

## PISTACHIO CULTIVARS

*Dan Parfitt, Craig Kallsen, and Joseph Maranto*

The edible pistachio of commerce is the species *Pistacia vera* L. In addition to many named cultivars, significant populations of wild germplasm exist, primarily in central Asia from Turkey to Afghanistan. The species has been long propagated for nuts throughout the Mediterranean and Middle East. Several reports (Hormaza et al., 1994), suggest that the Romans were responsible for the spread of *Pistacia vera* within the Mediterranean basin. Wild pistachio nuts are typically much smaller than the cultivated pistachio, usually about 1 cm long and non-split. There is considerable variation in size and other characteristics among wild pistachio nuts (Plate 7A), especially those from the Bagtiz region of Turkmenistan and adjacent areas of Iran, considered the center of diversity for pistachio (Whitehouse, 1957).

Europeans have recognized the differences in flavor of pistachios produced in different parts of the world. Since the 1800s Sicilian pistachios have been mentioned by some traditional European consumers as one of the best tasting. The nuts are normally small, and a high percent of nuts are unsplit and filled with dark green kernels. The pistachio nut produced in the Middle Eastern countries is larger, with a yellowish kernel, and are considered by some to have less flavor. Other pistachios grown in Tunisia and neighboring countries are generally small, and are considered to have a good but not exceptional flavor. Many pistachio cultivars (cultivated varieties) are grown in several countries and have different characteristics, especially for fruit shape and the color of the kernel (cotyledon), which varies from light-yellow to deep green. A survey made in the United States showed that pistachio consumers do not have a preference for nut shape, which could vary from oblong (almond shaped) to round (filbert shaped). European consumers

formerly preferred the elliptical to the round shape. Some scientists (e.g. J. Maranto) believe that the Italian cultivars have a superior flavor although D. Parfitt has also identified excellent flavor in Persian cultivars. Flavor is a very subjective subject to evaluate and ultimately what emerges as the 'correct' pistachio flavor will be an average of the total public perception. A study by Kader et al. (1982) using organized taste panels as well as measurement of various fat and sugar concentrations showed no significant differences in overall flavor among 'Kerman', 'Red Aleppo', 'Trabonella', and 'Bronte'. 'Kerman' had more linoleic and less oleic acid than the other cultivars and thus could be considered more healthy. However, the differences were only about 4%. 'Kerman' also had more sugars than the other cultivars, including reducing sugars which can be a problem when roasting. 'Trabonella' was somewhat more oily and bitter than the other cultivars, while 'Red Aleppo' was most crisp or more crunchy. However, 'Kerman' had a substantially higher firmness score than the other cultivars.

### EUROPEAN CULTIVARS

'Napoletana' is the predominant variety in Sicily. Less often planted are 'Agostana', 'Girasola', 'Notaloro', 'Cappuccia', and 'Femminello'. 'Trabonella' and 'Bronte' are Sicilian cultivars with similar characteristics. Nut color is greenish, nut shape is longer and thinner than 'Kerman' or Iranian cultivars. Nut size is considerably smaller than 'Kerman' and nut quality under California conditions is poor, with a high level of non-splits in some seasons and significant disease and pest problems. 'Sfax', 'Mateur', and 'El Guettar' are grown in Tunisia. 'Mateur' may be the best of these and is being tested in Spain. 'Sfax' produces large

tight nut clusters, but nut size, yield, and percent splits are quite inferior to 'Kerman' nuts. 'Aegina' ('Aegenes') and the more recently released 'Pontikis' are grown in Greece. 'Aegina' appears to be very susceptible to *Botryosphaeria dothidea*, perhaps due to its very early flowering in the spring. 'Pontikis' was developed and tested by C.A. Pontikis Agricultural College of Athens, Botanikos, Greece. (Pontikis, 1986). It has a moderately large fruit, kernel weight 55% of fruit weight; oblong-ovate, with an oblong-ovate kernel. It splits much better than 'Aegenes', 90% to 98% splits Blank nut percentage is about 5% to 10%, the same as 'Aegenes' and has yields similar to 'Aegenes'. However, the adaptation of 'Pontikis' outside of the Athens area has not been determined. 'Lamarka' is the main cultivar in Cyprus. 'Sirora' was developed in Australia (Maggs, 1990). The industry has remained small in Australia, so this cultivar has not been widely planted. 'Kastel' and 'Rashti', grown in Israel, are similar in some aspects to our 'Kerman' variety. Neither 'Kastel' nor 'Rashti' have been tested directly against 'Kerman' in California yield trials. 'Rashti' has large nuts, high split percentage, and a good flavor. Tree structure is similar to 'Kerman' as is its alternate bearing characteristic. It is a late maturing cultivar, probably several weeks after 'Kerman'. This has been an issue during years when late summer and fall have been very cool. Under these conditions it may not ripen before the start of winter rains. 'Kastel' seems to be very similar to 'Kerman' in most characteristics.

