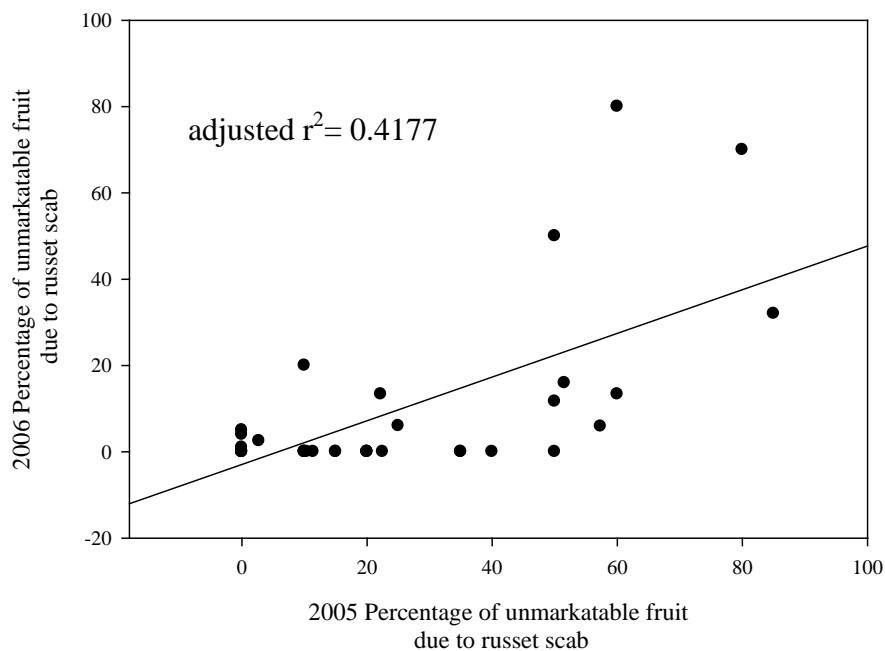


Figure 3. The correlation between the 2005 and 2006 percentage of fruit that was scored unmarketable due to russet scab (scores of 3-4). Each point represents an individual selection.

The percentage of russet scab susceptibility was compared at Kearney for the higher level selections in 2005 and 2006 (Figure 4 and 5). The selections that scored the highest in the incidence of scab (Figure 4) and the percentage of unmarketable fruit due to scab (Figure 5) for 2005 also scored high in 2006. For the most part, this follows the expected correlation in disease incidence with the exception of D18S-12 which scored much higher in 2006 than it did in 2005. The one selection, D6S-87, that scored higher than French for disease incidence in both years will be removed from further testing and discarded. Sutter showed a higher amount of unmarketable fruit than French in 2005 and a lower amount in 2006. Previous observations of these two cultivars over the years have shown no difference between them in russet scab susceptibility. Both cultivars should be treated for scab if the weather after bloom becomes wet and cold. Muir Beauty has shown a lower susceptibility to russet scab than French in the last two years and in previous observations. Tulare Giant showed virtually no russet scab damage in 2005, 2006 and in previous observations. This tolerance seems to have a genetic basis because the weather following Tulare Giant bloom was wet and cold in 2006.

