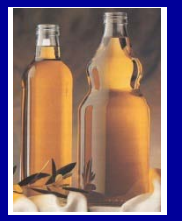
Improvement of olive oil quality using a molecular and biochemical approach



AGRONOMY

GENETICS

TECHNOLOGY

Olive tree → Olive fruit → Reception, washing, storage → Milling → Malaxation → Centrifugation (Two phase separation) → **Virgin olive oil**

By-products

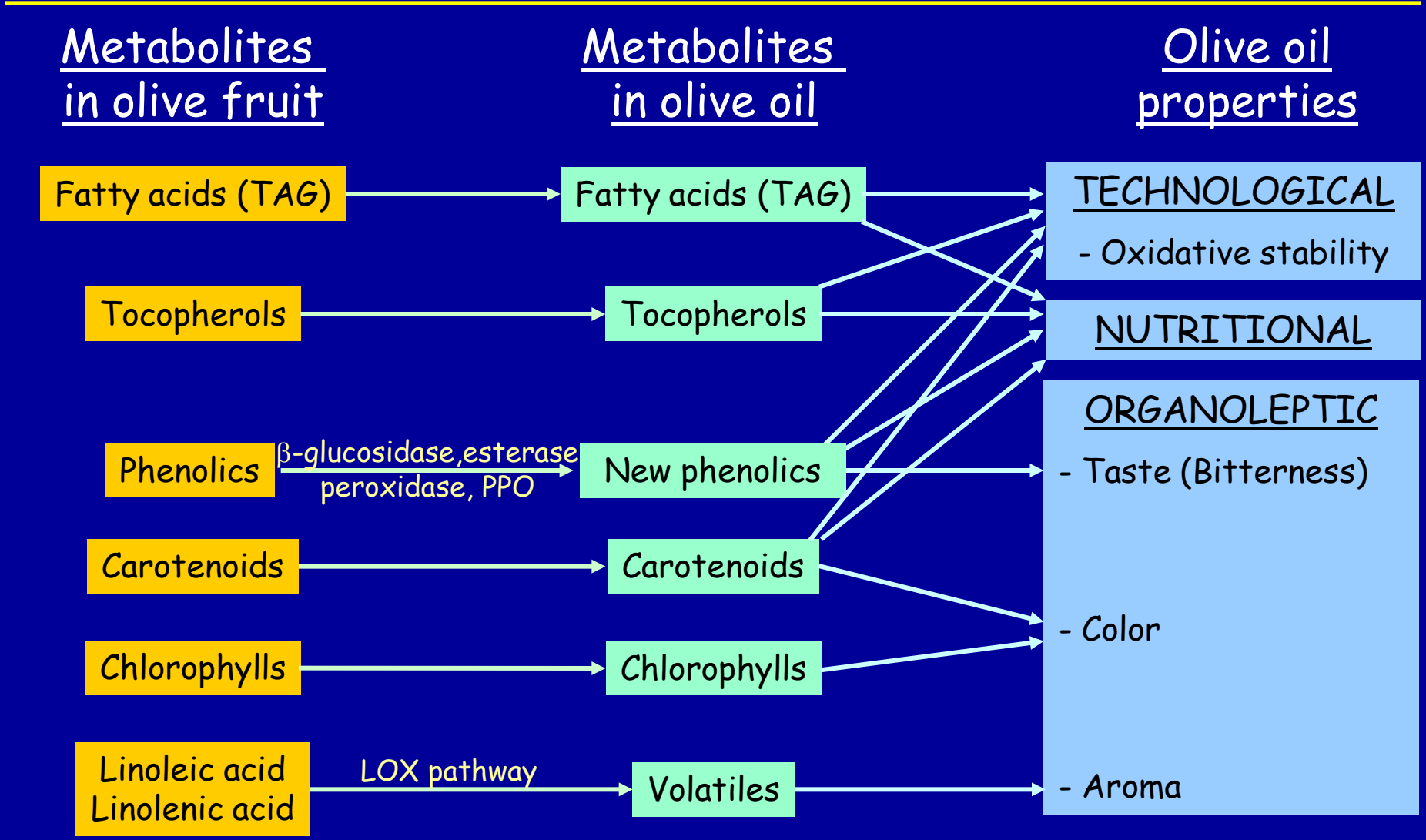
Metabolites → Transformation → New metabolites → Final components