#### **TURKISH AND SYRIAN CULTIVARS**

Turks prefer 'Uzun' and 'Kirmizi'; less favored is Turkish 'Red Aleppo'. In Syria, the 'Red Aleppo', is more common. 'Achoury', 'Alemi', 'El Bataury', 'Obiad', and 'Ayimi' are also grown in Turkey. 'Red Aleppo' was used as a cultivar during the early development of the California industry. It splits and yields well but may not produce as well as 'Kerman'. Nut size tends to be somewhat smaller than 'Kerman'.

#### **IRANIAN CULTIVARS**

Major pistachio cultivars grown in Iran are 'Momtaz', 'Ohadi', and 'Kalehghouchi'. Other

cultivars are 'Ghermeza', 'Tbeahimi', 'Ogah', and 'Wahidi'. 'Ohadi' produces attractive nuts that are slightly smaller than 'Kerman' nuts. 'Kalehghouchi' has very large nuts as well as a good yield and has attracted some interest in California because of its nut size and good split percentage, which may be better than 'Kerman' under California conditions. In two replicated trials budded in 1998, one trial located on the east side of the San Joaquin Valley and the other on the west side of Kern County, 7<sup>th</sup> leaf 'Kalehghouchi trees' yielded similarly to 'Kerman'. Nut split percentage was higher and nut size larger than 'Kerman'. 'Kalehghouchi' flowers 10 days to 2 weeks earlier than Kerman, and matures at about the same time as 'Kerman.' 'Kalehghouchi' produces excessive vegetative growth on mature trees under California management conditions. It has a tendency to produce many long 'whips' and 'hanger' branches on which a considerable fraction of the fruit is borne. This makes shaking difficult or requires considerable additional pruning to maintain tree structure. Another cultivar 'Aria', when tested in the same trials, produced nuts with poor shell-hinge strength resulting in excessive loss of shells and kernels during hulling. The location of flower buds on new branches has made tree training difficult and has resulted in sunburned nut clusters.

These limited replicated trials have demonstrated that a particular cultivar's success in a foreign country does not translate to successful performance in the United States. In California, very few experimental comparisons of horticultural performance have been conducted among 'Kerman' and cultivars from other countries.

#### **CALIFORNIA CULTIVARS**

Less than 20 named cultivars have been imported into the United States. Some of the female cultivars that were introduced into California by the USDA in the early 1900s were: 'Red Aleppo' from Syria, 'Bronte' and 'Trabonella' from Sicily, 'Sfax' from Tunisia, 'Kastel' and 'Rashti' from Israel and some from other countries. Additional unnamed *Pistacia vera* germplasm was introduced through the USDA Plant Introduction Gardens

at Chico which was closed in 1967. However, very little germplasm has been imported into the U.S. since the station was closed.

‘Kerman’, a California developed cultivar, was selected from seed lot P.I. 86372 in 1936 (collected by W.E. Whitehouse - 1929) and released for trial by the USDA Plant Introduction Station, Chico CA in 1957 (Parfitt, 1997). The release of ‘Kerman’ occurred just prior to the major growth of the industry in California. ‘Kerman’ is now the primary female cultivar commercially grown in all regions in California. ‘Kerman’ is a very good cultivar, producing large yields of large and attractive nuts, especially in the primary growing areas of the southern San Joaquin valley. It is not a perfect cultivar. It has a strong alternate bearing tendency, high percentage of blank nuts in some years, a relatively high level of non-split nuts, and a light greenish-yellow kernel with almost minimal flavor when dried at commercial temperatures. Kernel color and flavor has not been an issue with American consumers, who have not been exposed to European cultivars with different flavor characteristics.

In 1980, another open-pollinated seedling introduced as a seed from Damghan, Iran, was selected at the University of California, Davis, by Dr. J. Crane and named ‘Joley’, in honor of the former director of the Chico USDA Station. ‘Joley’ has been planted in a few orchards in California and in the state of New Mexico, where there is a limited acreage of pistachios. The cultivar is considered by some to be one of the best tasting pistachios developed in California. The tree has moderate vigor, blooms and matures about 10 days earlier than ‘Kerman’. It has almond-shaped nuts similar to ‘Trabonella’ or ‘Bronte’ (Sicilian varieties). The kernel color is greener than ‘Kerman’, but the nut size is significantly smaller and the non-split percentage can be high in some years. There are few blanks; however, in some instances shell removal by consumers is not as easy as for ‘Kerman’. On a few young trees grown in Kern County, the yield has never been high. It does not appear to be a commercially viable cultivar.

‘Lassen’ was developed by Whitehouse from the same seed lot as ‘Kerman’ (P.I.

86372) and released in 1962 from the USDA Plant Introduction Station at Chico CA. It is very similar to ‘Kerman’ with respect to nut characteristics. Data from yield trials with ‘Kerman’ is not available. ‘Damghan’ was also developed from this seed collection (Joley, 1979). It has very large nuts but appears to be very low yielding under California conditions.

