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The Evaluation and Selection of Current Varieties

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For a grower, variety selection is key to both establishing and replanting orchards. Because few almond varieties are self-fertile, combinations of varieties rather than single varieties should be selected. Several at least partly self-fertile varieties have been introduced, but in California none has been extensively planted due to uncertainties about their productivity or because of unfavorable characteristics.

Major varieties planted in California include Nonpareil, Carmel, Mission (Texas), Merced, Ne Plus Ultra, Price, and Peerless. These seven varieties made up about 90 percent of the state's acreage in 1989.

CHARACTERISTICS TO CONSIDER

Important characteristics to consider in almond variety selection include time of bloom; pollen compatibility; time of maturity and ease of nut removal; yield; freedom from pests, diseases, and other disorders; and marketability (including kernel quality). This chapter

provides information about most of these characteristics for certain varieties.

Bloom Time

When determining a variety's susceptibility to frost damage, bloom time is important. Early-blooming varieties may be more subject to frost conditions and inclement pollination weather.

Coincidence of bloom among varieties is important in selecting satisfactory pollinizers. Almond varieties are grouped by their bloom periods in table 8.1. Usually, varieties within the same bloom group (for example, Nonpareil and Carmel) or from adjacent bloom groups (for example, Nonpareil and Sonora, or Nonpareil and Monterey) will overlap and cross-pollinate satisfactorily, except in the case of incompatible combinations (table 8.2). However, the closer that varieties bloom together, the better the opportunity for cross-pollination and the setting of a crop. The reasons for this are better overlap of flower receptivity and the tendency of bees to fly between trees at a

Table 8.1 Almond varieties grouped by approximate bloom periods.

Early (-6 and earlier)	Early mid (-5 to -1)	Mid (0 to +2)	Late mid (+3 to +4)	Late (+5 to +7)	Very late (+8 and later)
Jordanolo	Milow	Aldrich	Butte	Livingston	Planada
Ne Plus Ultra	Peerless	Carmel	Carrion	Mission	Ripon
	Sonora	Fritz	Drake	Mono	
		Harvey	LeGrand	Padre	
		Jeffries	Monarch	Ruby	
		Merced	Monterey	Thompson	
		Nonpareil	Norman		
		Price	Sauret #2		
		Sauret #1	Tokyo		
		Solano			
		Woods Colony			

Note: This table is based primarily on results of the Manteca Regional Variety Trial. The numbers in the column heads indicate the days before (-) or after (+) peak Nonpareil bloom.

similar stage of bloom. Early- and late-blooming varieties (such as Ne Plus Ultra and Mission) will not have sufficient bloom overlap, and therefore will not provide adequate cross-pollination for each other. Even the overlap of mid- and late-blooming varieties (for instance, of Nonpareil and Mission) is usually inadequate.

Besides coincidence, the relative order of bloom time between varieties can be important, particularly between the main producing variety and its pollenizers. Assume, for example, that Nonpareil is the main variety. Overlap with the early Nonpareil bloom is particularly important, because the earlier bloom of a variety usually has a higher-percentage set than does the later bloom on the same tree. From this standpoint, even though Ne Plus Ultra's bloom may peak 6 days earlier than Nonpareil's does, it is a much better pollenizer for Nonpareil than is Mission, which blooms 5 to 7 days later than Nonpareil. Ne Plus Ultra is regarded as a relatively good pollenizer for Nonpareil; however, the reverse may not be true, because of their sequence of bloom.

The time of almond bloom may change somewhat from year to year, and in a given year may even differ between locations. The sequence of bloom among varieties seldom changes greatly, but some crossover between adjacent groups can occur in some years and locations. Differences depend on temperature sequences—both cool and warm—during the winter prior to bloom and during the bloom itself.

Pollen Incompatibility

Almond varieties fall into specific groups within which cross-pollination will not occur. Tables 8.2 and 8.3 summarize our knowledge of such incompatibility between varieties. Varieties listed within the same group (table 8.2) are cross-incompatible and will not cross-pollinate each other. However, any variety in one group is cross-compatible with any variety in other groups. The exception is Jeffries, which is reciprocally incompatible within certain groups.