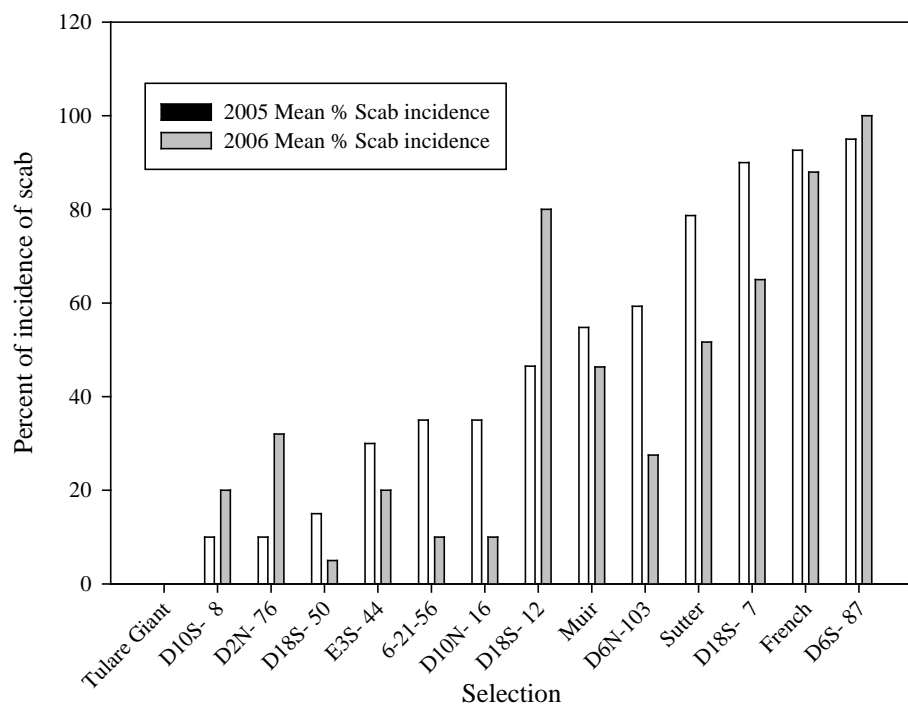


Figure 4. Elite selections comparing 2005 (black) and 2006 (grey) percentage of scab incidence at Kearney selection block.

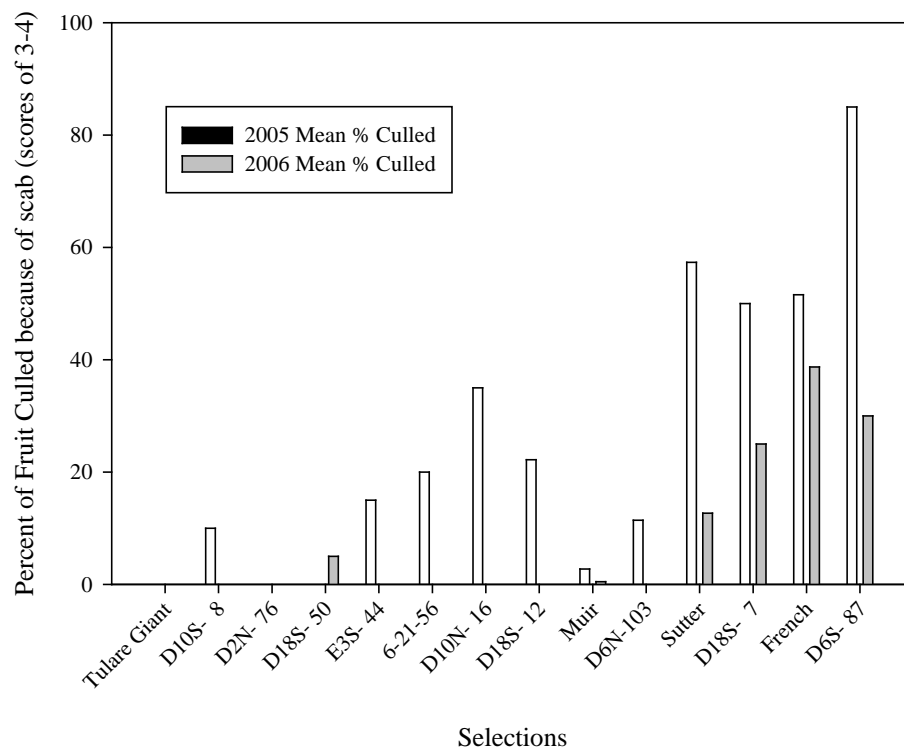


Figure 5. Elite selections comparing 2005 (black) and 2006 (grey) percentage of unmarketable fruit (scoring 3 or 4) at Kearney selection block.

### Dried Plum/Prune Testing Group

The Dried Plum/Prune Testing Group met in early 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 December in Davis to evaluate the top 19 selections (including French as a standard) and discussed their dried product characteristics. Tables 8 and 9 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 10 which is sorted by flavor score.

Sutter was again one of the highest rated dried plums for flavor. This evaluation has been successfully held for three years, 2002, 2003 and 2005, and in every year Sutter has been rated one of the highest for flavor. This year the dried plum that was rated higher than Sutter in flavor score was D18S-12. This new item is a 'Gourmet' type dried plum that is distinctly different from French. French, on the other end of the rating scale, has been rated in the lower end of the scale for flavor over the years. This year French was also rated very low in pitability also. The flavor preference may be shared by consumers and may help increase consumption of dried plums once Sutter is available in the market. Two of the Level 2 items have been promoted to Level 3 testing based on testing group interest. They are D18S-12 and D18S- 50 (see Level 2 summary for a description of these dried plums). The evaluations of the Testing Group added important data and opinions to our evaluation of the programs advanced dried plum selections.

Table 8. The characteristics of the fresh fruit of the top 19 dried plum selection shown at the Dried Plum/Prune Testing Group meeting in December.