Two new female cultivars were released from the pistachio breeding program of Parfitt et al. in 2005 (8<sup>th</sup> leaf in replicated trials). ‘Golden Hills’ is a new female cultivar that flowers 1 to 2 weeks before ‘Kerman’ and matures 2 to 4 weeks earlier than ‘Kerman’; permitting efficient use of harvesting and processing equipment in much the same way that cultivar maturity series for peaches facilitate limited resources for harvesting and marketing. Earlier harvest also allowed this cultivar to miss infestation by the (most damaging) September flight of navel orangeworm. This cultivar produced 46% higher grower paid yield than ‘Kerman’ during the first three years that harvestable yields were collected from a replicated trial in the southern San Joaquin valley. Nut size and weight were similar to ‘Kerman’ (Plate 7B), but percentage of blank nuts was lower than for ‘Kerman’ during the three years of tests. Golden Hills has a balanced shell-hinge strength that provided for a split nut percentage about 5% greater than ‘Kerman’ during the three years of data collection without the often associated problem of excessive loss of shells and loose kernels. ‘Golden Hills’ had more but smaller scaffold branches than ‘Kerman’, producing a smaller more bushy tree after 3 to 4 years of training.

‘Lost Hills’ is a new female cultivar from the breeding program of Parfitt et al. that flowers 1 to 2 weeks before ‘Kerman’ and matures 2 to 4 weeks earlier than ‘Kerman’. As with ‘Golden Hills’, earlier maturity results in less navel orangeworm damage at harvest. This cultivar produced 26% higher grower paid yield than ‘Kerman’ during the first three years of harvestable yield collection. Nut size and weight were larger than ‘Kerman’ (Plate 7C). Percent splits were about 7% higher than for ‘Kerman’. ‘Lost Hills’ produced more lost shells and loose kernels than ‘Kerman’ during hulling as well.

Flowering was more uniform than 'Kerman' for both this cultivar and 'Golden Hills' during low chilling seasons. This translated into a more uniform maturity and less difficulty in determining the correct time to harvest for maximum splits and minimum staining. Evaluation of 'Lost Hills' and 'Golden Hills' is continuing.

## MALE CULTIVARS

The California pistachio industry is based on one male cultivar, 'Peters'. 'Peters' is a good pollinator and was found in the early 1900s by A. B. Peters at Fresno, California. However, the parentage is unknown. It produces abundant pollen, shed over a relatively long period (ca. 2+ weeks) and pollen viability over time (durability) is very good as evaluated by D. Parfitt. In recent years, under low chill conditions it has shed pollen at the end of the receptive period for 'Kerman', resulting in poor and irregular pollination. In addition to 'Peters', the selections at Chico of 02-16 and 02-18 imported from Russia are early and late blooming compared to 'Peters'. Pollen from '2-18' is somewhat less durable than pollen from 'Peters' (Polito and Luza, 1988). 'Nazareth', 'Ask', and 'Chico' males are also grown sporadically in some locations in California. 'Chico' was introduced from the Chico, Calif., USDA Plant Introduction Station in 1962 as PI150646. It is reported to be a male seedling of *Pistacia vera* selected from seed introduced under PI73396 from Aleppo, Syria; probably of species hybrid origin and tested as Chico 23. Leaf characters and bloom period observations suggest that it is probably an interspecific hybrid between *Pistacia vera* L. and *Pistacia integerrima* L. It is a prolific pollen producer and blooms early. 'Chico' sheds pollen prior to and during the earliest part of the 'Kerman' bloom period. If there are any Xenia effects on nut size (male contribution), then this cultivar should not be used. 'Ask' and 'Gazvin' were introduced from Israel a few years ago and may have some value as pollenizers. They flower earlier than 'Peters', but have poor pollen durability.

A number of new pollen sources were evaluated as part of the pistachio breeding program conducted by Parfitt, et al. They were

evaluated for quantity of pollen produced, the period over which the pollen was shed, pollen viability percentage at pollen shed, and pollen durability (the length of time during which pollen viability remained high). Two selections were made to complement 'Peters', flowering earlier and later than 'Peters', respectively. The early flowering selection, 'Randy' was released in 2005. 'Randy' flowers 1 to 3 weeks earlier than 'Peters'. It is characterized by a relatively long bloom period, in excess of two weeks, a characteristic that 'Peters' shares. (Most male pistachios have a flowering period of about one week.) Peak flowering is 1 to 2 weeks earlier than peak flowering for 'Kerman'. The pollen is more durable than 'Peters' pollen (75% viable declining to 35% viable after 29 days of storage vs. 'Peters' initial viability of 45%, declining to 15% to 5% after 27 days). Although it was selected as a pollenizer for early flowering cultivars from the breeding program of Parfitt et al., 'Randy' may be useful as a 'Kerman' pollenizer during low chill seasons, when there is less overlap in flowering period between 'Kerman' and the later flowering 'Peters'. It flowers too early to serve as the primary pollenizer for 'Kerman', however. The bloom period for 'Randy' closely matches that of 'Kaleghouchi' and would be a better pollenizer choice for this cultivar than 'Peters'. (Some reports of poor yield in 'Kaleghouchi' in California may be attributable to poor pollinization with 'Peters'.)

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