Table 8.2 Pollen-incompatible groups of almond varieties.

Nonpareil	Mission	Ne Plus Ultra	Thompson	Carmel	Solano	Monterey
IXL	Ballico	Merced	Granada	Carmel	Eureka	Monterey
Jeffries*	Languedoc	Ne Plus Ultra	Harvey	Carrion	Jeffries*	
Long IXL	Mission	Norman	Mono	Jeffries*	Kapareil	
Nonpareil		Price	Robson	Livingston	Solano	
Profuse		Ripon	Sauret #2	Monarch	Sonora	
Tardy Nonpareil		Rosetta	Thompson	Sauret #1	Vesta	
			Woods colony			

*Jeffries is a mutation of Nonpareil and should belong to the Nonpareil incompatibility group. However, field experience combined with controlled tests in 1984 and 1985 show that Jeffries possesses unilateral incompatibility. All varieties—including the parent Nonpareil—can fertilize Jeffries. But Jeffries is unable to fertilize Nonpareil, Carmel, Solano, Monterey, and all varieties in these incompatibility groups, as well as Butte. On the other hand, Jeffries can fertilize all varieties in the Mission, Ne Plus Ultra, and Thompson groups, as well as Fritz.

Table 8.3 Varieties tested for pollen incompatibility, for which no separate incompatibility group has been identified.

Variety	Successful test crosses (cross-compatible varieties)*
Aldrich	Butte, Carmel, Sonora, Monterey, Sauret #2, Nonpareil
Butte	Nonpareil, Mission, Carrion, Fritz, Merced, Norman, Mono, Padre, Tokyo, Thompson, Aldrich, Woods colony
Fritz	Butte, Carrion, Merced, Harvey, Thompson, Ripon, Nonpareil, Ne Plus Ultra, Jeffries, Sonora, Woods colony, Monterey, Carmel, Aldrich
Padre	Nonpareil, Mission, Thompson, Fritz, Carrion, Ruby, Butte, Price
Ruby	Nonpareil, Mission, Thompson, Ripon, Merced, Padre, Price, Monterey

*If a variety in a known incompatible group is listed as compatible, then any other variety in that group should also be compatible.

Time of Maturity and Ease of Nut Removal

Time of maturity and ease of harvest (tables 8.4 and 8.5) are two other major factors in variety selection. Knowing when—and in what order—varieties mature is important for efficiently managing harvest labor and equipment. Harvest must be prompt to minimize quality deterioration. It is likewise critical to minimize exposure of the newly matured crop to navel orangeworm and to fall rains, which can lead to mold and concealed damage. Planting cross-pollenizing varieties that mature close to the same time makes possible a well-timed final preharvest irrigation (which minimizes water stress to later-maturing varieties) and orchard-floor preparation. Late-maturing varieties are more subject to inclement harvesting weather.

Although the time of almond harvest may change from year to year and will vary according to location, the sequence of maturity for varieties usually does not change.

Ease of knocking is a requisite for efficient harvesting. The complete removal of nuts without causing tree injury is essential. Nuts left on the trees represent lost income and an added expense to remove later. Remaining nuts can harbor navel orangeworm, leading to a more serious infestation the following season. The excessive shaking required to dislodge stubborn nuts can damage the tree to the point of causing limb or tree loss, either directly from injury or indirectly from subsequent *Ceratocystis* canker.

Yield

Although the yield potential of a variety is very important in variety selection, it can vary because of the year, the location, pollenizing conditions, orchard management, and other factors. A comparison of the yield potential of different varieties at one site and three specific years is shown by data from the Manteca Regional Variety Trial in table 8.6. (In trials such as the one reported here, there is an abundance of compatible

pollen available because of the number of varieties being evaluated; therefore, yields may be somewhat higher than in conventional orchard plantings.)

Pest and Disease Susceptibility

Navel orangeworm and peach twig borer are the principal insects that cause wormy kernels. The industry-wide reject levels generally reflect worm damage, although other conditions such as gummy kernels are also included in these figures. Table 8.7 gives reject levels for a number of almond varieties.