Enzyme activities ← – – – – – – – – **BIOCHEMISTRY**

Gene expression ← – – – – **MOLECULAR BIOLOGY**

Identification, characterization and regulation of genes/enzymes involved in olive oil quality

Components responsible for olive oil quality



Strategies for the improvement of olive oil quality using a molecular and biochemical approach

Identification of genes and enzymes involved in olive oil quality

Development of molecular markers linked to olive oil quality traits	→ Generation of new varieties with improved olive oil quality using marker-assisted selection
Studies on the regulation by environmental stresses of genes/enzymes involved in olive oil quality	→ Determination of optimal olive culture conditions to improve olive oil quality
Look for correlations between metabolite content-enzyme activity-gene expression levels during olive fruit development and ripening	→ Determination of the optimal moment for harvesting each cultivar
Characterization of kinetic properties of isoenzymes acting during the milling and malaxation processes involved in olive oil quality	→ Selection of the optimal technological conditions of the milling and malaxation processes to obtain olive oils with improved quality

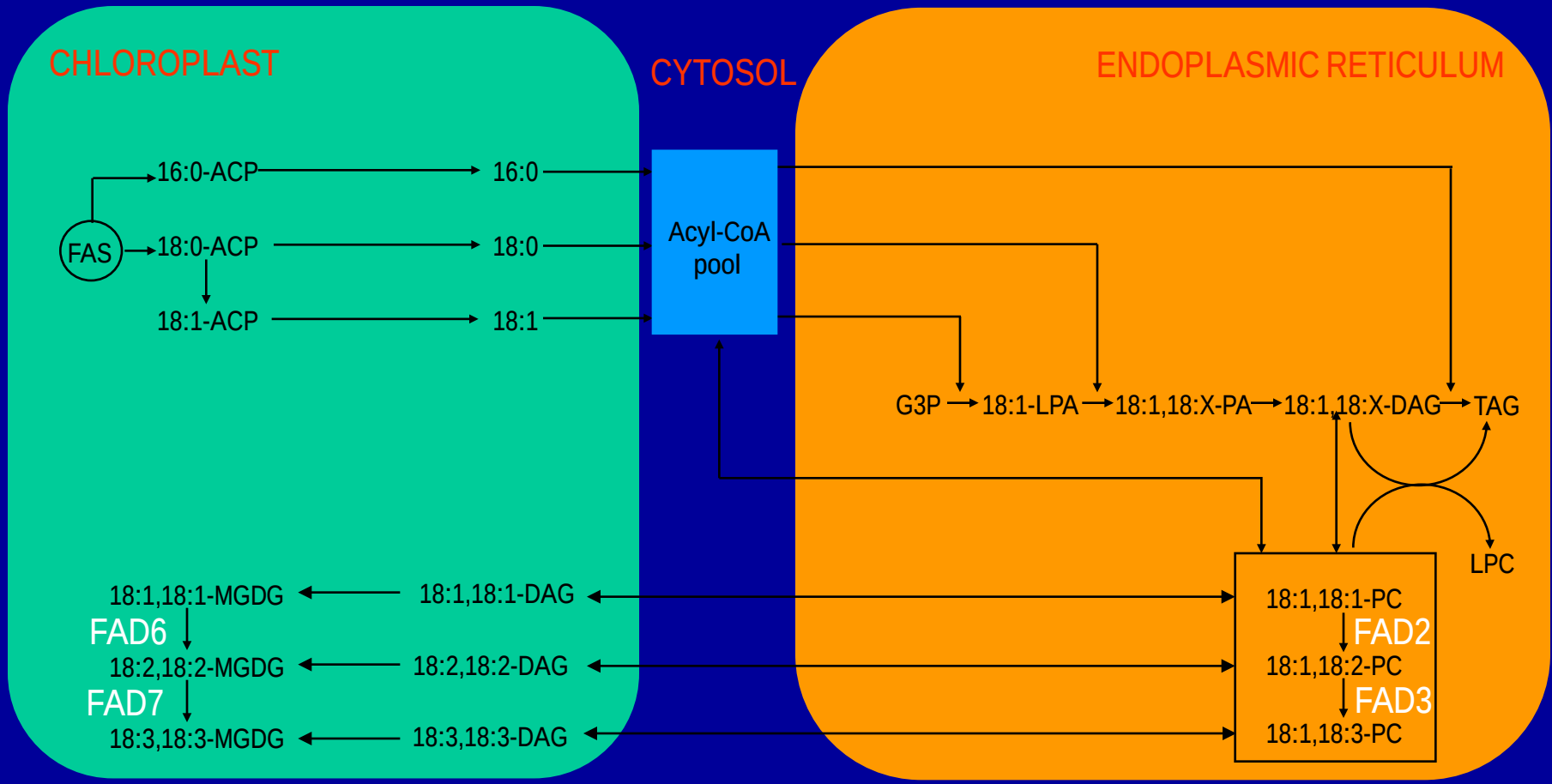
Improvement in fatty acid composition

- Reduction of the linoleic acid content in some varieties to improve oxidative stability and nutritional properties, and to keep the percentage below 21%.
- Reduction of the linolenic acid content in some varieties to keep the percentage below 1%.

	16:0	16:1	18:0	18:1	18:2	18:3
Picual	11	1	4	79	4	0.9
Arbequina (Spain)	15	1	2	67	14	0.8
Arbequina (Argentina)	19	3	2	53	22	0.9
Picudo	15	2	2	64	15	1.4

Identification, characterization and regulation of olive genes/enzymes involved in the biosynthesis of linoleic and linolenic acid

Biosynthetic pathway for glycerolipids in olive fruit mesocarp



Hernández et al., (2008) J. Exp. Bot.

