Harvest timing and irrigation for optimal olive oil quality in Australian conditions

Jamie Ayton[1] and Rodney Mailer[2]
[1]NSW Department of Primary Industries, Wagga Wagga
[2]Australian Oils Research, Lambton

The effect of harvest timing and irrigation on the quality of olive oil produced in Australian conditions was investigated in RIRDC projects DAN -197A (Publication no. 05/13) and PRJ-000496 (Publication no. 10/177). Project DAN-197A was carried out over three seasons (2002-2004) in a commercial grove near Darlington Point, NSW, while project PRJ-000496 was undertaken between 2005-2008 in a commercial grove near Yarrawonga, Victoria. Varieties, harvest timing and irrigation differed slightly between the sites (Table 1).

Harvest timing

Both projects showed moisture content declines as the fruit matures, although significant rain or irrigation events directly attributed to the moisture content, especially if preceded by lengthy dry spells. Some cultivars, such as Manzanillo, naturally retain higher moisture contents than others. Moisture is an important consideration at harvest as it can have a significant influence on extraction efficiency during processing.

Total oil content measured by solvent extraction showed that oil content in all cultivars follow the same pattern, a sigmoidal curve with an initial rapid increase of the oil content, the early stages of maturity followed by more gentle increase in the latter stages of maturation, usually beginning around the start of May at the sites studied. Oil content measured using mechanical, or cold press extraction, was affected by the moisture present, as high moisture contents can lead to a stable emulsion between the oil/water phases.

Quality parameters free fatty acids and peroxide value generally remained low, increasing only at the end of the season when the fruit was ageing and well past usual harvest dates. Parameters with antioxidant properties, total polyphenols and tocopherols, generally decreased as the fruit matured, which led to a decrease in the induction time of oil with later harvest dates.

Irrigation

Irrigation treatments had a greater effect on fruit and oil quality for project PRJ 000496, as confounding factors such as water limitations during drought conditions in project DAN -197A prevented discrimination between treatments. Moisture content was clearly affected by irrigation treatments, with moisture highest in samples that had received the mist irrigation. Total oil content (solvent extracted) was significantly affected by water application, with higher irrigation leading to increased oil yields. Maturity index was reduced with irrigation. Early maturation was the result of water stress.

Free fatty acids remained significantly below the standard limits for olive oil, while total polyphenols were generally unaffected until very dry years, when irrigation deficit treatments showed the highest total polyphenols.

Differences in oil yield and quality between irrigation treatments were less obvious in the beginning of the projects than the final seasons. This indicates that the trees take some time to adapt to the treatments, which should be taken into account in any further studies.

Recent developments

Researchers have investigated physical parameters such as maturity index or oil accumulation as indicators for predicting optimal harvest time, as well as the effect on harvest timing on quality parameters. However, these reports are usually in limited geographical areas and with minimal varieties (Dag, Kerem et al. 2011, Navas-Lopez, León et al. 2019). Even with the development of quicker, cheaper techniques such as near infra-red spectroscopy (NIR) for measuring the parameters (Saha and Jackson 2018), collecting fruit and analysing it in a laboratory environment leads to delays in providing information to growers.

Research on the effect of irrigation on olive oil yield and quality in Australia has found that irrigation management should be cultivar specific for maximum productivity (Zeleke, Mailer et al. 2012). It has also been suggested that deficit irrigation, especially during particular phenological phases, can lead to considerable savings (Zeleke and Ayton 2014). While plenty of research on olives and irrigation management has occurred overseas, the information generated in Australian conditions is important for local growers.

Future research

The Multi-scale monitoring tools for managing Australian tree crops (remote sensing) research currently being undertaken with support from Horticulture Innovation Australia (HIA) will provide valuable real time information for growers regarding the status of their crop and when optimal harvest times occur. However, the data used to build the calibration models for these instruments must accurate and precise to ensure the outcomes are useful to growers.

Irrigation studies which allow specific watering regimes, as well as precise soil and plant moisture monitoring systems are important for future study. Irrigation management of individual varieties and soil types across all environments where olives are grown in Australia remains a priority, and could be included in some of the climate change funding opportunities that are being utilised by other industries.

References

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Further reading

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Mailer RJ, Ayton J and Conlan D. (2007). Influence of harvest timing on olive (*Olea europaea*) oil accumulation and fruit characteristics under Australian conditions, *Journal of Food, Agriculture and Environment*, **5 (3-4)**, 58-63.

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Table 1 Summary of harvest timing and irrigation projects.

	DAN-197A			**PRJ-000496**		
Location	Darlington Point			Yarrawonga		
Years studied	2002-04			2005-08		
Varieties	Mission Paragon Corregiola			Nevadillo Blanco Paragon Corregiolla Manzanillo		
Harvest timing	6 harvests: February - July			5 harvests: March - July		
Irrigation	Furrow			Spray		
Irrigation treatments		**Total applied (Ml/ha)**	**Irrigation period**		**Total applied (Ml/ha)**	**Irrigation period**
	1	3.0	November - March	1	5.0 - 7.0	September - April
	2	1.6	November - March	2	4.4 – 6.4	September – April*
	3	1.2	November - March	3	3.4 – 5.1	September - January
				4	3.5 – 5.8	September – January**

* full irrigation until end of January and then partial root zone irrigation

** full irrigation until end of January and then nil irrigation until April.

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