Commercial Varieties of Olives

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In the past few years there has been, and still is, an unprecedented demand for olive trees. Eager requests have been made for information with regard to the cultivation and other conditions necessary for the success of this crop. Invariably the choice of cultivars figures prominently amongst these questions. As growers of plants we know very well how important it is to make the right decision as far as the choice of cultivars is concerned, especially when we deal with commercial fruit crops. For the olive there is no exception. What the grower must be informed of before selecting any particular cultivar is the characteristics that the cultivar(s) must possess to achieve optimum production in the environment in which it is to be grown.

BOTANICAL HISTORY

Before we set out to explain the diverse properties of this remarkable tree, I would like to go back and trace the olive's botanical background, its origin, development, and its expansion around the world, albeit in a superficial manner.

The olive belongs to :

Family :	Oleaceae
Sub family or tribe :	Olineae
Genus:	*Olea*
Species:	*europaea*

We shall overlook the distant members of this family and concentrate briefly on the genus *Olea.* The cultivated olive has many close relatives which are scattered over the five continents. The majority of these are to be found in Asia; the Pacific, including Australia and New Zealand; Africa is well represented; and to a lesser extent the Americas and Europe.

The species or subspecies of the genus *Olea europaea* are localised in the Mediterranean basin and in Portugal on the Atlantic.

***Olea europaea* ssp. *euromediterranea*.** *Euromediterranea* comprises two lines or series:

The cultivated olives or sativa which have now spread from the Mediterranean to the America's, Asia, Australia, New Zealand, and South Africa.

The wild olive or oleaster. These are seedlings from the cultivated olive often in different phases of evolvement. They can be seen growing spontaneously along road verges on vacant land all over olive growing areas of the world, including the southern states of Australia and in particular South Australia.

The fruits of both species can vary in size and quality and can be used for oil production and preserving. The shape and size of the leaves and the general aspect of the plants change very little.

There are another three subspecies of the *Olea*, closely related to *O. europaea*. They are of little interest to us at the moment but are valued by the scientist for the development of new cultivars and rootstocks.

1) *Olea europaea* ssp. *laperrini*: Typically from the Sahara mountain of the Haggar-Tassil altitude 2000 to 2700 m. The fruit are of little value and the trees are small.
2) *Olea europaea* ssp. *cyrenaica*: A vigorous tree, the fruit are bigger than *laperrini*. This subspecies is found in Cyrenaica.
3) *Olea europaea* ssp. *mariena*: Again from the areas of North Africa, south of the Atlas Mountains.

Another close relative can be found on the Himalayas in India, Belucistan, Nepal, and Tibet. This subspecies is called *O. europaea* ssp. *cuspidata*. The leaves of this olive are dark green on the surface and reddish on the lower part (ferruginea). The natives of these parts have been known to use the small fruits. Ferruginea has an affinity with all the cultivars of *O. europaea* (sativa). From the African continent including Madagascar, Mauritius, east Africa, Upper Egypt, and Saudi Arabia we have *O. chrysophylla* (see *O. europaea var. cuspidata*). From South Africa, Natal, and Transvaal we have *O. verrucosa* (see *O. europaea* ssp. *africana*), and from Somalia *O. somaliensis*. Further to the west of the Indian sub continent in Belucistan, Anatolia, Syria, and Arabia, many forms of *O. europaea* are to be found. Most of them have large silvery coloured foliage and good-sized fruits. It is not unreasonable to presume that the so called *O. europaea* originated from plants introduced into the Mediterranean from the areas mentioned above.

The longevity of the olive is widely accepted. In combination with its capacity to regenerate from seed and the aptitude to be propagated asexually, we are given reason to believe that the high number of cultivars we have at the present time had their origins in the distant past. Additionally we have a large number that throughout the cross fertilisation and the dissemination of seeds have evolved from the juvenile stage into new cultivars. The duplication of names (synonyms) does not help and the subtle changes that these cultivars have undergone throughout the diverse environments where they have been transplanted over the years have contributed to the diverse forms or clones that we have today. The number of cultivated cultivars of olives are very many indeed. Amongst those there are only a few that fulfil the needs of modern oliviculture.

AGRONOMIC EVALUATION

The classification of plants has traditionally been based on morphological data. That is, the science and study of external structure and form. DNA fingerprinting is now common for the identification of diverse cultivars. However the evaluation of most of the fruiting cultivars is still based on the appearance of their fruit and the smoothness of the skin (cosmetic look), often the flavour of the flesh is forgotten. To some extent sugar content or brix is evaluated.

Beauty and an appealing name is what is needed for commercial success of the ever-increasing numbers of cultivars of peaches, nectarines, and plums that make their way onto the market every year. For the olive cultivars, this is not of any importance, the final outcome of their fruits is everything but pretty. The oil cultivars are crushed beyond recognition and their pickling relatives do not end much better off.

The system to classify olive cultivars to be of any value to prospective growers, therefore allowing them to choose the right selections, should only be based on the cultivars performance or agronomic properties.