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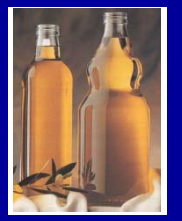
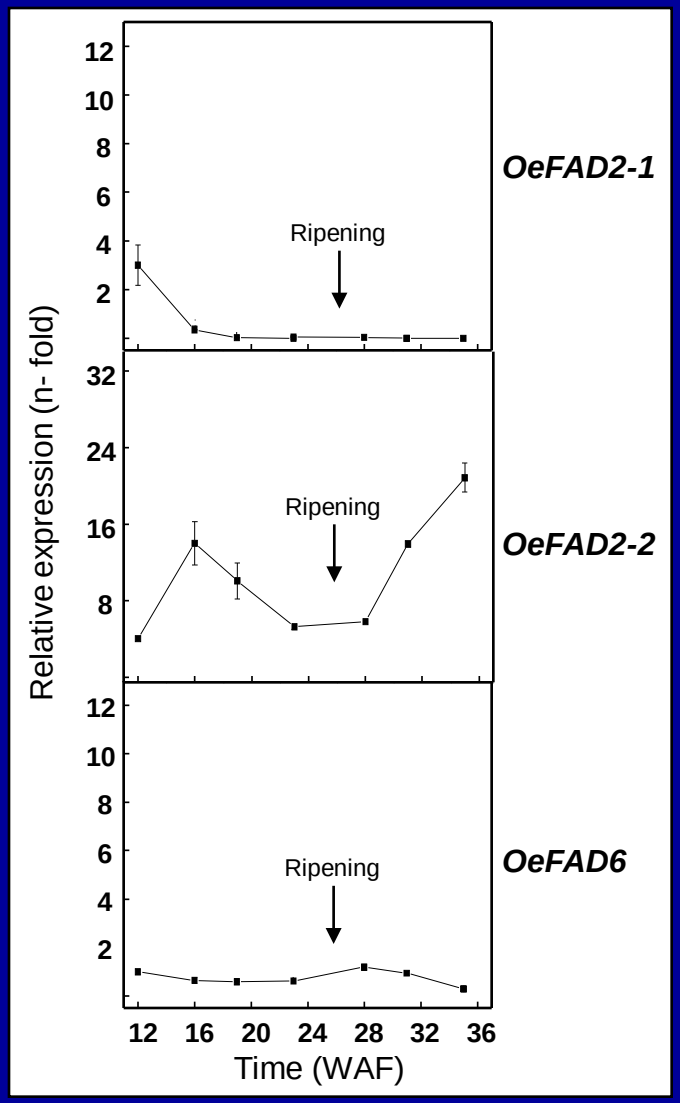
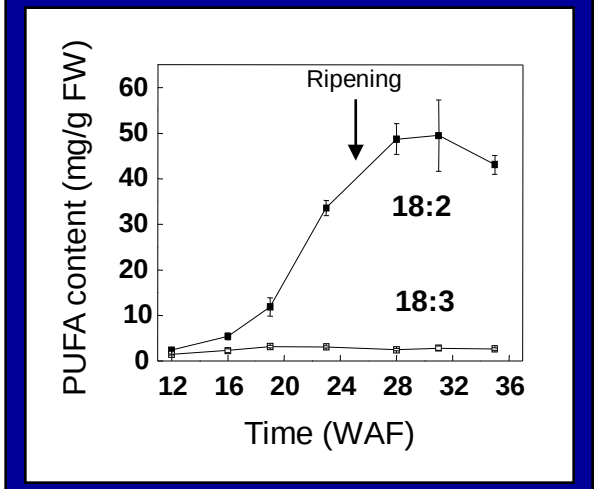
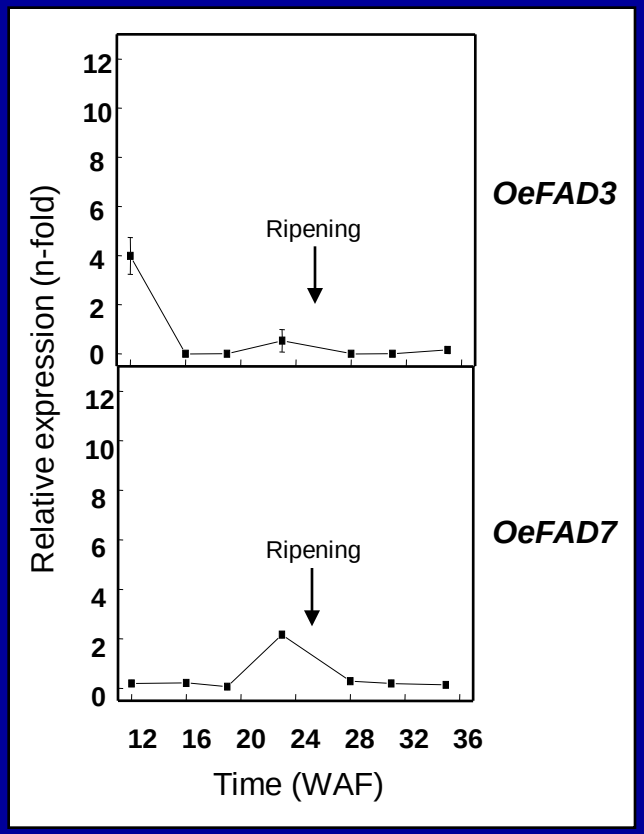
Expression levels of olive *FAD2* and *FAD6* genes and linoleic acid content in mesocarp tissue during fruit development and ripening of Arbequina





ARBEQUINA





OeFAD2-2 seems to be the gene mainly responsible for the linoleic acid content in olive fruit mesocarp

Hernández et al., (2005) Phytochem.; Hernández et al., (2009) J. Agric. Food Chem.

