

## PRUNE CULTIVAR EVALUATION AND DEVELOPMENT

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### OBJECTIVES

The California prune industry currently produces on over 75,000 acres and is almost entirely dependent on a single cultivar, the "Improved French Prune." The utilization of this old cultivar and several other mutations from the "French" type, virtually ensures that all prunes in a specific production region need to be harvested and dehydrated in a short period of time. The development of other acceptable prune cultivars, maturing earlier or later than the "Improved French Prune" to spread out the harvest and processing season, would greatly increase the efficiency of California prune production.

The Prune Cultivar Evaluation and Development project was initiated at the Kearney Agricultural Center (KAC), Parlier, California in July, 1985, in response to the need for new prune cultivars. The project has three main objectives.

1. The importation of several new prune cultivars developed in France that are reported to have earlier or later maturity dates than "Improved French", and the evaluation of these cultivars to determine their adaptation to California orchard conditions and their potential for utilization by the California prune industry.
2. The development of a California prune cultivar improvement program to produce cultivars with earlier or later maturity dates than "Improved French." These cultivars would also need to exhibit equal or improved production and processing characteristics in comparison with "Improved French."
3. The investigation of various cultural means of shortening the unproductive juvenile development period of P. domestica seedlings and thereby shortening the breeding generation interval.

### PROCEDURES

1. Budwood of eight prune cultivars was imported from France in 1985 through the USDA Plant Germplasm Quarantine Center at Beltsville, MD. Three of the eight items are patented cultivars developed by Dr. Rene Renaud at the Tree Fruit Research Station of Grande Ferrade at Ponte de la Maye, Bordeaux, France. All eight cultivars were obtained with the assistance of Mr. Wallace Heuser of International Plant Management, Lawrence, MI, the North American licensee of the French government (INRA).

In February of 1986, trees of the eight new cultivars were established in a 1.25 acre site at KAC along with trees of the "Improved French" as a comparison. The planting at KAC was randomized and replicated with ten trees of each variety.

One of the eight test cultivars the "Lorida" prune was eliminated from the test in 1989. The Lorida fruit has consistently cracked badly from the outset of testing. Even with a heavy crop in 1990 the cracking problem did not diminish.

Data collection from the seven remaining test cultivars and the Improved French continued in 1990. Measurements included average trunk circumference, harvest date, average fruit pressure and soluble solids content at harvest, average yield per tree, average fruit size, drying ratio and average dry count per pound.

2. The development of new prune cultivars has received increasing emphasis in this project. A number of Kearney selections were test dried in 1990. Evaluation of the first seedling block (502-5) neared completion in 1990. Additional hybrid prune seedlings were planted both in seedling rows and in the nursery, and additional hybrid crosses were made. Evaluation of prune seedling selections transferred to Kearney from a previous U.C. Davis cultivar development program continued in 1990.
3. The use of various cultural systems to induce precocity continued in 1990. Many direct budded seedlings on Marianna stock have set flower buds and will fruit in 1991. Selection of vigorous seedlings in the nursery also continued in 1990.

#### RESULTS:

Trunk circumference measurements were made in November of 1990 and the results are given in Table 1. The Double Robe (812) cultivar continues to be substantially larger in circumference than the other seven cultivars in the test.

Table 1. Mean trunk circumference of nine cultivars in KAC test orchard.

<u>CULTIVAR</u>	<u># TREES*</u>	<u>Trunk Circumference (cm)</u>			
		<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Double Robe (812)	9	27.2	39.3	48.3	51.0
GF 642	10	21.1	32.4	41.1	45.9
GF 2733	3	23.2	34.0	40.8	45.2
Tardicotes	10	24.9	34.4	40.6	45.0
Im. French	10	23.1	33.3	40.0	43.8
GF 303	7	20.8	31.1	39.0	43.1
GF 652	1	20.0	32.2	41.3	42.9
Primacotes	10	22.7	32.1	37.0	42.2

\*Some cultivars had fewer than 10 trees measured because of a lack of trees of equal age.

Table 2 summarizes the production data obtained from the cultivar evaluation block in 1990. Most trees in this test are in their fifth year and are planted on a 18 by 18 foot spacing. Only measurements from trees of equal age were used in this comparison.

Table 2. Fruit and yield comparison. KAC prune cultivar evaluation 1990.

CV.	HARV. DATE	WET KG/TREE	GM/FT.	HARV. PRESS	(°BRIX) SS.	DRY T/A	DRY RATIO(:1)	CT/LB
Primacotes	7-23	31.7	31.1	2.2	20.2	1.3	3.5	53
GF 652	8-16	83.4	23.1	3.8	17.9	3.3	3.7	68
GF 303	8-23	61.8	20.4	2.4	18.4	2.7	3.4	75
Im. French	8-23	102.9	19.2	3.0	20.9	4.7	3.2	80
GF 642	8-23	84.3	21.7	2.8	20.8	3.8	3.3	68
GF 2733	8-23	75.8	24.6	2.9	20.6	3.6	3.1	59
812	8-28	91.5	36.5	3.2	21.2	4.1	3.3	43
Tardicotes	9-19	35.3	20.3	3.9	20.3	1.6	3.2	71

The first major crop on the test trees was produced in the 1990 growing season. Table 3 contains the cumulative yields for the first three years of production.

