

ARISTOIL

“Reinforcement of Mediterranean olive oil sector competitiveness through development and application of innovative production and quality control methodologies related to olive oil health protecting properties”

PRIORITY AXIS:

OBJECTIVE: The guide for production and quality control of olive oil with increased health protecting properties, which will be published for use by all stakeholders.

Project website: <http://aristoil.interreg-med.eu/>

DELIVERABLE Number: 4.2.4

Title of DELIVERABLE: Training course material in e-form

ACTIVITY n.: 4.2

WP n.: 4

PARTNER IN CHARGE: University of Córdoba

PARTNERS INVOLVED: All partners

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Confidential <input type="checkbox"/>	Public <input checked="" type="checkbox"/>	
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Date: 02/11/2018

The Aristoil Project

*Reinforce the competitiveness of the olive oil sector of the Mediterranean area through the development and application of methodologies for innovating production and quality control related with the **health claim value** of olive oil*



**EU432/2012 Regulation
Phenolic compounds**

Presentation scheme

1. Introduction

- Healthy value of VOO and EVOO: mono/unsaturated profile and minor components
- Health claims associated to VOO and EVOO composition
- Phenolic compounds

2. Health claim associated to phenolic compounds

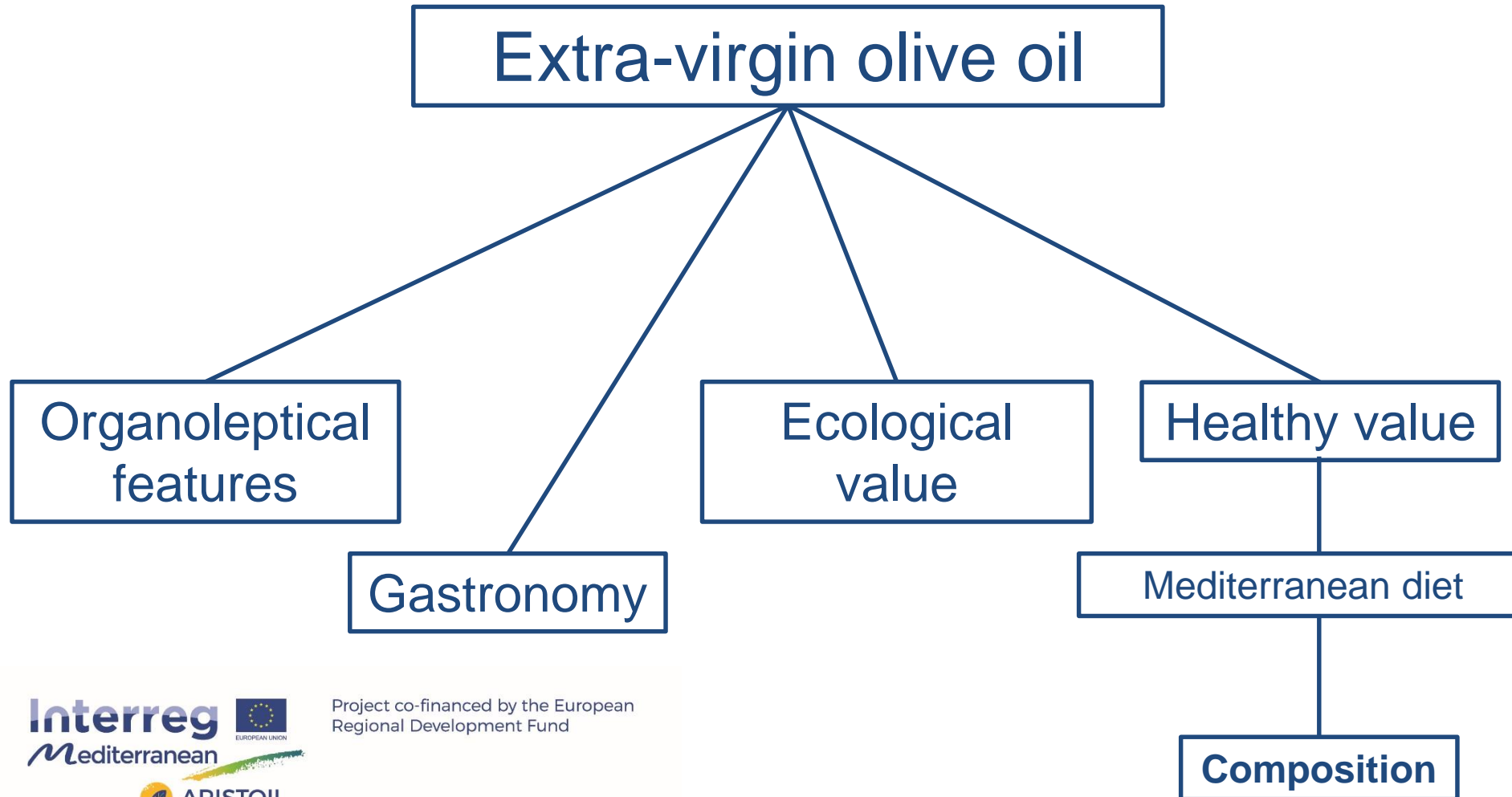
3. General results obtained in 2017/2018 season

4. Factors contributing to explain phenolic differences in VOO and EVOO

5. Description of the main factors identified to enhance phenolic content

6. Conclusions

Added values of EVOO



Nutritional information of olive oil

Extra-virgin olive oil

INFORMACION NUTRICIONAL		por 100 g
Valor energético	3.700 kJ 900 kcal	
Fat / Grasas	100 g	
de las cuales		
Saturadas	13 g	
Monoinsaturadas	79 g	
Poliinsaturadas	8 g	
Hidratos de Carbono	0 g	
de los cuales		
Azúcares	0 g	
Proteínas	0 g	
Sal	0 g	
Vitamina E	20 mg (167% VRN*)	

Refined sunflower oil

Ingredientes: Aceite de Girasol.
Este producto, al igual que todos los de origen vegetal, no contiene colesterol.