Show Number	Selection ID	Harvest Date	Days from French	Test Level	Location	Crop Size	Skin Color	Fruit Shape	Weight Grams /Fruit	Internal Pressure (PSI)	Soluble Solids (Fresh)	Percent of fruit affected by SCAB	Percent of SCAB fruit that would be CULLED
1	E11N- 29	8/16/06	-26	1	Davis	Heavy	Yellow	French +/-	32.5	3.5	19.2	50%	10%
2	F10S- 60	8/18/06	-24	1	Davis	Medium	Purple	Oval	28.7	2.6	23.8	0%	0%
3	F2N- 32	8/18/06	-24	1	Davis	Light	Rose/ Yellow	Oval	29.1	3.2	24.1	10%	10%
4	F9S- 88	8/18/06	-24	1	Davis	Medium	Purple	Oval	34.5	2.1	27.8	0%	0%
5	Muir Beauty	8/22/06	-14	4	Winters	Medium	Purple	Round	46.5	4.1	26.4	53%	0%
6	E1N- 34	8/25/06	-17	1	Davis	Medium	Blue	Oval	29.7	2.5	26.8	0%	0%
7	E13N- 39	8/29/06	-13	1	Davis	Medium	Lt. Rose	French +/-	42.6	1.9	22.5	10%	0%
8	F3S- 5	8/29/06	-13	1	Davis	Light	Yellow/ Rose	French +/-	22.4	3.4	26.0	0%	0%
9	E5S- 93	8/30/06	0	2	Kearney	Medium	Purple	Oval w/point	49.9	5.5	26.4	30%	10%
10	Sutter	8/31/06	-5	4	Winters	Medium	Purple	Sutter	35.6	4.7	26.3	7%	0%
11	D2N- 76	8/31/06	-5	3	Winters	Medium	Lt. Rose	Oval	33.7	4.5	26.0	60%	0%
12	D18S- 7	8/31/06	-5	3	Winters	Medium	Lt. Rose	French +/-	43.8	4.7	26.8	20%	0%
13	French	9/13/06	0	0	Winters	Medium	Rose	French	33.3	4.8	25.9	27%	7%
14	D13N- 53	9/14/06	9	2	winters	Light	Lt. Purple	Oval	26.6	3.5	28.1	40%	0%
15	D18S- 12	9/14/06	9	2	Winters	Light	Lt. Rose	Round	55.3	2.3	24.3	40%	10%
16	D18S- 50	9/14/06	9	2	Winters	Medium	Purple	LONG O	41.8	5.3	28.8	10%	10%
17	E6N- 30	9/18/06	7	1	Davis	Medium	Lt. Rose	French +/-	30.7	4.0	23.3	0%	0%
18	D6N-103	9/20/06	15	3	Winters	Medium	Purple/ green	Large French	40.8	3.4	26.3	10%	0%
19	D7N- 33	9/27/06	14	2	Winters	Medium	Purple	Round	27.4	5.2	27.7	0%	0%



Table 9. The characteristics of the rehydrated dried fruit of the top 19 dried plum selection shown at the Dried Plum/Prune Testing Group meeting in December. (Average flavor score is on a rating scale of 1-5 with 5 being the best tasting.)

