

Olive cultivars and oil polyphenols

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Polyphenols (or biophenols) constitute a large class of natural antioxidants found in olive oil. More than thirty polyphenols have been identified, which are most often measured as an aggregate value: Total Polyphenols (TPH).

Lately, there has been greater emphasis in seeking olive oils with higher polyphenol content, due to the beneficial health effects attributed to them. In addition, it is known that the antioxidant properties of polyphenols extend olive oil shelf-life, an important fact for both retailers and consumers.

Here we focus on oils that naturally have higher polyphenol content, as the olive cultivar is a major determinant. At a later time we will discuss factors that olive oil producers must take into consideration to achieve higher polyphenol levels, such as irrigation, harvest timing and milling. It all starts with the chosen olive variety.

Polyphenols and olive varieties

The genetic makeup of the olive plant determines the polyphenol level *potential* of its oil, since genes are involved in the synthesis of these chemicals in the fruit. Some olive varieties like Picual and Coratina produce oils high in polyphenols while others do not.

The table below shows olive varieties grown in California, grouped according to the polyphenols levels of their oils:

Low TPH	Med TPH	High TPH
Arbequina	Aglandau	Coratina
Casaliva	Arbosana	Cornicabra
Nocellara	Ascolano	Koroneiki
Picudo	Bouteillan	Manzanillo
Sevillano	Carolea	Maurino
Tanche	Frantoio	Mission
	Hojiblanca	Moraiolo
	Itrana	Picual
	Leccino	Picholine

Note that the low-polyphenol group contains varieties suitable for table olives.

With renewed interest, oil producers and retailers inquire about the polyphenol content of California olive oils. Some have wondered what values should be expected from particular varieties.

To provide an overview of the range in polyphenol content in oils, we have plotted values we measured at Agbiolab in the 2012 calendar year (Figure 1). These oils mostly from California producers display a wide range of TPH, from less than 100 to higher than 500

milligram equivalent of gallic acid per kilogram of oil.

To the left of the graph are the oil blends (e.g. 'Tuscan blend') and some uncommon oils derived from single olive varieties (e.g. Frantoio and Coratina). To the right are oils from Mission (known as Picholine Marocaine elsewhere), Arbequina and Favolosa plotted separately.

Mission oils contain high levels of polyphenols that can equal Picual and Coratina. By contrast Arbequina oils have lower content overall but also show a wide range. In California, Arbequina oils are typically produced from a common Spanish clone, a low-vigor plant used in Super High Density (SHD) plantings. Many Arbequina oils may include a fraction of Koroneiki and Arbosana, respectively high and medium-polyphenols varieties, given that these two cultivars are often used as Arbequina pollinators in SHD plantings, and are harvested together.

Plotted for comparison is the newer SHD cultivar Favolosa, also known as FS17. This Italian variety is a low-vigor clone derived from Frantoio. The original Frantoio yields medium polyphenol oils. As shown on the graph, the genetics of Favolosa, a 'dwarf Frantoio', have higher polyphenol potential than Arbequina

Polyphenols during olive fruit development

In 2012, Italian researchers published a detailed study of polyphenol content in fruit along the growing season, from pit hardening onwards. This study included low and high polyphenol varieties. Interestingly, the expression of several genes and composition of polyphenols deposition in the fruit was different between the low and high-polyphenols groups.

As depicted in figure 2, the low polyphenols group showed low content from pit hardening onwards. On the other hand, the high polyphenols varieties started with a high level that diminished almost continually in the growing season. However, the composition of the polyphenols changed later in the season (depicted as double arrow on figure 2). Some of polyphenols components became more abundant with fruit ripening.

Conclusion

In summary, there is a wide range of polyphenols values in olive oils in the market. Even common monovarietal oils like Arbequina and Mission show a range of values, in the low end and in the high end, respectively. Genetics play a major role by determining a maximum potential content (low or high TPH). The great diversity of olive cultivars provide options for growers that wish to produce high-polyphenol oils, even in Super High Density plantings with new varietal releases that supersede Arbequina