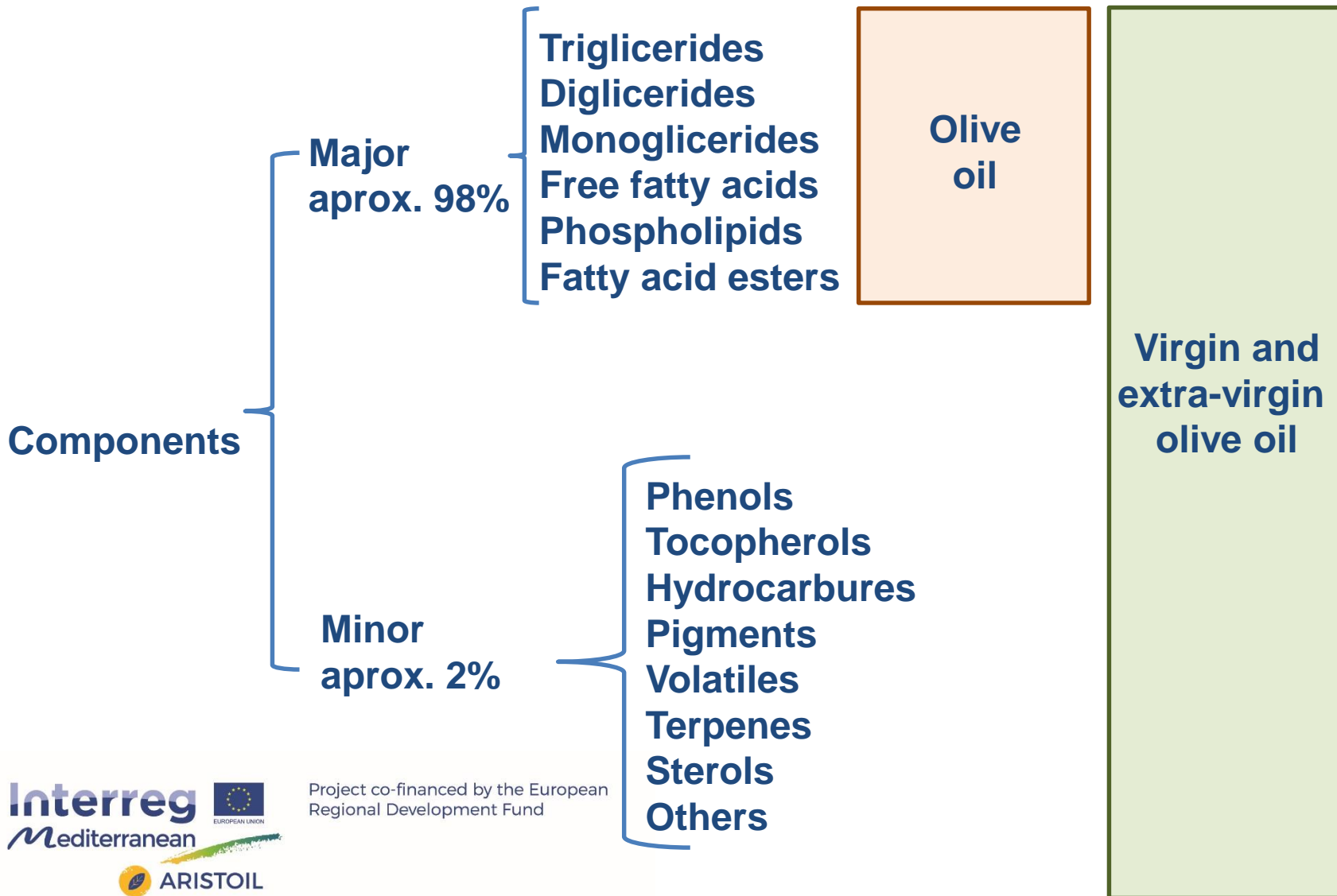
INFORMACIÓN NUTRICIONAL		
Porción 13 ml (1 cucharada de sopa)		
	Cant. por porción	%VD (*)
Valor Energético	108 kcal = 452 kJ	5%
Carbohidratos	0 g	0%
Proteínas	0 g	0%
Grasas totales	12 g	22%
Grasas saturadas	1.2 g	6%
Grasas trans	0 g	
Grasas monoinsat.	4.2 g	
Grasas poliinsat.	6.4 g	
Colesterol	0 mg	
Fibra alimentaria	0 g	0%
Sodio	0 mg	0%
Vitamina E	7.2 mg	72%

(*) % Valores Diarios con base a una dieta de 2.000 kcal u 8400 kJ. Sus valores diarios pueden ser mayores o menores dependiendo de sus necesidades energéticas.

High-oleic refined sunflower oil

Información nutricional media por 100 g	
Valor energético	3700 kJ / 900 kcal
Grasas	100 g
de las cuales:	
saturadas	9 g
monoinsaturadas	80 g
poliinsaturadas	11 g
Hidratos de Carbono	0 g
de los cuales:	
azúcares	0 g
Proteínas	0 g
Sal	0 g
Vitamina E	70 mg (583% VRN**)

Olive oil composition



EU432/2012 Regulation

25.5.2012

EN

Official Journal of the European Union

L 136/1

II

(Non-legislative acts)

REGULATIONS

COMMISSION REGULATION (EU) No 432/2012

of 16 May 2012

establishing a list of permitted health claims made on foods, other than those referring to the reduction of disease risk and to children's development and health

(Text with EEA relevance)

EU432/2012 Regulation

ANEXO

LISTA DE DECLARACIONES DE PROPIEDADES SALUDABLES AUTORIZADAS

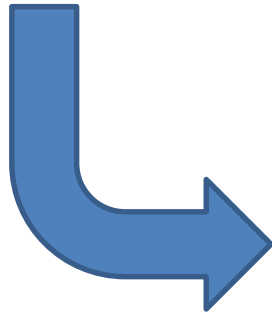
Nutriente, sustancia, alimento o categoría de alimentos	Declaración	Condiciones de uso de la declaración	Condiciones o restricciones de uso del alimento o bien declaración o advertencia complementaria	Número del boletín de la EFSA (EFSA Journal)	Número de entrada en la lista consolidada que se remitió a la EFSA para su evaluación
Ácidos grasos monoinsaturados o poliinsaturados	La sustitución de grasas saturadas por grasas insaturadas en la dieta contribuye a mantener niveles normales de colesterol sanguíneo (los ácidos grasos monoinsaturados o poliinsaturados son grasas insaturadas).	Esta declaración solo puede utilizarse respecto a alimentos con alto contenido de ácidos grasos insaturados, de acuerdo con la declaración ALTO CONTENIDO DE GRASAS INSATURADAS que figura en el anexo del Reglamento (CE) n° 1924/2006.		2011; 9(4):2069 2011; 9(6):2203	621, 1190, 1203, 2906, 2910, 3065 674, 4335
Fitosteroles y fitostanoles	Los fitosteroles y los fitostanoles contribuyen a mantener niveles normales de colesterol sanguíneo.	Para que un producto pueda llevar esta declaración, se informará al consumidor de que el efecto beneficioso se obtiene con una ingesta diaria mínima de 0,8 g de fitosteroles o fitostanoles.		2010; 8(10):1813 2011; 9(6):2203	549, 550, 567, 713, 1234, 1235, 1466, 1634, 1984, 2909, 3140 568
Polifenoles del aceite de oliva	Los polifenoles del aceite de oliva contribuyen a la protección de los lípidos de la sangre frente al daño oxidativo.	Esta declaración solo puede utilizarse respecto a aceite de oliva que contenga un mínimo de 5 mg de hidroxitirosol y sus derivados (por ejemplo, un complejo de oleuropeína o tirosol) por 20 g de aceite de oliva. Para que un producto pueda llevar esta declaración, se informará al consumidor de que el efecto beneficioso se obtiene con una ingesta diaria de 20 g de aceite de oliva.		2011; 9(4):2033	1333, 1638, 1639, 1696, 2865
Vitamina E	La vitamina E contribuye a la protección de las células frente al daño oxidativo.	Esta declaración solo puede utilizarse respecto a alimentos que son, como mínimo, fuente de vitamina E de acuerdo con la declaración FUENTE DE [NOMBRE DE LAS VITAMINAS] Y/O [NOMBRE DE LOS MINERALES] que figura en el anexo del Reglamento (CE) n° 1924/2006.		2010; 8(10):1816	160, 162, 1947