For modern olivioculture, the positive or negative features of any particular cultivar should be evaluated and then compared to the features of the other cultivars that we can choose, in this way the right selection of cultivars necessary for a modern olive plantation can be made.

We will concentrate on the oil cultivar which makes up 90% of the total olives grown at the moment. The balance being processing or table olives. The conditions needed by an oil producing cultivar to satisfy current demands are: (1) machine yield, (2) quality, (3) quantity and early cropping, (4) fertility, (5) disease resistance, (6) adaptability, and (7) growth habit.

Machine Yield. A term used to indicate the percentage of fruits that can be shaken from the tree by a shaker-machine at harvest time. This percentage varies greatly from one cultivar to the other, at times it can be as low as 10% and at best as high as 95%. The higher percentage can be achieved by employing a shaker which features an abrupt, high-powered shake lasting a maximum of 5 sec, as any longer will cause damage to the bark.

The structure of the entire tree, i.e., the way the secondary branches are located, can determine the outcome of the harvest. However, the genetic factor at this point must be given the greatest consideration. There are chemical treatments which use ethylene-based compounds to assist with harvest but so far the abscission rate of the fruits has been erratic and in some cases catastrophic. The degree of ripeness of the fruit has a big influence on the quality of oil, i.e., the greener the olive, the better the oil, but the more difficult to remove from the tree with a machine harvester. With increasing ripeness, there is better machine harvest yield, but the quality of the oil decreases.

Olives require five times more energy to remove from the tree than other fruit crops like almonds or walnuts. Improvement in mechanical harvesting is continuing and a new generation of machinery is on its way.

Quality. The quality of olive oil is determined by several factors. The first is genetically inherited and therefore entirely dependent on the cultivar. The timing of harvest and the extraction process plus the storage of the oil are crucial in determining quality. Also the cultural practices, an example of this is choosing to irrigate or rely on natural rainfall, or how to achieve control of pests and diseases. We will concentrate entirely on genetic heritage.

A good cultivar must produce an oil that expresses its distinctive organoleptic properties like any other fruits of the soil. Also it must possess the ability to safeguard these genetically inherited properties. The fruits of a cultivar must have low initial acidity (vacuolar oil), 0.2% pre-extraction and a final acidity level of 0.4% to 0.5% oleic acid. By law for top quality oil it is 1%. Polyphenol (antioxidants) optimal value is 2000 to 3000 ppm, in some cultivars it is as low as 40 ppm.

The structural stability of the fruit is the most important aspect which will determine the final result, The cellular walls of the fruit are maintained by the presence of the pectines. These substances protect the vascular oil from coming in contact with the enzyme and the subsequent ossidatiance.

The Kreiss Test. It has to be a negative value, a positive result will indicate a process of rancidity in action.

Acidity. Expressed in oleic acid, must be less than 1 (which is the legal maximum). A good oil should have a value between 0.4 to 0.5.

Peroxide P.V. A process of rancidity, initially can only be detected with analysis. The legal value is 20, a good oil should be around 10.

Polyphenols. Antioxidant substances. High values will result in oils with more stability or a longer life. Optimal value is 200 to 300 ppm.

I : S. The relation between insaturated acids and saturated acids. A higher ratio of insaturated acids results in an oil which is easier to digest. Oils from cool regions contain proportionally more insaturated acids than oils from hot areas. Saturated acids are mostly prevalent in animal fats.

Quantity and Early Cropping Fertility. We refer to this as the productive potential. The profile of quantity starts with the onset of flowering, following with the setting, and then to the retention of the fruits on the tree. Some cultivars undoubtedly have the ability to set and carry more fruits than others. This is due to: the number and length of the fruiting branchlets, the number of flowers per branchlet, the percentage of fruits set, the number of perfect flowers, the percentage of fruit shed before harvest, and percentage of oil in relation to the weight of the fruit.

All factors mentioned above are influenced by cultivation practice and environmental conditions, however, the genotype is still very prominent.

Fertility. Some cultivars are self-fertile and some are not. Cross pollination is imperative for the first and beneficial for the second.

Disease Resistance. We are lucky in Australia in that we do not have so many of the diseases endemic to the Mediterranean basin. The climatic conditions are also on our side. *Pseudomonas savastanoi*, *Cycloconium oleaginum*, and *Verticillum dahliae* are the most troublesome of these diseases. *Cycloconium* has affected some cultivars of olives in New Zealand already. Humidity caused by summer rainfall can be a problem. There are some cultivars with a resistance to the three diseases.

Adaptability. So far all of the cultivars introduced in the last 20 years have performed well under Australian conditions. Naturally in time, particular areas will be more suitable than others to the diverse cultivars, seasonal conditions may prove to be more influential.

Growth Habit. This refers to the way a particular tree grows, i.e., upright, spreading, weeping, vigorous, or not so vigorous. Smaller and upright trees can be planted closer together in the rows than vigorous and spreading trees. A knowledge of the growth habit of any particular cultivar will be very useful in deciding the planting density of an olive grove. With the introduction of new cultivars, the planting distance can vary from 8 m × 6 m to 5 m × 2 m.