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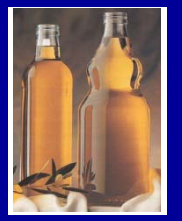
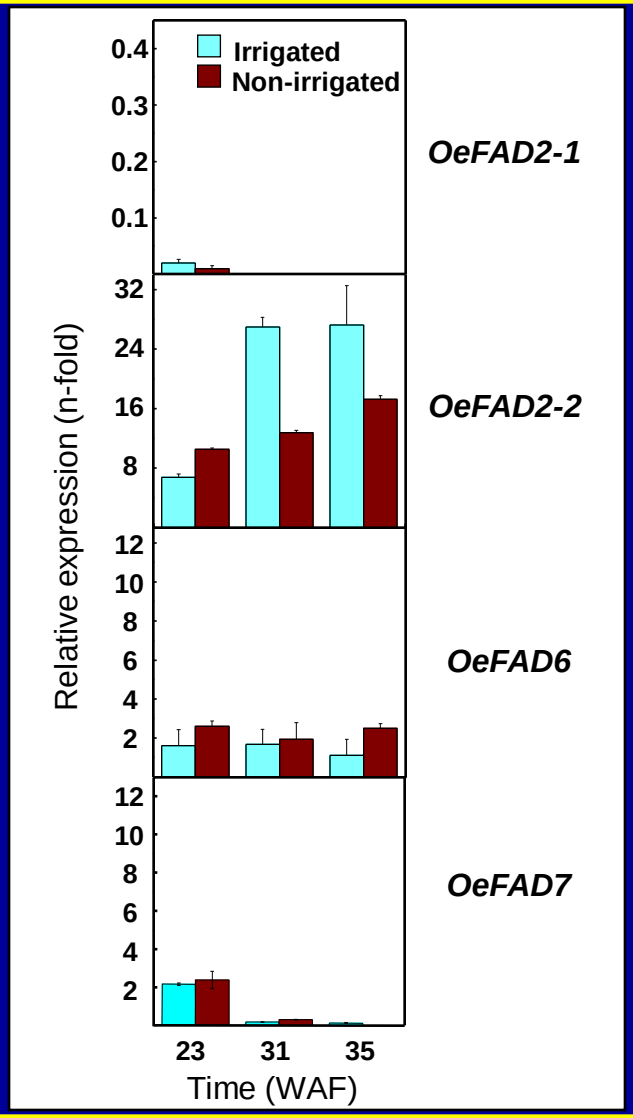
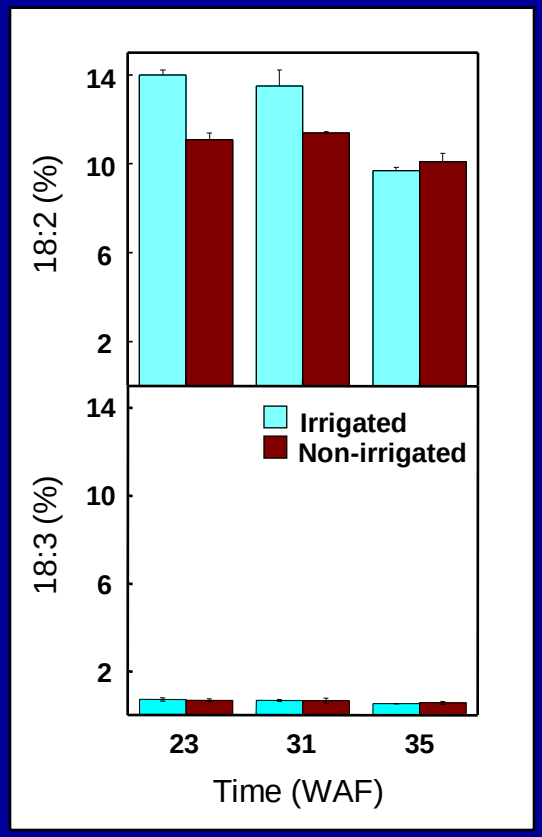
Effect of water regime on the expression levels of olive *FAD2*, *FAD6*, *FAD3* and *FAD7* genes and PUFA content in mesocarp tissue of Arbequina







Water deficit reduces linoleic acid content possibly due to the decrease of *OeFAD2-2* transcript level

Hernández et al., (2009) J. Agric. Food Chem.; Hernández et al., (2011) Phytochem.