Phenolic content

ANEXO

LISTA DE DECLARACIONES DE PROPIEDADES SALUDABLES AUTORIZADAS

Nutriente, sustancia, alimento o categoría de alimentos	Declaración	Condiciones de uso de la declaración	Condiciones o restricciones de uso del alimento o bien declaración o advertencia complementaria	Número del boletín de la EFSA (EFSA Journal)	Número de entrada en la lista consolidada que se remitió a la EFSA para su evaluación
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EFSA Journal 2011;9(4):2033

SCIENTIFIC OPINION

Scientific Opinion on the substantiation of health claims related to polyphenols in olive and protection of LDL particles from oxidative damage (ID 1333, 1638, 1639, 1696, 2865), maintenance of normal blood HDL-cholesterol concentrations (ID 1639), maintenance of normal blood pressure (ID 3781), “anti-inflammatory properties” (ID 1882), “contributes to the upper respiratory tract health” (ID 3468), “can help to maintain a normal function of gastrointestinal tract” (3779), and “contributes to body defences against external agents” (ID 3467) pursuant to Article 13(1) of Regulation (EC) No 1924/2006¹

EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA)^{2, 3}

European Food Safety Authority (EFSA), Parma, Italy

Phenolic content

This health claim can be only used for those olive oils with a minimum content of **5 mg of hydroxytyrosol and its derivatives** (derivatives of oleuropein and tirosol) per **20 g of olive oil**.



250 mg/kg of oil

Hydroxytyrosol

Tirosol

Oleocanthal

Oleacein

Oleuropein aglycon

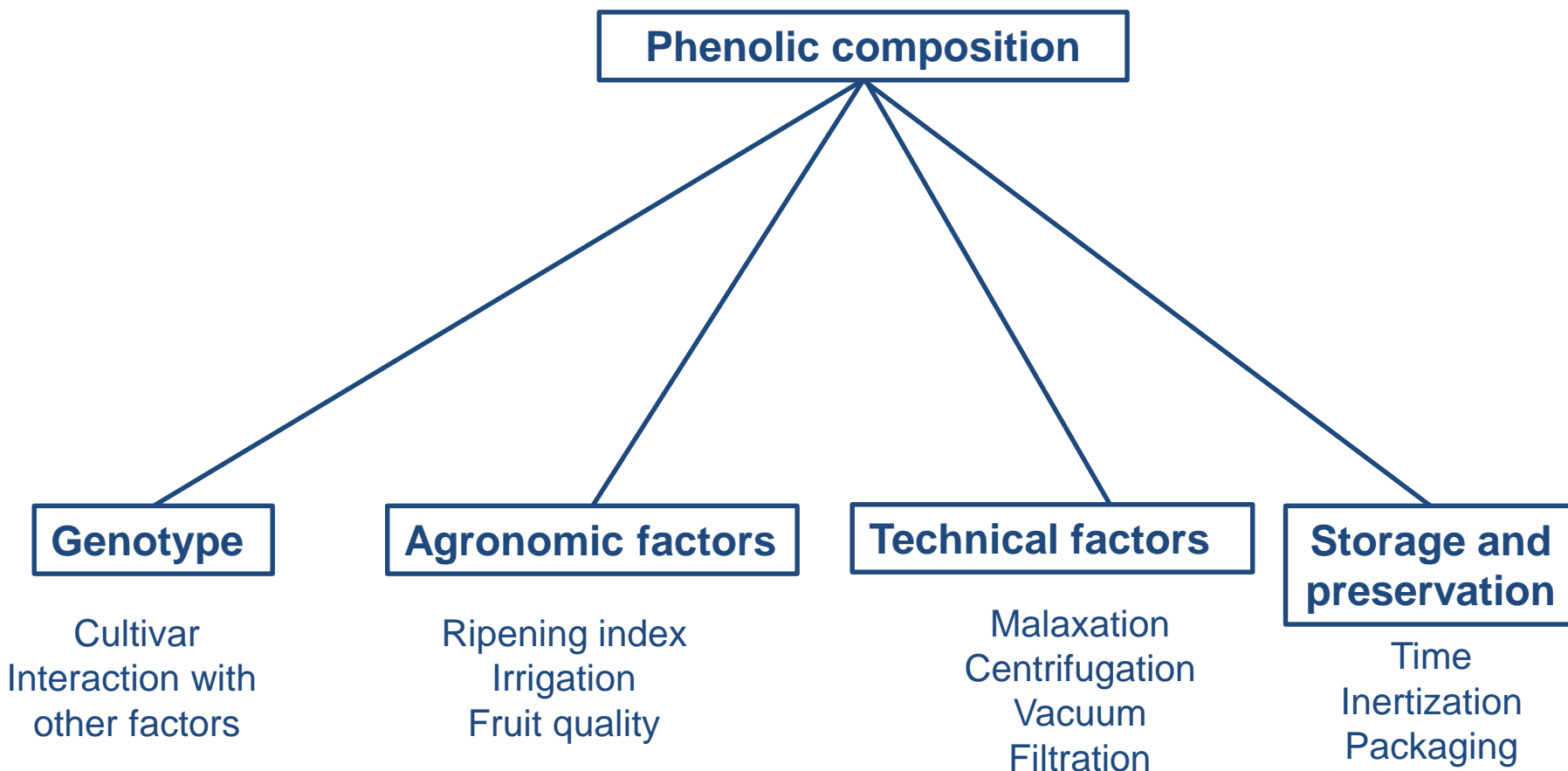
Ligustroside aglycon

2017/2018 season

Number of analyzed samples = 1242 samples

COMPOUND	MINIMUM	MAXIMUM	AVERAGE	STANDARD DEVIATION
Hydroxytyrosol	0,0	22,2	1,7	1,8
Tyrosol	0,0	6,0	0,9	1,0
Oleacein	0,0	1830	304	211
Oleocanthal	0,0	270	55,6	46,8
Oleuropein aglycon	0,0	895	219	131
Oleomissional	0,0	367	45,5	46,6
Ligustrosido aglycon	0,0	511	85,5	72,0
Oleokoronal	0,0	637	89,1	83,4
Hydroxytyrosol derivatives	7,0	2968	570	312
Tyrosol derivatives	2,0	1166	230	164
Total phenolic content	13,0	3734	800	425
Intake mg/20 g of oil	0,3	74,7	16,0	8,5

Factors influencing phenolic content of EVOO



Factors influencing phenolic content of EVOO

Decalogue for the production of EVOO with high phenolic content

1. Prioritize the production of EVOO

95% out of 1242 samples analyzed during last season: > 5,0 mg/20 g of EVOO
75% out of 1242 samples analyzed during last season: > 10,0 mg/20 g of EVOO

- EVOO production: Warranty to produce healthy EVOO.
 - Anomalies reduce antioxidant content.
 - Climatology during collection period.
 - Protection against pests and diseases.
- Optimum collection moment associated to the suited ripening stage.
 - Maximum hygiene.