Show Number	Selection ID	Harvest Date	Dried Count per lb.	Dry ratio	Skin Color	Surface Wrinkles	Skin Peel	Surface Brightness	Shape	Pit Size	Pit Type	Flesh Color	Flesh Quality	Average Flavor Score	COMMENTS
1	E11N- 29	8/16/06	48	3.33	Date	Irregular	some	dull	French +/-	Medium	semi Free	Gold/ brown	Average/ Meaty	3.5	Fruity, use to breed for date color
2	F10S- 60	8/18/06	50	3.05	Black	Regular	slight	Medium	Oval	small	semi Free	Amber/ red	Goosey/ Meaty	3.8	Slight acid, Fruity, not french
3	F2N- 32	8/18/06	45	2.97	Brown	Regular	none	Bright	Oval	small	semi Free	dark Amber	Goosey	3.4	Dried persimmons, baked goods flavor
4	F9S- 88	8/18/06	36	2.61	Dark Brown	Regular/ Fine	none	Bright	Oval	small	semi Free	Amber	Meaty	4.2	Excellent flavor, slight acid, fruity
5	Muir Beauty	8/22/06	32	3.08	Brown	Irregular	some	Medium	Oval	small	cling	Orange	Goosey/ Meaty	4.0	Fruity
6	E1N- 34	8/25/06	49	2.99	Dark Brown	Broad/ Fine	slight	Medium	Oval	Medium	semi Free	dark Gold	Goosey	3.7	slight fruity acid, different from French
7	E13N- 39	8/29/06	35	3.46	Lt. Brown	Regular	slight	Bright	Oval/neck	small	Free	Amber	Meaty/ Goosey	3.2	slight acid
8	F3S- 5	8/29/06	57	2.54	Lt. Brown/ Red	Regular	none	Bright	French +/-	Medium	cling	bright Orange	Meaty	3.7	good flavor
9	E5S- 93	8/30/06	29	2.65	Brown/ Date	Regular	slight	Bright	long Oval	small	cling	Gold/ orange	Meaty	4.2	Tangy, dried peach flavor
10	Sutter	8/31/06	40	2.94	Brown	Regular	slight	Bright	Oval/neck	large	semi Free	Amber/ gold	Meaty/ Goosey	4.1	Sweet and fruity
11	D2N- 76	8/31/06	38	2.79	Brown	Regular	slight	Medium	Oval/ Round	extra small	Free	Amber	Meaty	4.4	Dried plum flavor
12	D18S- 7	8/31/06	31	2.80	Brown	Broad	slight	Medium	Oval	small	cling	Amber/ orange	Meaty/ Goosey	3.8	baked goods flavor, nice
13	French	9/13/06	42	2.78	Lt. Brown	Regular	slight	Bright	French +/-	small	cling	Yellow	Meaty	2.5	Dried plum flavor
14	D13N- 53	9/14/06	46	2.51	Lt. Brown	Fine/ Regular	none	Bright	French +/-	small	cling	Gold	Goosey	3.1	Dried plum flavor similar to French
15	D18S- 12	9/14/06	28	3.17	Brown	Broad	slight	Bright	Flat Oval	small	semi Free	Amber/ brown	Goosey	5.0	Apricot "Gourmet"
16	D18S- 50	9/14/06	28	2.52	Black	Regular	none	Medium	Long Oval	Long medium	semi Free	Gold/ amber	Meaty	3.6	sweet
17	E6N- 30	9/18/06	47	3.15	Brown/ Lt. Brown	Irregular	some	Medium-	French +/-	small	Free	Yellow/ amber	Meaty	3.5	fruity, could blend w/French
18	D6N-103	9/20/06	29	2.86	Brown/ Lt. Brown	Regular	none	Bright	Large French	Large	Free	Yellow/ gold	Meaty	3.8	fruity, caramel, exceptional
19	D7N- 33	9/27/06	42	2.60	Dark Brown	Regular	none	Bright	Oval	small	semi Free	Yellow/ gold	Goosey/ Meaty	4.6	excellent flavor, fruity

Table 10. The average group score ratings (1=worst, 5=best) given to the characteristics of the top19 dried plum selection shown at the Dried Plum/Prune Testing Group meeting in December 2006, sorted by flavor score.

Show Number	Item	Flavor	Skin color	Skin quality	Fruit size	Pitting quality	Flesh Texture	Flesh Color	Average over all	Comments
15	D18S- 12	4.38	3.68	3.57	4.50	3.14	3.79	3.93	3.86	taste like candy, complex flavor, amber flesh color, slightly dull skin, large fruit size, large pit
10	Sutter	4.29	3.71	3.64	4.36	2.82	3.79	3.39	3.71	good flavor balance, firm texture, long pit moderately free
17	E6N- 30	4.07	3.36	3.50	3.31	4.36	4.00	3.79	3.77	very fruity, one of the best, yellow flesh with soft skin
8	F3S- 5	3.79	3.50	3.33	2.14	2.64	3.36	3.46	3.18	butterscotch flavor, orange color flesh
6	E1N- 34	3.65	3.29	3.04	3.54	2.50	3.43	3.25	3.24	apricot fruity flavor, dark flesh, flesh adheres to pit slightly
3	F2N- 32	3.64	3.36	3.46	3.36	4.07	3.36	3.07	3.47	date flavor, fruity, apricot, sweet, dark flesh, average size pit
19	D7N- 33	3.61	3.46	3.00	3.14	3.07	3.64	3.43	3.34	fruity, taste better than French, dark flesh, firm skin
5	Muir Beauty	3.46	3.36	3.31	4.57	2.75	3.69	3.50	3.52	fruity flavor, gooey to firm flesh, flesh adheres to pit slightly
4	F9S- 88	3.43	3.43	3.61	4.00	3.14	3.43	3.32	3.48	tart/sweet, fruity, good texture, flesh adheres to pit slightly
16	D18S- 50	3.43	3.43	3.50	4.50	2.50	3.64	3.14	3.45	date-like flavor, complex flavor, wow!, dark skin and flesh, long pit
1	E11N- 29	3.39	2.75	3.36	3.77	3.46	3.69	3.93	3.48	weak flavor, taste of persimmons, dull skin color, almost free pit, nice flesh
9	E5S- 93	3.29	3.86	3.71	4.57	2.21	3.27	3.14	3.44	nice sweetness tartness balance, slight acid, rich flavor, large fruit size, large pit, dark skin color, Maybe fresh market?
12	D18S- 7	3.21	3.43	3.23	4.21	2.86	3.29	3.64	3.41	very nice fruity flavor, bright colored and meaty textured flesh, large fruit size
18	D6N- 103	3.21	4.00	3.62	4.43	2.64	3.23	3.50	3.52	Okay flavor, tough skin, meaty(tough) flesh
2	F10S- 60	3.18	3.18	3.43	3.11	4.46	3.23	3.04	3.37	cherry, spicy, tangy flavor, dark skin and flesh, small free pit
11	D2N-76	2.93	3.57	2.93	3.86	3.64	3.29	3.75	3.42	taste similar to French, good balance, nice light color flesh, good pit to flesh ratio
13	French	2.86	3.15	2.77	3.15	2.35	3.08	3.19	2.94	plain flavor, dull slightly dark flesh, firm texture, slightly tight pit
7	E13N- 39	2.79	3.21	2.88	3.64	2.57	2.92	2.82	2.98	Cognac flavor, amber flesh, nice flesh texture
14	D13N- 53	2.71	3.50	3.14	3.15	2.36	3.00	3.21	3.01	not so nice of flavor, similar to French, tough skin, meaty flesh