Noninfectious bud failure, a genetic disorder, has been prevalent in a number of almond varieties, though its severity varies among varieties. Table 8.8 provides information about which varieties are known to be affected and how seriously. This disorder is further discussed in chapter 12, “Genetic Disorders.”

Marketability

Several categories of varieties are used by the industry for marketing nuts. It is important not to mix nuts of different varieties at harvest, because this may reduce their hullability, marketability, and value. Marketing categories can affect the price received by growers for their crop. A description of several marketing categories follows, which includes varieties generally marketed in each. Handlers may differ in how they categorize varieties; thus, it is important to consult your handler before selecting varieties to plant.

Nonpareil. Nonpareil is used in products in which the kernel is visible. Nonpareil kernels are uniform, fairly flat, and light colored; they have the widest range of uses of all the categories. Kernels of only a few other varieties are similar. This category is therefore reserved mostly for Nonpareil, although Kapareil, Milow, and Jeffries may be included.

Table 8.4 Almond varieties' time of maturity (readiness for harvest).

Early days)*	Early mid (7–10 days)*	Mid (15–20 days)*	Late mid (25–30 days)*	Late (40–60
Jeffries	Harvey	Carrion	Butte	Drake
Kapareil	Milow	Jordanolo	Carmel	Fritz
Nonpareil	Mono	Ne Plus Ultra	LeGrand†	Mission
	Peerless	Ripon	Livingston	Monterey
	Price	Thompson	Merced	Planada
	Sauret #1	Tokyo	Padre	
	Solano	Yosemite	Sauret #2	
	Sonora			

*Indicates approximate number of days after Nonpareil maturity.

†LeGrand may harvest better at an earlier date (or a double harvest may be helpful).

Table 8.5 Relative ease of nut removal for almond varieties.

Easy	Average	Difficult
Butte	Carmel	Drake
Ne Plus Ultra	Fritz*	LeGrand
Norman	Livingston	Merced
Peerless	Mission†	Thompson
Price	Mono	
	Monterey	
	Nonpareil	
	Padre	
	Ruby	
	Sauret #1	
	Sauret #2	
	Solano	
	Sonora	

*Fritz matures very late and is difficult to knock if harvest is attempted too early.

†Mission is harder to knock as a young tree.

California. The California group consists of varieties whose kernels differ significantly from those of the Nonpareil group. These kernels must be blanchable and are often used in manufactured products. Among the varieties included in this group are Merced, Thompson, Price, Harvey, Norman, and Carmel

(though Carmel is sometimes marketed as a separate group).

Mission. Varieties in the Mission group tend to have plump kernels that roast well but that may not be easily blanched; they frequently have a strong flavor. Butte and Padre varieties are often included in this category.

Ne Plus Ultra. Varieties in the Ne Plus Ultra group have large, elongated kernels that are used for panning (covering the kernel with a candy glaze). Nuts in this group are also used in manufactured products. Jordanolo is included along with Ne Plus Ultra.

In-Shell. The in-shell group consists of varieties that have uniform, well-sealed shells, are bleachable, and have little or no worm damage. Peerless is the main variety in this group.

Other Considerations

Other characteristics to consider when selecting almond varieties include shelling percentage (percent kernel), tree growth habits, and sensitivity to salt damage. Varieties with poor shell characteristics are generally more susceptible to navel orangeworm damage.

Table 8.6 Yield (in pounds of nutmeats per acre) from the Manteca Regional Variety Trial for the 4th, 8th, and 13th years.

Variety	1981 4th season	1985 8th season	1990 13th season	Accumulate (10-year) yields
Early-blooming varieties				
Jordanolo	402	2,313	2,796	17,953
Ne Plus Ultra	423	2,484	2,872	17,121
Peerless*	474	2,334	2,034	11,956
Sonora	441	2,575	2,972	16,335
Mid-blooming varieties				
Carmel	382	3,125	2,936	19,579
Fritz	421	1,943	2,809	16,690
Monterey	513	2,267	2,675	19,596
Nonpareil	394	2,116	2,907	16,901
Price	498	2,441	1,775	16,003
Sauret #1	554	1,597	2,961	16,573
Sauret #2	221	2,224	2,859	17,169
Late-blooming varieties				
Butte	177	2,361	2,988	21,792
LeGrand	391	2,862	3,150	19,522
Livingston	493	2,277	2,936	19,828
Mission	378	2,100	3,136	16,765
Mono	176	1,859	3,530	17,224
Padre	387	1,722	2,646	16,950
Ruby	157	2,107	2,694	16,940
Thompson	400	2,009	2,337	15,577
Tokyo	165	2,931	3,160	16,280

*Peerless was shelled for these data, though this variety is normally sold in-shell.