Factors influencing phenolic content of EVOO

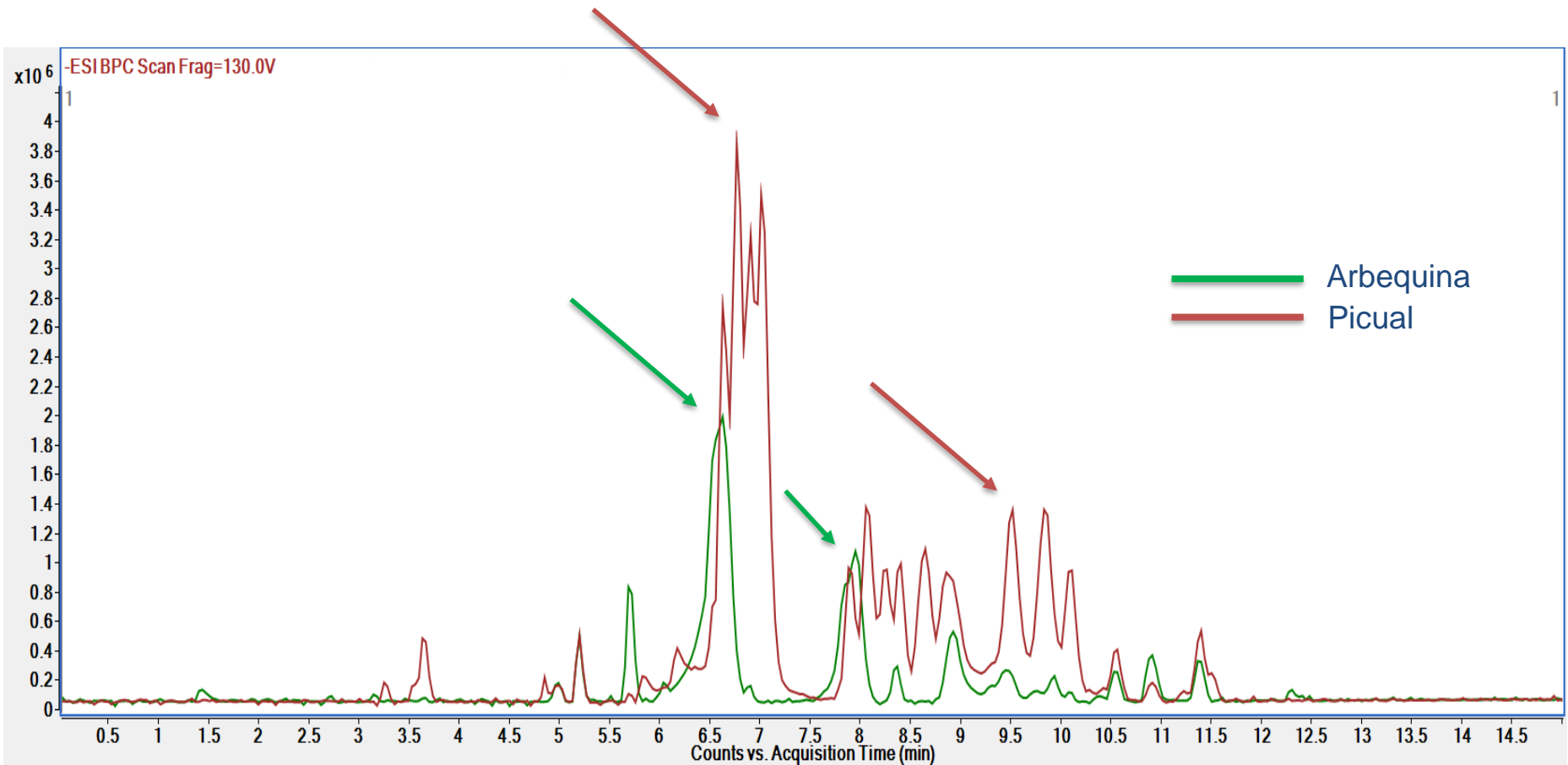
Decalogue for the production of EVOO with high phenolic content

Cultivar

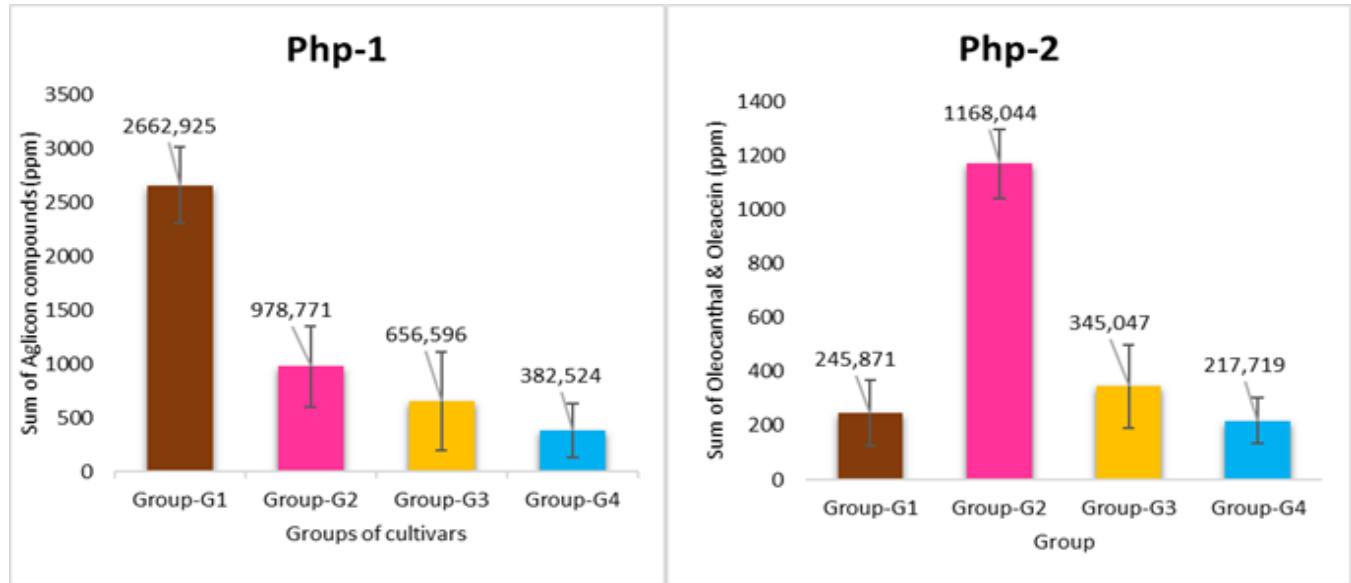
2. The cultivar is one of the most determining factors to explain the variability of phenolic composition of olive oil.

- Genetic predisposition of cultivars to provide olive oil with a particular phenolic profile.
- Any cultivar can provide EVOO with a phenolic content above the level indicated in the EU432/2012 Regulation.