Table 3. Cumulative yields for prune test cultivars. KAC evaluations 1988 to 1990.

CV.	DRY TONS PER ACRE			
	1988	1989	1990	cum
Im. French	0.3	1.7	4.7	6.7
812	0.2	1.3	4.1	5.7
GF 642	0.1	0.9	3.8	4.8
GF 2733	0.1	0.8	3.6	4.5
Tardicotes	0.4	1.6	1.6	3.6
GF 652	-	0.3	3.3	3.6
Primacotes	0.3	1.6	1.3	3.2
GF 303	0.1	0.4	2.7	3.2

CONCLUSIONS:

The following comments are based upon performance in the KAC plot over the last two years (1989 and 1990).

Primacotes:

This new hybrid cultivar continues to be the least vigorous of the cultivars under test. The early date of maturity and large fruit size are positive characteristics but are substantially offset by low soluble solids, low productivity and difficulty in harvesting. In 1990 harvest was delayed to the latest reasonable date in order to obtain the most favorable solids accumulation and best possible removal of fruit from the tree. Even with

pressure as low as 2.2 pounds and a relatively light crop, solids averaged only slightly above 20 °Brix. At three pounds pressure, solids were 18.3. Removal of the fruit from the tree by shaking was not appreciably improved by the advanced maturity. Almost no natural fruit drop occurred by July 23rd. The primary fruit bearing area of the tree is at the end of shoots on one year old wood. As the tree matures the new wood is reduced and, as seen this season, the crop is also correspondingly reduced. Very little fruit is being set on spurs. The terminal position of the crop, usually borne in large drooping clusters, is very difficult to remove by shaker. If the long shoots are shortened by pruning in dormant season this results in one year wood being removed and substantial reduction of the crop. This terminal bearing habit appears to limit the value of the Primacotes cultivar in the California shake-catch system of prune production.

#### GF 652:

The GF 652 is a clonal selection of the French Prune d'Ente. It is a "spur type" tree with moderate vigor, fewer numbers of strong upright limbs and relatively dense spur development. The cultivar has been slower coming into production than Improved French in the Kearney test, but in 1990 a large increase in productivity occurred. This was principally due to the numerous spurs that began to flower and set fruit. The GF 652 appears to be 3 to 5 days earlier in maturity than Improved French. The fruit does not hang well and drop can be substantial after fruit pressure lowers to 3.5 lbs. Soluble solids were the lowest of all cultivars in the test. Correspondingly the drying ratio for GF 652 was the highest in the test. Unless this combination of low soluble solids and early drop changes in the future, this cultivar will be of little value to California growers.

#### GF 303:

The GF 303 is another clone of the French Prune d'Ente. The tree is similar in vigor and bearing habit to the Improved French. The 303 has been the least productive of the d'Ente clones in this test, less than half as productive as Improved French. During the last two years this clone appears to have suffered from fruit heat damage prior to harvest. Up to one third of the fruit on the tree darkened internally and began to shrivel prematurely although no appreciable fruit drop occurred. This internal damage may account for the low solids accumulation and unusually rapid drop in fruit pressure observed in this cultivar during both 1989 and 1990. If heat tolerance and productivity continue to be a problem with this cultivar there is little chance of its success in the interior valleys of California.

#### Improved French:

This cultivar is the industry standard in California. It has performed very well in the Kearney test, with the highest cumulative production and good soluble solid accumulation. The Improved French has had the smallest fruit size in the test but this is in part due to the high productivity.

GF 642 and GF 2733:

These clones of the French Prune d'Ente have been the best performers of the d'Ente group. Both have good tree vigor and larger fruit size than the Improved French, and harvest together with Improved French. Although yields of the two clones have been acceptable, they have been lower than Improved French, one dry ton per acre less in 1990 and two dry tons per acre less cumulatively. The dates of harvest do not achieve the program goals of producing cultivars with earlier or later maturity dates than Improved French.

812:

The 812 cultivar, also known as the "Double Robe" is a non-French type prune. In the test at Kearney the 812 has had large fruit size, high soluble solids and the largest, most vigorous tree of the cultivars under test. Productivity has been good, second only to Improved French. Date of maturity is about five days after Improved French. By 28 August, about eight percent of the fruit had dropped (3.2 pounds pressure) and fruit fall was increasing. Harvest needs to be accomplished by this date in order to prevent substantial losses.

Tardicotes:

Late date of maturity is possibly the only asset of this new hybrid cultivar. By 19 September, with 3.9 pounds pressure, 52 percent of the crop had dropped on the ground. Many fruit on the tree appeared to have heat damage or to be very dry internal textured. Fruit size in 1990 was relatively small and solids accumulation, even at advanced maturity was just above 20° Brix. The high number of fruit doubles (20%) and internal heat damage indicates that this cultivar is not adapted to California interior valley conditions. Further testing of this cultivar does not appear warranted and the Tardicotes will probably be dropped from the Kearney test in 1990.