Table 8.7 Industry reject levels for several varieties in the 1980s.

Low	Medium	High
Butte	Fritz	Harvey
Carmel	Monterey	LeGrand
Mission	Ne Plus Ultra	Merced
Peerless	Nonpareil	Thompson
Price	Ruby	

Note: "Low" indicates a typical rejection proportion of less than 2 percent; "medium," between 2 and 4 percent; "high," over 4 percent.

Table 8.8 Varieties affected by noninfectious bud failure and the severity of this disorder.

Variety	Relative prevalence	Relative severity when present
Jordanolo	high	high
Merced	high	high
Yosemite	high	high
Harvey	moderate to high	moderate to high
Carmel	moderate to high	moderate to high
Nonpareil	moderate	moderate
Peerless	low	moderate to high
Price	low	moderate
Carrion	low	moderate
Sauret #1	low	moderate
Thompson	low	high
Mission	low	high
Norman	low	unknown*
Butte	not observed	
Padre	not observed	
Sonora	not observed	
Ne Plus Ultra	not observed	
Fritz	not observed	
Monterey	not observed	
Mono	not observed	
Tokyo	not observed	

*Insufficient data for rating.

TRENDS IN VARIETY PLANTINGS

Varieties that have been or are becoming standard include Nonpareil, Carmel, Mission (Texas), Ne Plus Ultra, Price, Peerless, Butte, Monterey, Ruby, Sonora, Padre, and Fritz. Even within this group, trends are constantly shifting; however, Nonpareil continues to be the major variety grown in California. Carmel has been increasing to second in importance, but concerns about its susceptibility to noninfectious bud failure may change this trend. Mission, Peerless, and Ne Plus Ultra continue to be important, but trends are downward for plantings of these varieties.

Varieties that have been grown previously but are seldom planted due to specific problems include

Merced, Harvey, Jordanolo, and Yosemite (noninfectious bud failure); Merced, Thompson, Drake, Le Grand, Davey, and Milow (difficulty in harvest); and IXL, Hasham, Jeffries, Sauret #1, Sauret #2, Kapareil, Milow, Carrion, Solano, and Norman (various reasons). Newer varieties with limited commercial acreage include Mono, Tokyo, Livingston, Aldrich, Woods colony, and Rosetta.

Many almond varieties have been planted commercially by growers since 1900. Table 8.9 lists varieties that have been grown recently in sufficient numbers to be recorded by the California Agricultural Statistics Service, and that are delivered to nut handlers.

ADDITIONAL INFORMATION ABOUT SPECIFIC VARIETIES

Nonpareil

Originated in Suisun, California, in 1879 by A. T. Hatch, Nonpareil continues to be the most important almond variety in California because of its consistently high productivity and high market demand. The tree is large, and upright to spreading, and harvests early. The nut has a paper shell that gives a high shelling percentage (65 to 70 percent). However, the nut is poorly sealed and this, with the paper shell, makes it susceptible to worm and bird damage.

Although noninfectious bud failure has affected trees within the variety, progress has been made in selecting away from this problem. Specific source clones are available that have been progeny tested in high-temperature growing areas for up to 13 years.

Nonpareil has a medium-size kernel (22 to 25 per ounce) and has been a high and consistent bearer, taking into account fluctuations due to adverse weather conditions in specific years. It tends to yield somewhat less in its earlier years of bearing than do some of its pollenizers, but at full bearing it produces well and continues to grow in size. The consistent yield reflects its bearing habit of producing on both spurs and long shoots, with good ability to renew fruiting wood. It is relatively resistant to frost damage and is vigorous but generally easy to train.