Influence of the genotype



Influence of the genotype

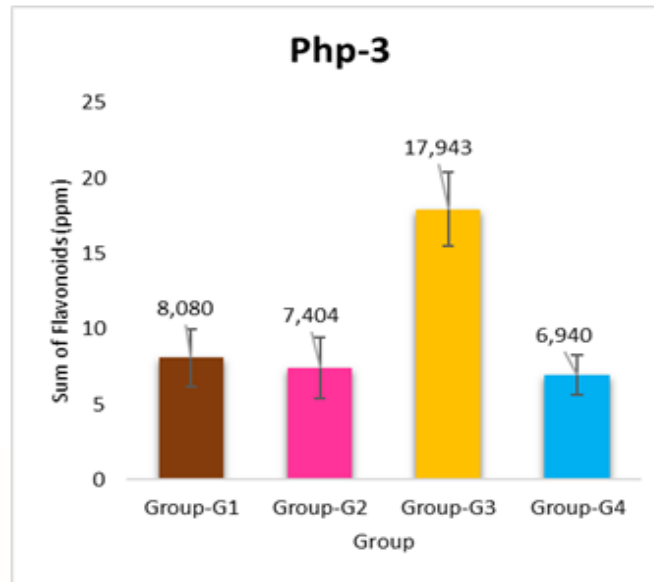


G1: High content in aglycon forms

G2: High content in Oleocanthal/oleacein

G3: High content in flavonoids

G4: Not highlighting



Factors influencing phenolic content of EVOO

Decalogue for the production of EVOO with high phenolic content

Cultivar

3. Multivarietal oils tend to provide balanced phenolic profiles with high probability to be qualified with the health claim

All samples

Compound	Min	Max	Average	SD
Total phenolic content	13,0	3734	800	425
Intake mg/20 g of oil	0,3	74,7	16,0	8,5

Region Sierra de Cádiz

Compound	Min	Max	Average	SD
Total phenolic content	479	2020	1065	443
Intake mg/20 g of oil	9,6	40,4	21,3	8,8

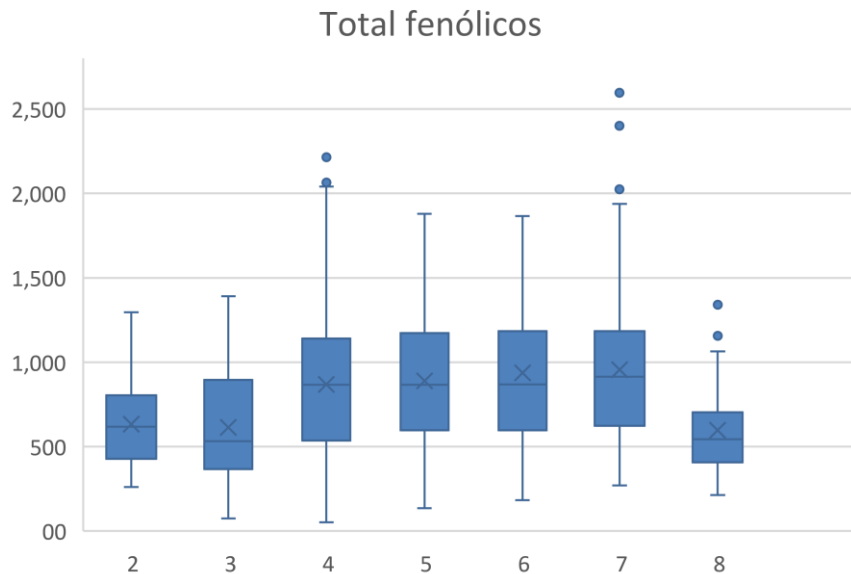
- This aspect especially reinforces those areas based on traditional cultivation system with wide cultivars contribution.

Factors influencing phenolic content of EVOO

Decalogue for the production of EVOO with high phenolic content

Geography

4. The altitude above sea level also constitute a parameter with influence on the phenolic concentration. Olive oil produced from fruits collected in geographical areas cultivated above 400 m above the sea level generally contain higher phenolic concentration than those areas located at lower altitude.



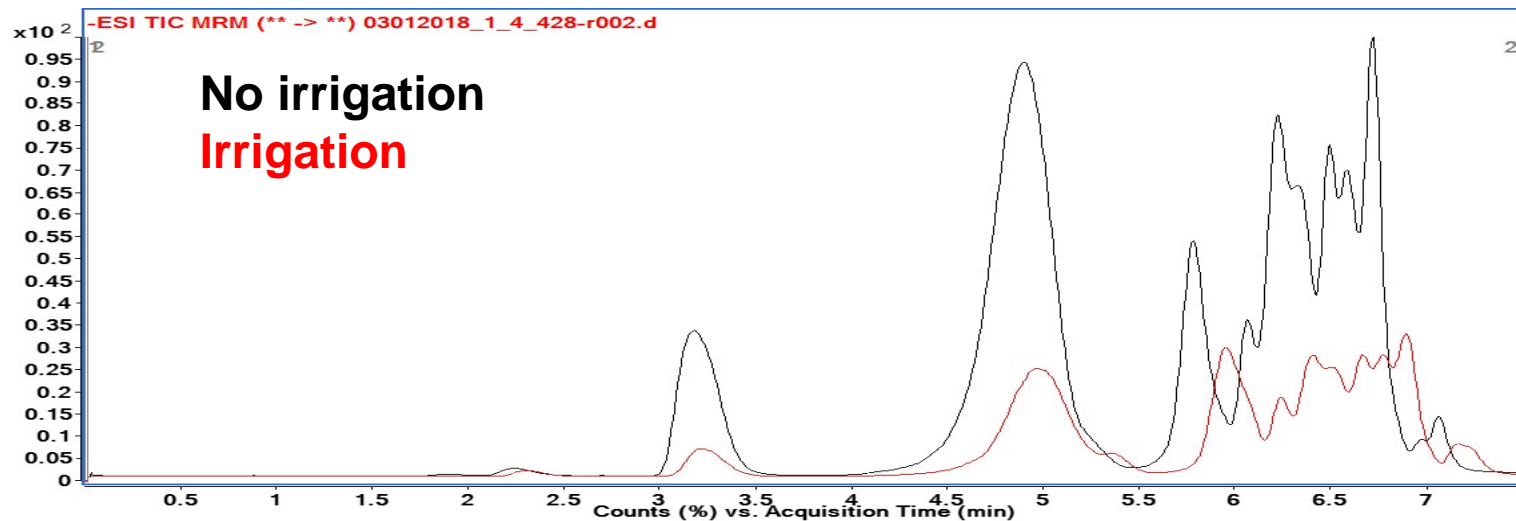
- 2: 200 - 300 m a.s.l.
- 3: 300 - 400 m a.s.l.
- 4: 400 - 480 m a.s.l.
- 5: 480 - 600 m a.s.l.
- 6: 600 - 695 m a.s.l.
- 7: 695 - 770 m a.s.l.
- 8: >770 m a.s.l.

Factors influencing phenolic content of EVOO

Decalogue for the production of EVOO with high phenolic content

Agronomic practices

5. Irrigation is an agronomic factor with high incidence on the phenolic concentration. This practice reduces significantly the phenolic content of VOO and EVOO.