TOTAL POLYPHENOLS in OLIVE OILS

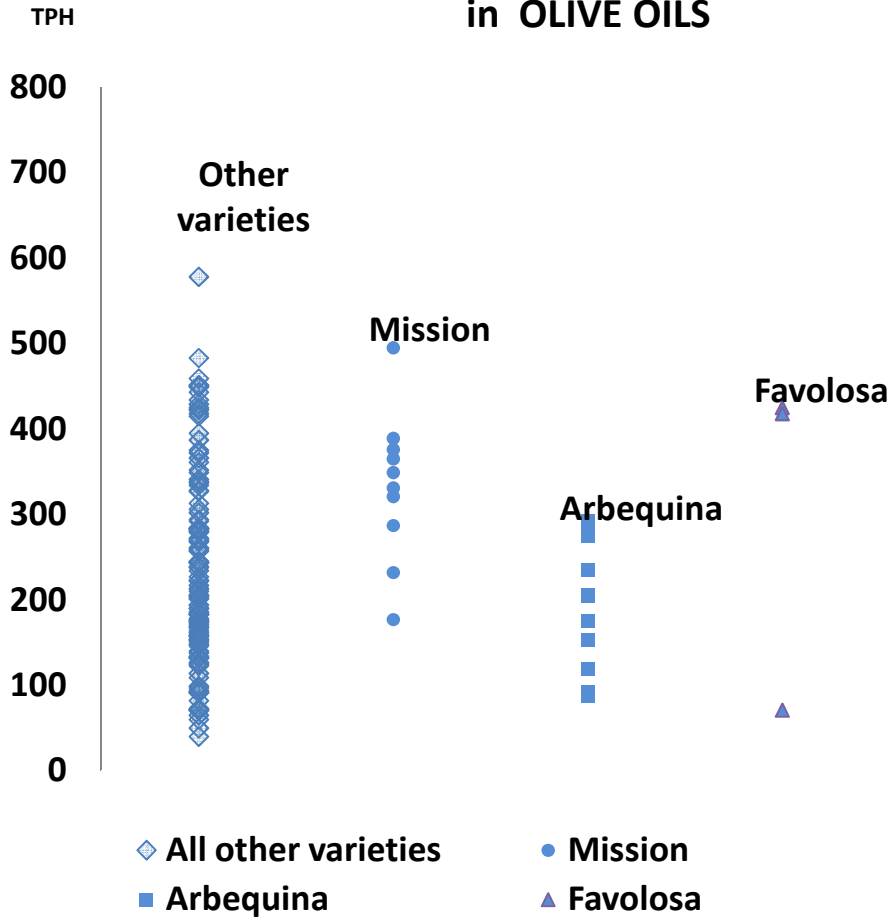
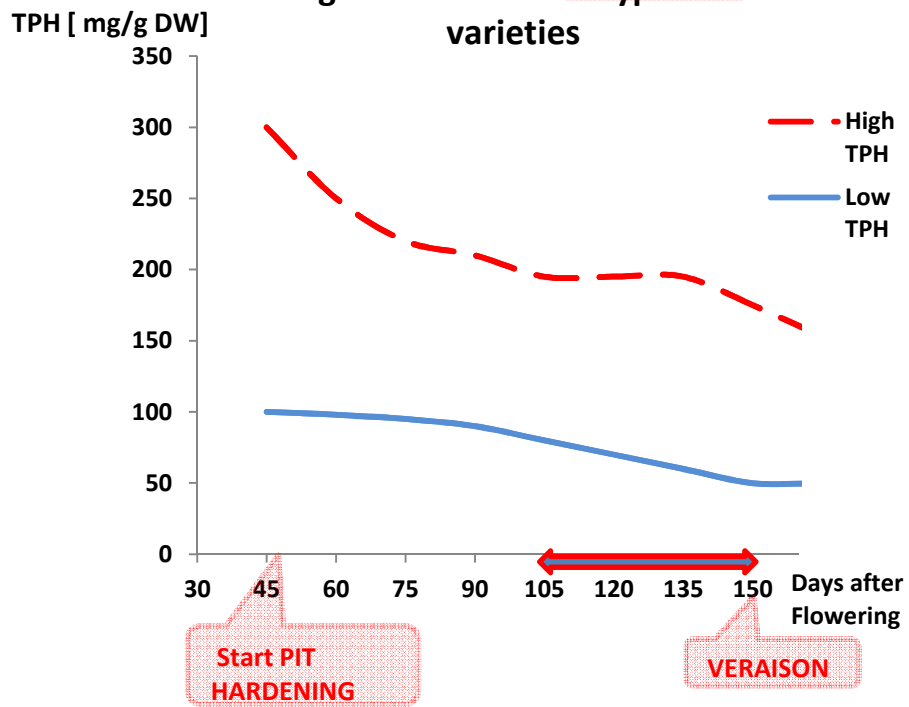


FIGURE 1

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**TOTAL POLYPHENOL IN OLIVE FRUIT
during the growing season in
High or Low Total Polyphenol
varieties**



Adapted from Alagna, et al *BMC Plant Biology* 2012, 12:162
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FIGURE 2

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