Mission (Texas)

A chance seedling originating in Texas about 1891, the Mission variety, originally known as Texas or Texas Prolific, was brought to California, where it was first grown at Acampo. Its continued popularity is due to its late bloom (which reduces its frost susceptibility), high productivity, and market demand. The tree is vig-

orous when young, but vigor decreases with age. It is upright in growth habit and easy to train. It may be short-lived, is quite susceptible to *Ceratocystis* (mallet wound canker), and is sensitive to salt injury. In sandy soils, Mission can also be susceptible to herbicide injury, but generally this is manageable. The hard-shelled nut is resistant to navel orangeworm attack. Noninfectious bud failure has been detected in only a few scattered trees and is not considered a production problem.

Mission yields relatively small kernels (25 to 28 per ounce) and therefore needs to produce high numbers of almonds to compensate. It shows a pattern of bearing on spurs rather than on shoots, so very early production can be delayed slightly. However, its yield potential develops rapidly to a moderate to high level. Some decline in production often develops as the tree gets older.

Ne Plus Ultra

This variety, selected along with Nonpareil and introduced by A. T. Hatch in 1879, is susceptible to frost, worm damage, and several diseases. In terms of market value, the kernel is generally considered inferior and is used primarily for manufactured products. It has a propensity to produce a high percentage (20 percent or more) of double kernels. The variety has been important because it is an early and good pollenizer for Nonpareil; it has also been a profitable producer for some growers. Trees have a spreading growth habit and are easy to harvest, though they tend to drop nuts prematurely. This variety is very susceptible to water stress, which is expressed as hull tights, nut and bud drop, and lack of shoot growth. The tree is also difficult to train. Noninfectious bud failure has not been detected in any trees or sources.

Table 8.9 Planting trends from 1980 to 1990.

Variety	Acres planted			Nonbearing 1990	Bearing 1990
	1980	1985	1990		
Nonpareil	12,852	2,240	1,918	8,498	212,180
Carmel	6,171	1,468	666	4,235	50,081
Mission (Texas)	1,558	151	95	891	41,174
Merced	119	99	0	34	21,560
Price Cluster	2,506	477	449	1,385	17,833
Ne Plus Ultra	802	35	37	158	17,368
Peerless	1,159	182	36	327	10,691
Thompson	95	9	0	5	9,630
Butte	628	143	411	1,633	4,624
Monterey	459	167	110	511	3,663
Fritz	278	295	110	973	2,727
Ruby	280	102	15	314	2,717
Harvey	73	2	3	3	2,433
Drake	0	0	0	0	1,862
LeGrand	133	3	0	0	1,564
Mono	217	13	0	0	1,452
Davey	0	1	0	0	973
Norman	1	0	0	0	869
Yosemite	152	0	4	4	838
Hasham	145	31	0	0	773
Tokyo	128	24	0	1	767
IXL	0	0	0	0	705
Jeffries	152	0	0	1	631
Sauret #1	112	15	0	1	419
Kapareil	25	2	0	0	397
Jordanolo	0	0	0	0	376
Sauret #2	124	10	0	0	370
Milo	0	0	0	0	195
Livingston	30	0	0	34	182
Padre	—	—	108	415	172
Carrion	28	1	0	24	157
Sonora	—	40	202	907	91
Aldrich	—	13	0	14	51
Woods colony	—	—	7	101	21

Source: *California Fruit and Nut Acreage*, 1990. California Agricultural Statistics Service, California Department of Food and Agriculture, Sacramento, CA 95812.

Ne Plus Ultra produces very large kernels (20 or fewer per ounce), which promotes yield. It produces nuts laterally on long, previous-season shoots, followed by heavy spur production. Consequently, it shows precocious bearing and potentially high yields on young trees—with good water management, it can outproduce Nonpareil. On the other hand, erratic bearing may result from pollination and disease problems at bloom.

Peerless

Selected before 1900 as a chance seedling near Davis, California, Peerless is of unknown origin. It has been used as an early-blooming pollenizer for Nonpareil, but it is unfortunately susceptible to frost. It continues to be an important variety as a pollenizer and because there is a limited market for in-shell nuts. In an in-shell product, shell appearance is important, so rain staining can be a problem and care must be taken in hulling. The tree is of medium size, medium to upright in growth habit, and tends to drop nuts prematurely. Noninfectious bud failure occurs sporadically (symptoms can be pronounced); therefore, this disorder is a potential hazard. The yield of Peerless is dependent on its ability to produce good-quality in-shell almonds. Peerless is hard shelled and has a low shelling percentage, low susceptibility to worm damage, and a mediocre-quality kernel.