Hydric stress for a period before collection of fruits.

Factors influencing phenolic content of EVOO

Decalogue for the production of EVOO with high phenolic content

Agronomic practices

6. Fruit ripening plays an essential role on the phenolic concentration of EVOO. The period in which the maximum concentration of phenolic compounds is achieved is relatively wide.

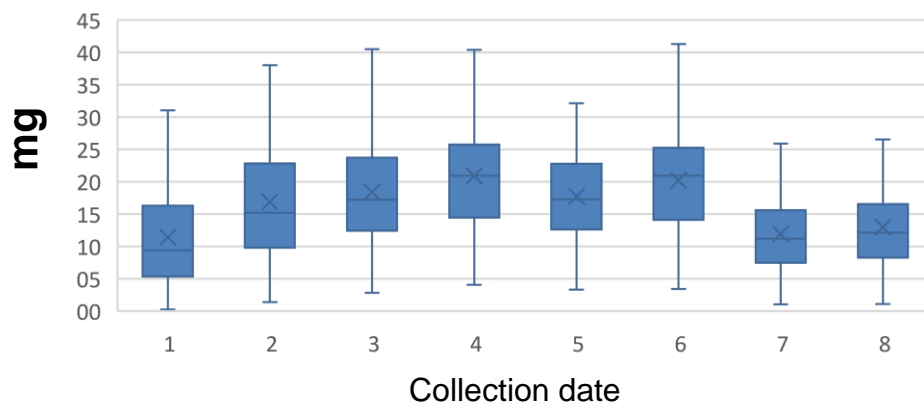
- Early EVOOs are not always providing high phenolic concentration.

Influence of ripening

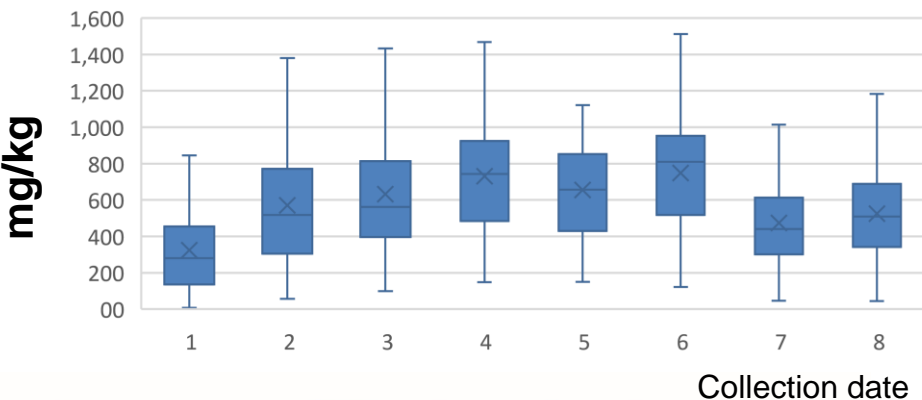
	N	Date of collection
G1	92	21/09 a 07/11
G2	95	08/11 a 26/11
G3	147	27/11 a 10/12
G4	106	11/12 a 27/12
G5	89	28/12 a 16/01
G6	129	17/01 a 31/01
G7	140	01/02 a 16/02
G8	118	17/02 a 26/03

Optimum period

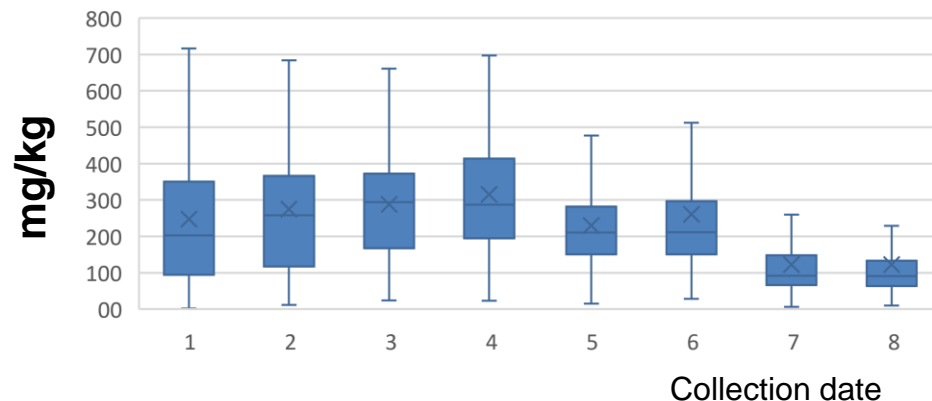
Cantidad de fenoles/20 g de aceite



Hydroxytyrosol derivatives



Tyrosol derivatives



Factors influencing phenolic content of EVOO

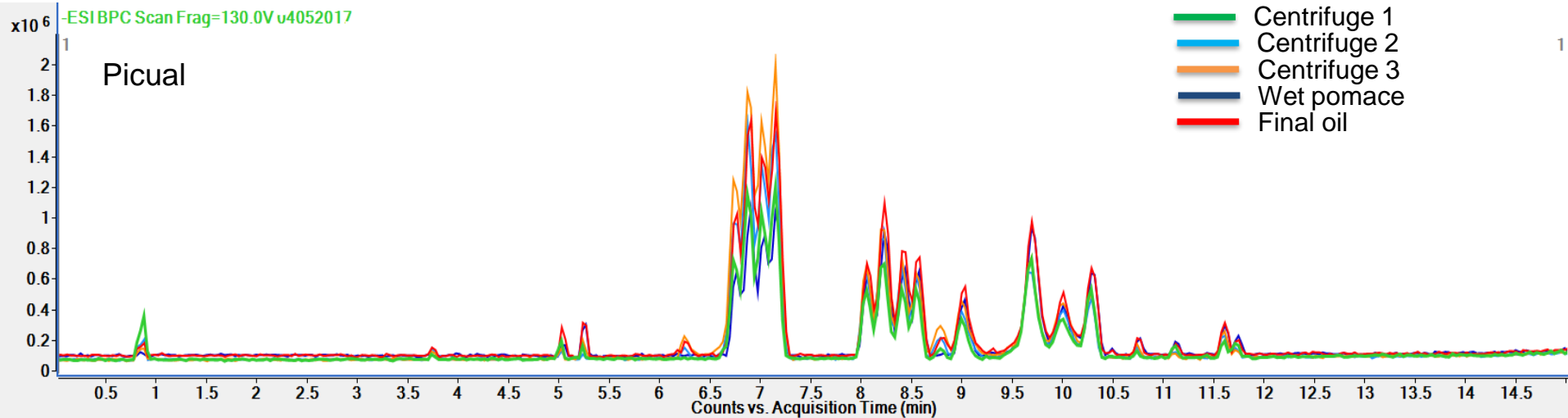
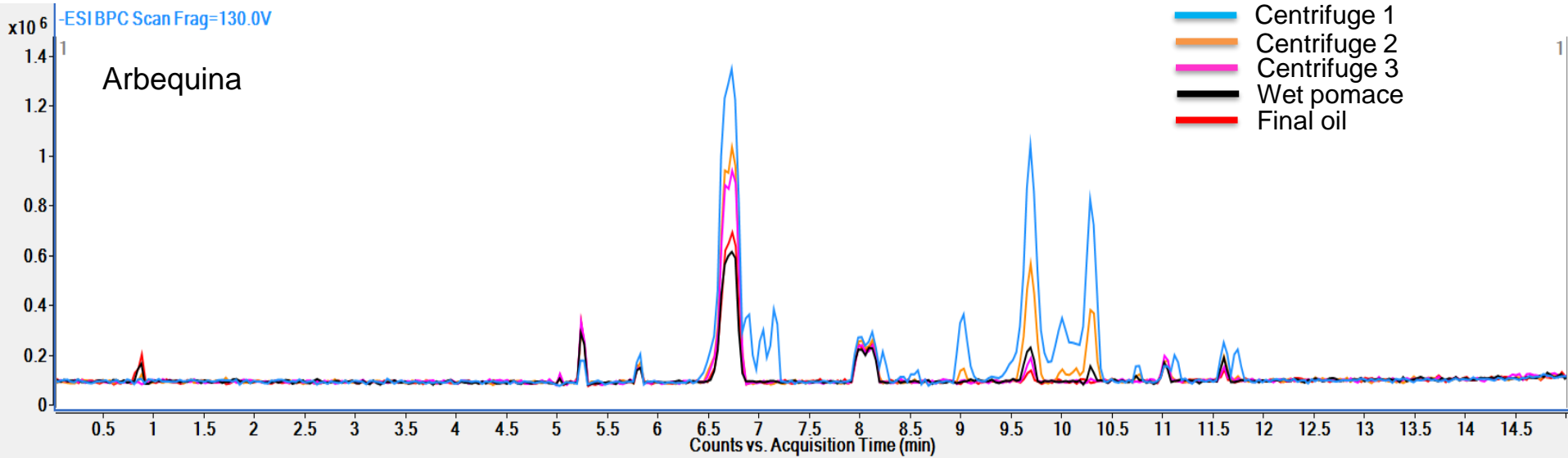
Decalogue for the production of EVOO with high phenolic content