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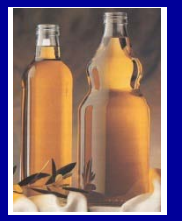
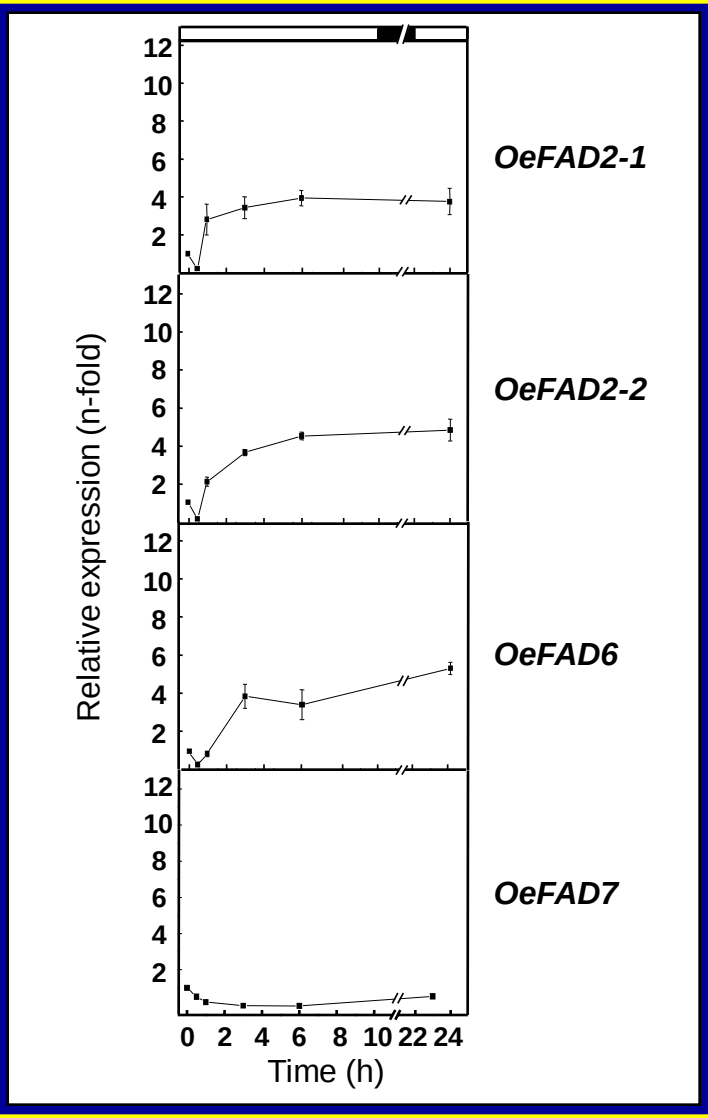
Effect of low temperature (15 °C) on the expression levels of olive *FAD2*, *FAD6*, *FAD3* and *FAD7* genes and PUFA content in mesocarp tissue of Arbequina





OeFAD2 and *OeFAD6* are induced by low temperature

Hernández et al., (2011) Phytochem.