Merced

Commercially introduced in 1958, Merced is a chance seedling of a Nonpareil-Mission cross. It has been valuable as a pollenizer for Nonpareil and produces heavy yields on young trees. Merced is very susceptible to navel orangeworm and is difficult to knock. Severe noninfectious bud-failure expression, particularly in the warmer growing areas, has become a factor in limiting plantings. Even without appreciable bud failure, a lack of tree vigor accompanied by declining production has become evident as orchards become older. The tree is small to medium in size and somewhat upright in its growth habit. The medium-size kernel is considered a standard for the California category, in market terms.

Thompson

A chance seedling found in Clovis, California, Thompson is apparently a Nonpareil-Mission cross; it was introduced commercially in 1957. Thompson has been relatively important because of its late bloom (close to that of Mission, for which it is a pollenizer) and high productivity. However, with time several faults have become evident, including difficulty in nut removal,

gummy nuts, susceptibility to navel orangeworm, and some noninfectious bud failure. Although bud failure in individual trees can be pronounced, it is not widespread and thus is not considered a serious problem in this variety.

Thompson has small kernels (25 to 30 per ounce) that fit well into the California marketing category. Thompson produces a medium-size upright tree that develops an extensive spur system and bears heavily when young. Its very high nut sets are generally considered to be the factor promoting yield.

Carmel

This variety was discovered as a single tree in a commercial orchard near Le Grand, California. Although originally thought to be a mutation of Nonpareil, genetic evidence indicates that it is a seedling of Nonpareil-Mission. Carmel was introduced in 1966. It blooms just after Nonpareil does, and its crop matures ahead of that of Mission. The tree is more upright than a Nonpareil tree and is of medium size. The nuts are quite resistant to worm damage. The variety is susceptible to foamy canker. Brown rot can be a problem and should be properly controlled with fungicide sprays. Carmel has also shown great sensitivity to noninfectious bud failure, which has become particularly evident in recent years. Carmel is a good pollenizer for Nonpareil and is highly productive when young, but its yields may decline along with tree vigor over time. Carmel has a large, elongated kernel, which is sometimes marketed in the California group, but some processors handle it separately because sufficient volume has developed, and because it has its own positive marketing attributes.

Price (Price Cluster)

A chance seedling discovered in a Durham, California, orchard, Price is apparently yet another seedling of Nonpareil-Mission. It was introduced commercially in 1965. The variety blooms within a day of Nonpareil, for which it is a popular pollenizer, and its crop matures shortly after that of Nonpareil. The tree generally has good vigor, and is somewhat spreading but more upright than a Nonpareil tree. Price may have a low bloom density in alternate years and thus bear light crops in those years. During “off” years it may not be particularly satisfactory as the only pollenizer in a Nonpareil planting. To some extent, Price bears on long shoots as well as on spurs. Nut clustering occurs both toward the ends of shoots and on spurs. Apparently this clustering is a result of a higher-than-normal set of blossoms. This high density in the “on” year is what reduces blossom density the following year. Noninfec-

tious bud failure has been found periodically but is not considered a serious problem. Price fits into the California marketing category and tends to produce a moderately high percentage (10 to 20 percent) of double kernels, especially on younger trees.

Butte

Originating from a controlled Nonpareil-Mission cross, Butte was introduced in 1963. This variety blooms relatively late and ahead of Mission; the crop also matures ahead of Mission crops. Butte is often planted as a pollinizer for Mission, though recently some growers have planted it as a main variety. The tree is spreading and has reasonable vigor. Noninfectious bud failure has not been detected. Brown rot can be a problem in Butte and should be properly controlled.

Both early-bearing and mature Butte trees show a high yield, even though the kernels are relatively small. Its high yield appears to result from the combination of early bearing on long shoots, a marked tendency to produce spurs, and sufficient vigor to maintain tree size. The kernel fits with the Mission marketing category.