At the olive mill

7. The two-phase extraction system clearly enhances the phenolic concentration as compared to the three-phase system.

- **Phenolic compounds are fractioned between the aqueous phase and the oil.**
- **The fractionation coefficient is enhanced with the added water.**
- **Special emphasis should be paid to centrifugation: a unsuited addition of wáter can reduce substantially the quality of the product.**

Influence of centrifugation



Factors influencing phenolic content of EVOO

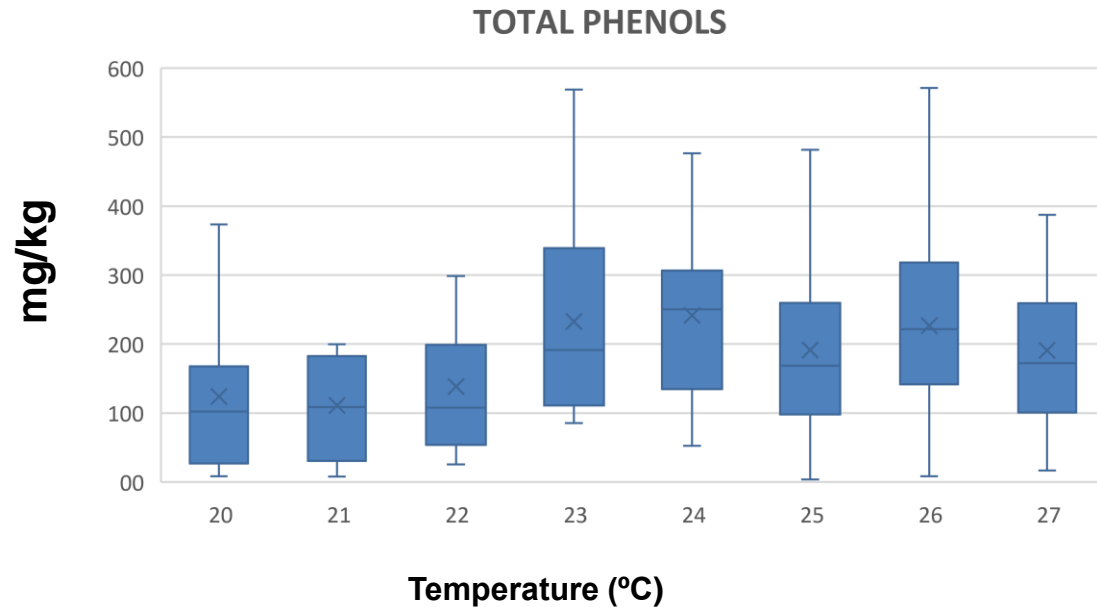
Decalogue for the production of EVOO with high phenolic content

At the mill

8. Absolute control of malaxation temperature.

- Control of enzymatic action of peroxidases and fenoloxidases: phenolic deterioration.
- This degradation is minimized if temperatura does not surpass 28 °C.
- Enzymatic activation of β -glucosidases and esterases: above 24 °C.
- Temperature control should be extended to the complete process.

Influence of malaxation temperature



- Malaxation temperature should be above 23°C to favor desired enzymatic reactions.
- Temperature should not surpass 28°C, particularly, if malaxation time is lengthened.

Factors influencing phenolic content of EVOO

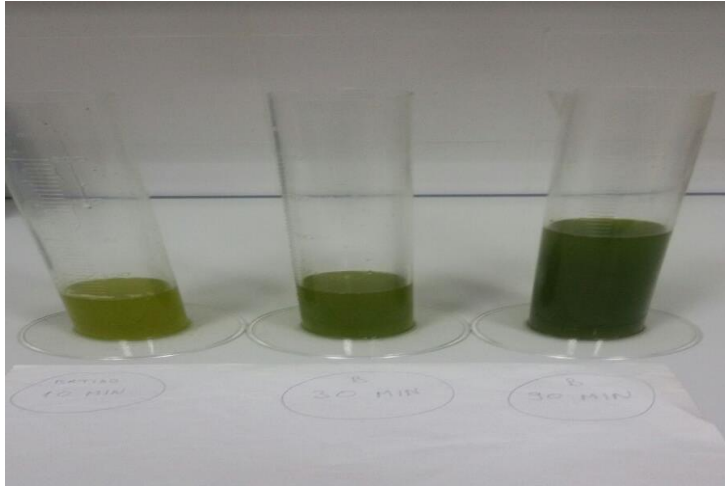
Decalogue for the production of EVOO with high phenolic content

At the mill

9. Relative control of malaxation time.

- Malaxation time is one other parameter that allows regulating the enzymatic activity.
- The general trend is that malaxation time should not surpass 45–60 minutes, although some cultivars should demand for temperatures below 30 minutes.
- Its influence is associated to temperatura achieved during malaxation, which should be controlled in a thermostated system.