2. The performance to date of the new prune cultivars from France emphasizes the importance of climatic adaptation to the eventual success of any new prune cultivar. With this in mind, emphasis in the Kearney project has turned to the evaluation of the large number of hybrid seedlings that have been produced and planted at KAC since 1985. Evaluation of the first block of 1650 seedlings, (Block 502-5) planted in 1986, was initiated in 1989 and neared completion in 1990. Fruit from 41 selected seedlings in Block 502-5 was dried in 1990 and a total of 12 selections have been retained for further testing. Table 4 is a summary of fruit measurements from the 12 selections made in 1990. The same measurements from the cultivars Primacotes and Improved French are listed for comparison.

Table 4. Block 502-5 Selections, KAC 1990

SEL.#	HARVEST DATE 1990	LBS. PRESS	WET GMS./FT.	(°BRIX) SS.
11-8	7-17	2.7	26.4	21.0
Primacotes	7-23	2.2	31.1	20.2
3-17	7-31	3.6	30.2	21.9
19-38	8-9	2.6	21.2	22.8
3-21	8-9	3.3	27.5	23.7
22-16	8-9	4.1	25.6	21.4
3-4	8-9	4.3	19.1	20.0
3-8	8-15	3.8	30.2	24.4
19-27	8-24	1.8	32.8	25.8
19-39	8-24	2.1	32.3	19.0
Imp. French	8-23	3.0	19.2	20.9
11-34	9-4	3.0	34.7	24.0
22-53	9-11	1.8	26.1	23.4
6-51	9-17	3.3	31.1	19.4

The data above compares fruit measurements from the original seedling on its own roots and Primacotes and Improved French on Marianna 2624. Almost all of the selections have been re-propagated on 2624 in an advanced selection block for further evaluation.

A new block of 1250 hybrid seedlings will begin production in 1991 (Block 502-1). Most of these have been propagated on Marianna 2624 and are more vigorous than Block 502-5 which was all on its own root. An additional block of 1210 seedlings (Block 502-2) will have a small amount of fruit in 1991 but will essentially begin production in 1992. Currently there are 2750 hybrid seedlings in the nursery. About half of these will be planted into permanent seedling rows in spring of 1991. A new nursery planting will be established in spring 1991 with 1100 hybrid seed from 1990 crosses. This seed was the result of 13,500 emasculations made in spring of 1990 involving 74 different combinations of parents.

Evaluation of parental cultivars remains an ongoing part of the project. Nearly all of the 60 *P. domestica* cultivars growing at Kearney have now fruited and several have been utilized in the breeding program. Advanced KAC selections and commercial prune cultivars round out the germplasm pool now in use in the KAC program.

In spring of 1985, thirty five prune selections from a previous U.C. Davis cultivar improvement program were transferred to Kearney. Fruit production and evaluation began in 1987 and, as of 1990, a total of ten selections remained under test. Table 5 is a summary of fruit and yield measurements made in 1990.

Table 5. U.C. Davis Prune Selections (KAC 1990)

SEL #	1990 HARVEST DATE	LBS PRESS	WET GMS/FT.	(°BRIX) SS.	WET KG/TREE
D1-25	8-24	2.9	25.2	23.4	36.1
D3-11	8-18	2.2	24.6	20.4	29.8
D3-20	7-31	3.2	26.8	17.2	Very few
D5-70	8-28	2.2	28.6	21.8	33.5
D5-71	8-23	3.5	23.5	23.4	20.8
D10-70	8-21	2.8	31.3	18.8	Very few
D2-3-35	7-31	2.9	25.3	18.2	moderate
D2-8-4	10-3	2.6	27.3	25.1	10.8
D2-10-40	8-14	3.1	22.4	23.2	moderate
D2-11-60	7-31	2.8	18.2	21.2	27.8
Imp. French	8-23	3.0	19.2	20.9	102.9

All of the numbered selections have now completed their sixth year in the test orchard. The Improved French trees used as comparison are one year younger (5th year) and are planted in the same test orchard.

This is the final evaluation for the group of 10 selections. None appears to have the potential for development into a commercial cultivar. Productivity is lacking in all of the items, yields in 6th leaf ranging from only 20 to 30 fruit up to 36 kilos, barely one third of the production of Improved French. In addition, two selections, D3-11 and D2-8-4, consistently have small shoulder cracks on a high percentage of the fruit. Further evaluation of these selections does not appear justified since more precocious and more productive material is now available from the newer hybrid plantings.

3. Techniques for managing seedling populations to shorten, as much as possible, the unproductive juvenile growth stage have been established for the duration of the program. Precocity in the seedling populations is being encouraged genetically by utilizing parents that produce precocious seedlings. Precocity appears to be highly heritable and parents so identified are being utilized where ever possible. In addition, screening in the nursery for seedling vigor is being used to identify vigorous populations. The more vigorous populations and progeny from precocious parents are moved directly to permanent seedling rows and left to fruit on their own roots. Populations of only moderate vigor or progeny from less precocious parents are propagated as unselected seedlings onto Marianna 2624 to stimulate vigor and promote rapid fruiting as possible. Weak or prostrate growing seedlings are identified at an early age in the nursery and discarded from the program.