Ruby

A chance seedling, apparently from Nonpareil-Mission parentage, Ruby was commercially introduced in 1958. This variety blooms late and after Mission, for which it is a pollinizer. As the tree gets older, bloom time may be later in relation to Mission bloom. Harvest is concurrent with, or slightly after, that of Mission. The tree is small, with an upright growth habit. Noninfectious bud failure has not been detected, and Ruby follows the Mission bearing pattern in developing large numbers of spurs. With age, its vigor may be reduced enough that there is some potential for yield decline.

Fritz

A chance seedling, Fritz was probably a cross of Mission with Drake; it was commercially introduced in 1969. This variety blooms concurrently with Nonpareil and harvests late, often after Mission. Normally it is not difficult to knock unless the harvest is attempted too early. The tree is of medium size, upright, vigorous, and a prolific bloomer. Noninfectious bud failure has not been found in Fritz. In terms of the market, its kernel fits into the California classification. Like Butte, Fritz has shown a tendency for high, consistent yields despite its relatively small kernel size. This results from its tendency to bear early on long shoots, followed by spur formation; it also has sufficient vigor to maintain tree size.

Monterey

Monterey was a chance seedling, apparently of Nonpareil-Mission parentage, that was commercially introduced in 1974. It blooms a little after Nonpareil does and is harvested about when Mission is. The tree is spreading. Noninfectious bud failure has not been found. Monterey is a very productive variety that has a large, elongated kernel with a rather dark pellicle. It has a propensity to produce a high percentage (20 percent or more) of double kernels. Growers should consult their handlers to determine the market classification of this variety.

Sonora

A second-generation seedling from a cross of Nonpareil and Eureka, Sonora was introduced in 1983. This variety blooms with or ahead of Peerless and ahead of Nonpareil. The blossoms are more frost resistant than those of many other early-blooming varieties. The crop matures after that of Nonpareil but before that of Ne Plus Ultra. The tree is medium to round in shape and usually a little smaller than a Nonpareil tree. Sonora has not exhibited noninfectious bud failure. The kernel is large and elongated, and the skin is smooth and light colored. The blond color and smooth pellicle of this variety are considered positive marketing attributes.

Sonora has a tendency to bear heavily on long shoots, especially as a young tree, with lesser development of spurs. Apparently for that reason, the tree begins to bear early and produces excellent crops when young. The large kernel size of Sonora promotes a high yield. This productivity continues as the trees mature. Sonora needs special attention and good management to maintain vigor and subsequent fruitwood production. When exposed to drought stress during bud formation the previous season, or after heavy crops, Sonora tends to produce low bloom densities, but it usually sets a high percentage of that bloom. However, because it blooms early and may have years of light bloom densities, it should not be used as the only pollinizer in a Nonpareil planting.

Padre

A seedling of a Mission-Swanson cross, Padre was introduced in 1983. The variety usually blooms with or slightly ahead of Mission. The crop matures just ahead of Mission's and about the same time as Thompson's. The tree resembles Mission but with more branching; it is of moderate size and vigor and is easy to train. Yields approximate those of Mission and are consistent, though production during the first few

years of bearing may be less. Like Mission, Padre bears on spurs, but it also produces flower buds on longer shoots, which enhances production. Blossom densities on Padre are high. Noninfectious bud failure has not been found in any trees or sources. The kernel is similar to Mission's but slightly smaller, and it fits into the Mission market classification.

Le Grand

Introduced in 1972, Le Grand has been planted commercially. Although it is partially self-fertile, orchard experience and research have shown that it sets better

crops when bees are placed in its orchards. Even bigger crops are produced when other varieties are planted with it for cross-pollination. It blooms just before Mission does. The variety tends to mature late (but before Mission), over an extended period. Le Grand is very difficult to knock, so double harvesting may be beneficial. This variety is susceptible to jacket rot, brown rot, and shothole, and its shell can be quite open, making it susceptible to worm damage. The tree is vigorous and upright. The bearing habit is quite similar to Padre's, and this variety also has high blossom densities. The kernel fits into the Mission marketing category.