

## **Review of Quality Enhancement of Australian Extra Virgin Olive Oils (06-135)**

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### **Original Summary**

The quality of olive oil is largely determined by the minor components, especially volatile (aroma, flavour) and phenolic (flavour, antioxidant) compounds. We have devoted a large part of this study in identifying and monitoring these compounds (among others) in fruit, and during processing and oil storage, while exploring how these stages may affect levels of these compounds and hence consumer satisfaction and acceptance. We show in this study that it is possible to have objective, reproducible, reliable measures of many of the compounds that affect the sensory properties of olive oil, and hence consumer satisfaction and acceptance.

### **Evaluation**

The report described the development and use of advanced analytical methodologies to quantify both volatile (aroma) and phenolic (taste, antioxidant) compounds in Australian EVOOs. The work was one of the first times worldwide, where both classes of compounds were determined simultaneously, and the world-leading nature of the work is evidenced by seven publications in the international peer-reviewed literature, cited a total of 605 times (see Appendix 1, below). The titles of the papers describe the breadth of the work covering most aspects of oil production, from fruit to consumer use/storage.

Having developed the methodologies to objectively quantify compounds of primary importance to oil quality and consumer acceptance, the next phase in the research was to extend the research to different growing locations and varieties, and to have a focus on the horticulture of olives – pruning, fertilizer, irrigation, etc. As noted in the Forward to the report:

“This research should provide considerable benefit to the industry. The tools developed and described in this report will enable the industry to measure volatile and phenolic compounds and link them to production and consumer needs. Furthermore, this work presents possibilities for further investigations that look at the relationship between horticultural practices (e.g. pruning and fertilizer regimes) and their effect on fruit (and hence oil) quality. This work also identifies the need for consumer education campaigns emphasising the importance of using olive oil quickly, while it still maintains its positive flavour characteristics.”

As far as I'm aware, the extension of the work as outlined above has never happened (at least not reported in the peer-review literature, or Agrifutures (RIRDC) or HIAL funded projects, see Appendix 2, below). Therefore, there is still much that the Australian Olive Industry could learn by applying the methods developed in the report to further research projects with the aim of understanding the relationship between horticultural practices and fruit quality. There is also growing awareness of the importance of sensory research in terms of consumer preference studies. The methods developed in the report would provide objective measures of compounds that could be linked to consumer liking. This would enable a sophisticated approach to marketing different oils to different consumer segments, both nationally and internationally. E.g. consumers of a certain demographic prefer oils with x and y characteristics related to specific compounds as measured by the reported methods.

### **Overall summary**

Much of the information in the report is still current and relevant. However, the Australian Olive Industry would benefit from a major project that combined the analytical chemistry methodologies described in the report, with sensory and consumer preference studies, over a much larger scale than was possible in the original research.

**Appendix 1: International peer-reviewed papers arising from work described in the report and the status of the information**

| Title   | Details   | Status   | Citations |
|---|---|--|-----------|
| Discrimination of olive oils and fruits into cultivars and maturity stages based on phenolic and volatile compounds   | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY Volume: 53 Issue: 20 Pages: 8054-8062 Published: OCT 5 2005  | Major project required.<br>The research showed a possible link between compounds and maturity stage and cultivar, but a more comprehensive study is required to ascertain key compounds linked to oil quality and sensory properties.  | 54        |
| Development of a headspace solid phase microextraction-gas chromatography method for monitoring volatile compounds in extended time-course experiments of olive oil | ANALYTICA CHIMICA ACTA Volume: 556 Issue: 2 Pages: 407-414 Published: JAN 25 2006                       | Current and relevant.<br>This is a methodology paper. The application of this methodology is still relevant for quantification of volatile compounds.  | 49        |
| Discrimination of storage conditions and freshness in virgin olive oil  | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY Volume: 54 Issue: 19 Pages: 7144-7151 Published: SEP 20 2006 | Current and relevant.<br>EVOO samples were stored in the light at ambient temperature, in the dark at ambient temperature, and at low temperature in the dark for 12 months both with and without headspace. Markers for different storage conditions were found. Light and oxygen had the biggest impacts on freshness.   | 33        |
| Changes in volatile and phenolic compounds with malaxation time and temperature during virgin olive oil production  | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY Volume: 54 Issue: 20 Pages: 7641-7651 Published: OCT 4 2006  | Current and relevant.<br>Volatile and phenolic compounds were measured after processing at different malaxation temperatures (15, 30, 45, and 60 °C) and times (30, 60, 90, and 120 min). Some of these combinations are outside the bounds of normal processing, but nevertheless allowed a very good understanding of how processing affected important sensory and quality compounds.   | 86        |
| Olive oil volatile compounds, flavour development and quality: A critical review  | FOOD CHEMISTRY Volume: 100 Issue: 1 Pages: 273-286 Published: 2007                                      | Major project required.<br>This paper was a comprehensive and critical review of the literature on compounds associated with sensory quality. An updated review would be warranted to capture latest developments in this field. Further research should investigate Australian oils for compounds that correlate with sensory perception, and consumer preference, using the quantitative methodologies developed in the report.                    | 348       |
| Changes in virgin olive oil quality during low-temperature fruit storage  | JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY Volume: 56 Issue: 7 Pages: 2415-2422 Published: APR 9 2008   | Current and relevant.<br>This research was undertaken to explore the potential of low temperature (4 °C) storage of olive fruit prior to processing, in the event that fruit production outstripped the availability of pressing facilities. The research showed that cold storage could be employed, but that further research was required to optimise oil quality from stored fruit.  | 25        |
| Flavour quality critical production steps from fruit to extra-virgin olive oil at consumption   | FOOD RESEARCH INTERNATIONAL Volume: 54 Issue: 2 Pages: 2095-2103 Published: DEC 2013                    | Major project required.<br>As mentioned earlier in the report, further research on a larger scale would be required to verify the findings in this paper (and other papers). What this paper showed was that it is possible to identify volatile and phenolic compounds that can be used as markers to trace processing effects on oil quality. Whether these compounds are common across multiple growing locations and varieties is still unknown. | 10        |

## **Appendix 2: Methodology for Assessing Peer-reviewed Literature**

The seven papers arising from this work were checked for citations in the Web of Science database. The citations for each paper were narrowed down to those by Australian authors. Not one of the articles in the Web of Science database drew on methods developed in the RIRDC report. These methods have been widely used elsewhere in the world as evidenced by the citations, but not, it would appear, in Australia.

The Agrifutures (RIRDC) and HIAL databases were also searched for reports from projects that were conducted subsequent to 06-135. No reports utilised the methodologies outlined in 06-135, nor attempted to extend the scope of work described in 06-135.