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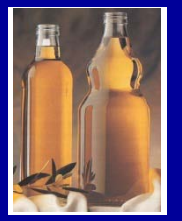
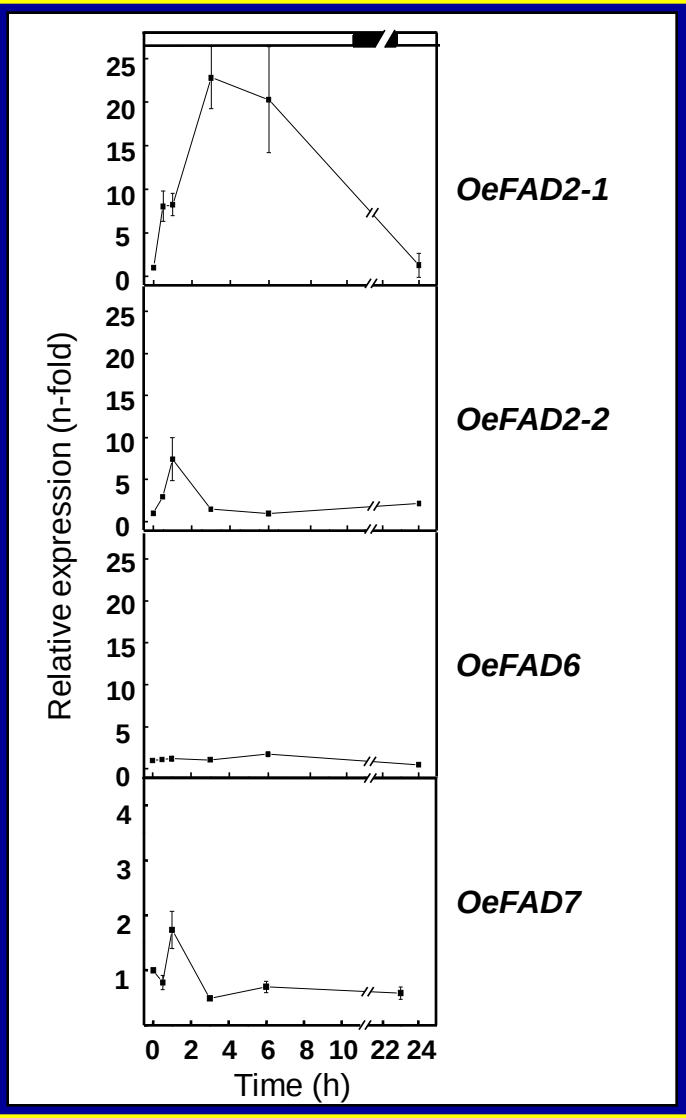
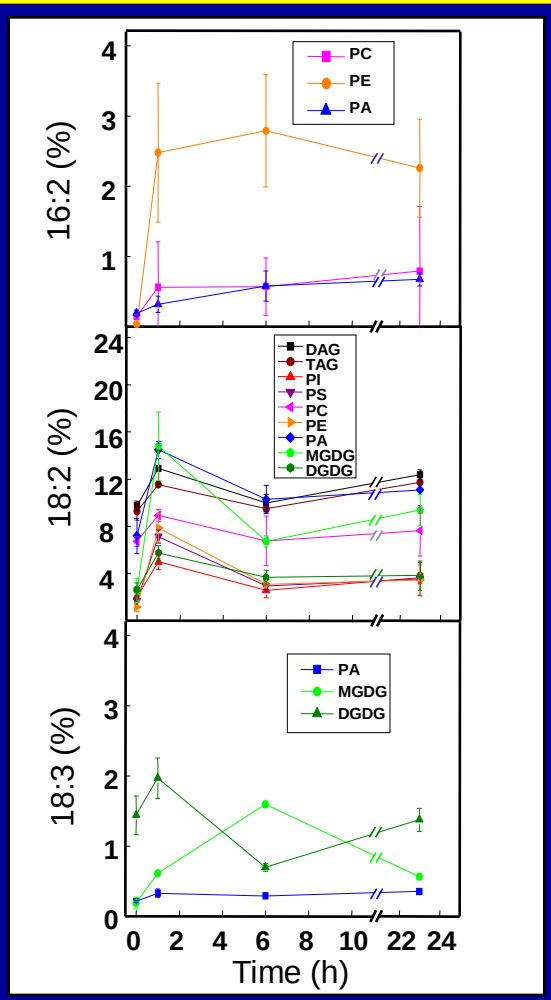
Effect of wounding on the expression levels of olive *FAD2*, *FAD6*, *FAD3* and *FAD7* genes and PUFA content in mesocarp tissue of Arbequina







OeFAD2 and *OeFAD7* expression levels and dienoic acid content are increased by wounding

Hernández et al., (2011) Phytochem.

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Project in olive genomics: OLEAGEN