Influence of malaxation time

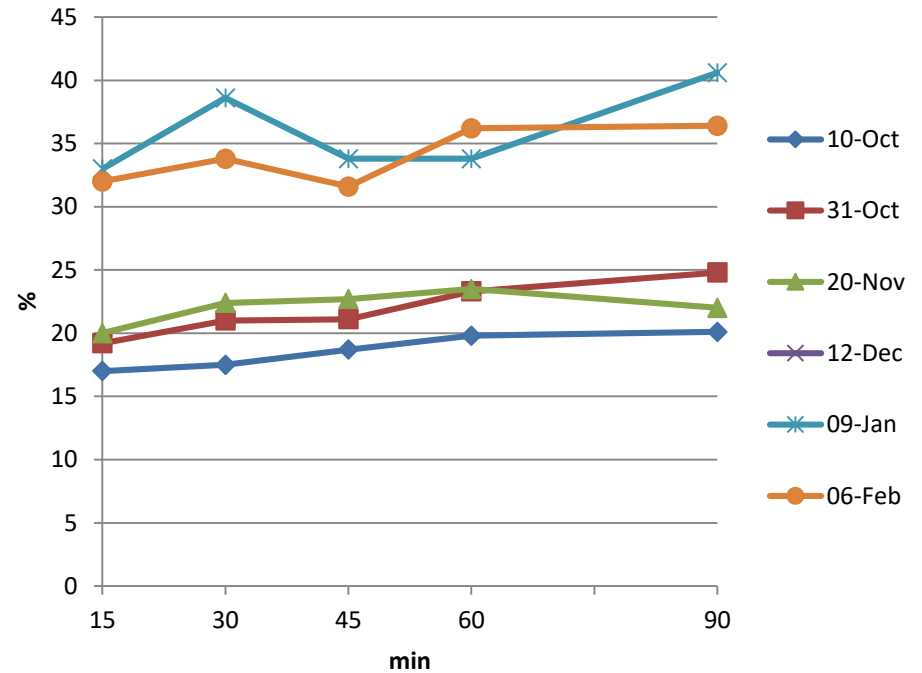


Left: 10 minutes

Middle: 30 minutes

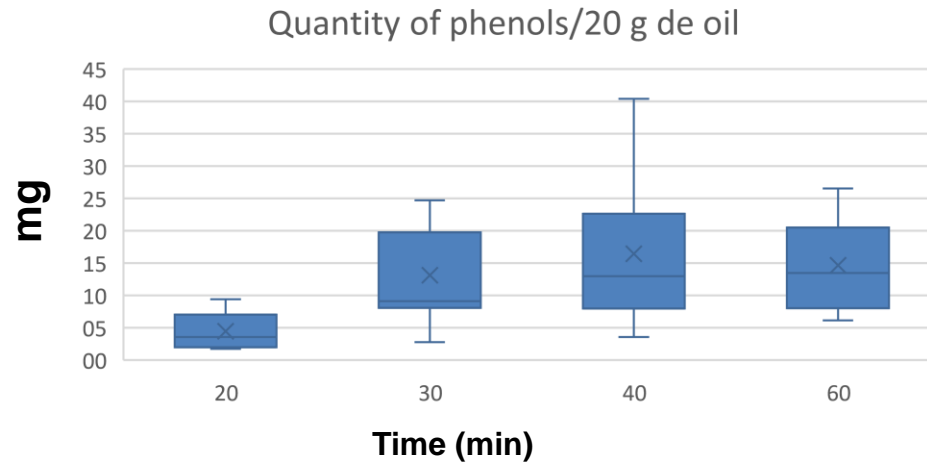
Right: 90 minutes

Oil extraction %

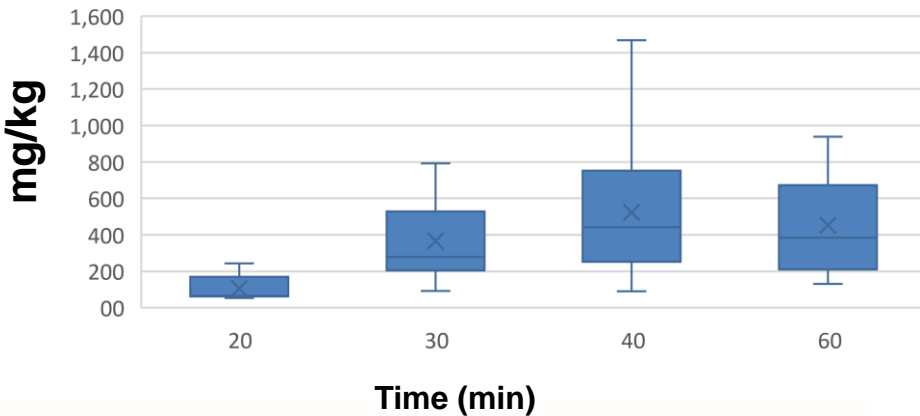


Influence of malaxation time

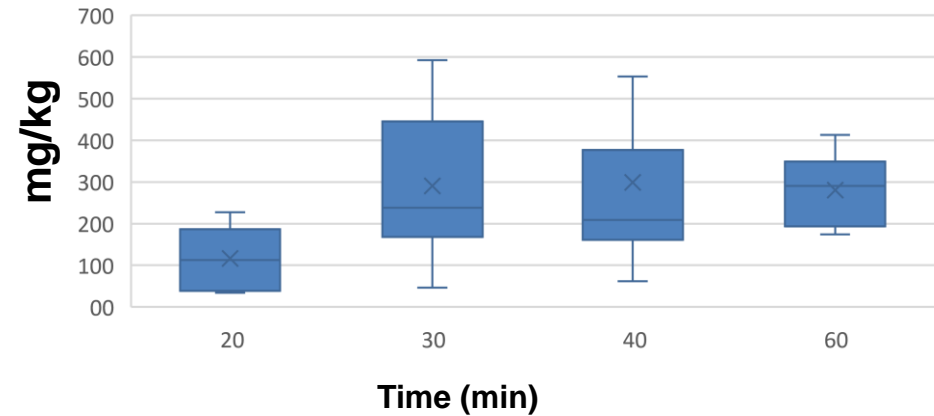
Picual



Hydroxytyrosol derivatives



Tyrosol derivatives



Factors influencing phenolic content of EVOO

Decalogue for the production of EVOO with high phenolic content

Storage & packaging

10. Storage & packaging is a crucial process to guarantee the stability of EVOO.

- **Utilization of opaque packaging made of stainless steel, glass, or any other inert material.**
- **Filtering to improve stability.**
- **Thermostatization and inertization of deposits are recommended practices to maintain the phenolic concentration of EVOO.**

Summary

Cultivars

Any cultivar is able to provide EVOO with high phenolic content

Groves with diversity of cultivars provide balanced EVOOs in phenolic content

Cultivation

Irrigation reduces the stress level and, thus, phenolic content

Avoid pests

EVOO production

Prioritize EVOO production

Fruit quality

Maximum hygienic conditions

Harvesting

Veraison

Minimum time between harvesting and processing (<24 h)

At the olive mill

Two-phase extraction system

Minimum water addition to avoid fractionation

Malaxation temperature 24-28°C

Malaxation time 15-30 min

Storage & packaging

Filtering

Opaque containers made of inert materials

Inertization with inert gases

Stable low temperature (<18°C)