## 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 future harvest dates. 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 6).

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 6) 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 September 10<sup>th</sup> at Wolfskill approximating 157 days from full bloom to harvest. For Kearney the harvest date of French would be about September 4<sup>th</sup> approximating 160 days from full bloom to harvest. This estimate was within 5 days of the actual harvest at these locations. Actual harvest for Wolfskill was September 5<sup>th</sup> and for Kearney October 30<sup>th</sup>.

We would like to collect historical and current data for bloom date and harvest date information for more locations than just these two. With a large collection of data, the model could be refined to the point of being a very useful tool to the industry.

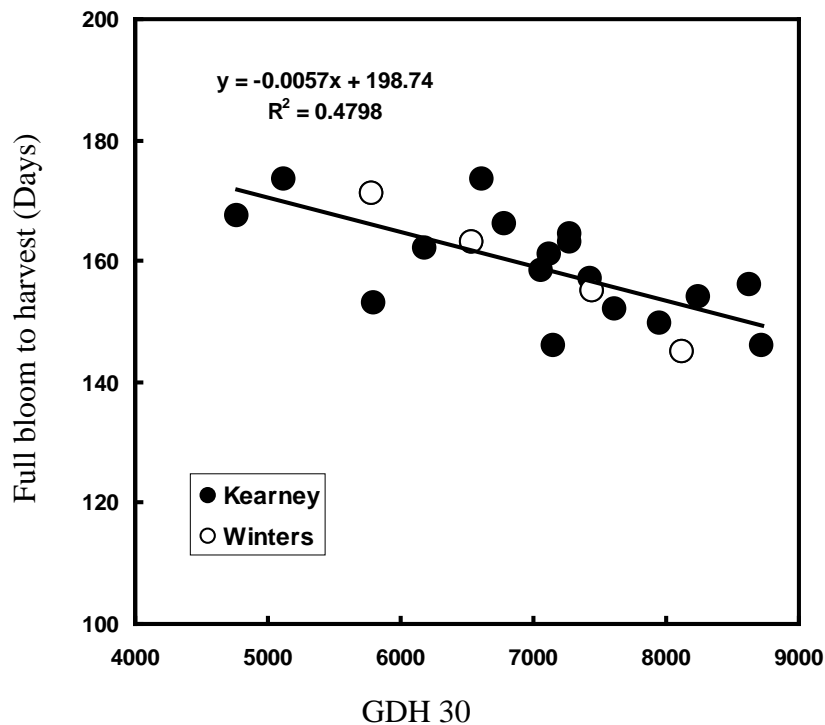


Figure 6. Relationship between growing degree hours (GDH) 30 days after full bloom and the number of days from full bloom to harvest for the cultivar ‘Improved French’ at Kearney and Winters.

## DONATIONS

We would like to thank Duarte Nursery Inc, for the donation of nursery care of the program’s 2006 seedlings. We would also like to thank Pacific Western Container for donating the tree protectors for the 2006 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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