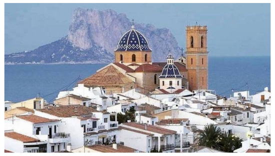
dhc Ángel A. Carbonell Barrachina
Director group Food Quality and Safety
Full Professor
Centro de Investigación e innovación Agroalimentaria y Agroambiental
Universidad Miguel Hernández de Elche
Ctra. de Beniel, km 3,2
03312 Orihuela, Alicante

MIGUEL HERNÁNDEZ UNIVERSITY

- Public University founded in 1996.
- More than 14,500 students.
- Total personnel: 1,632.
- Faculty: 1,063.
- Contracted to projects: 182.
- Administration and services personnel: 387.
- Organized in 4 Campus locations:
  Altea, Elche, Orihuela & Sant Joan d'Alacant.

Miguel Hernandez University of Elche

Four campuses in a privileged Mediterranean Location

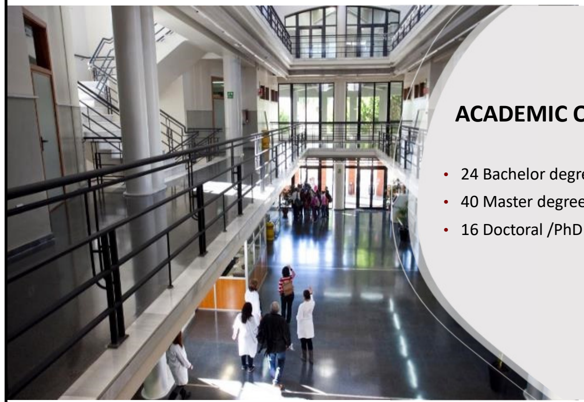


Altea

Elche

Orihuela

San Juan



ACADEMIC OFFERING

- 24 Bachelor degrees.
- 40 Master degrees.
- 16 Doctoral /PhD programs.


CIAGRO
CENTRO DE INVESTIGACIÓN E INNOVACIÓN AGROALIMENTARIA Y AGROAMBIENTAL
UNIVERSITAS
Miguel Hernánde
Image © 2010 European Space Imaging
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Fecha de las imágenes: 3 de Abr. de 2007
38°03'58.94" N 0°58'49.87" O elev. 26 m
Alt. ojo 130 m
Google

FOOD QUALITY AND SAFETY, CSA

FOOD QUALITY

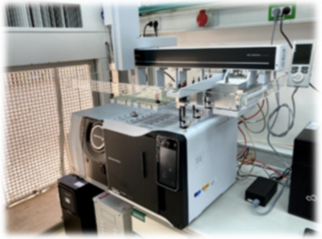
- Effects of **UNIT OPERATIONS (e.g., drying) & FARMING PRACTICES** on **quality** (functionality, consumer, …) of fruits & vegetables:
  1. Pomegranate juice.
  2. Nuts: pistachios, almonds.
  3. **Table olives**, olive oil.
  4. *Turrón/nougat/torrone*.
- Application of **sensory evaluation** of food in the agro-food industry:
  1. Wine and rum.
  2. Chocolate, and confections.
  3. Ice-creams.
  4. Vegetables & fruits (juices).

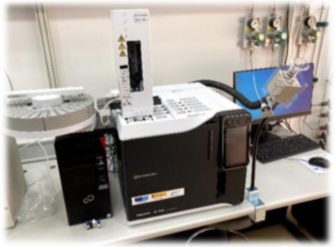
FOOD SAFETY

- Occurrence of **chemical pollutants (arsenic)** in foods:
  1. Vegetables from polluted areas (India).
  2. Infant foods.
  3. Food for celiac consumers.

SensoFood solutions

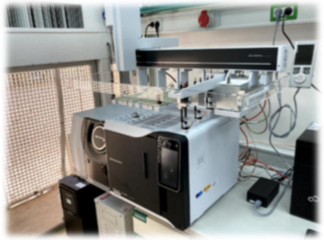
Flavor chemistry laboratory

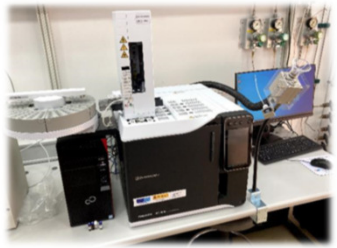




SensoFood
solutions

Flavor chemistry laboratory

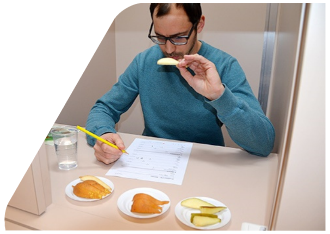




SensoFood
solutions

Sensory analysis center

SensoFood
solutions



WORKING LINES: service to companies and partners

1. PERSONAL INFORMATION

Name and surnames	Ángel Antonio Carbonell Barrachina	
Birth date:	17-03-1967	
Research codes	Researcher ID	J-6592-2012
	Orcid code	0000-0002-7163-2975

2. WORK INFORMATION

University	Universidad Miguel Hernández de Elche	
Center	Departamento Tecnología Agroalimentaria Escuela Politécnica Superior de Orihuela	
Address	Carretera de Beniel, km 3.2. 03312-Orihuela, Alicante (Spain)	
Phone	966749754	e-mail: angel.carbonell@umh.es
Position	Full professor	Starting date: 22/02/2011
UNESCO code	330910, 330913, 330914, 330920, 330991	
Keywords	Food quality, food safety, sensory evaluation, product development	

UNIVERSITAS Miguel Hernández

4. RESEARCH INDEXES

Research periods (*sexenios*): *5 (last one: 2016-2021).*
PhD dissertations supervised: 16.
Cites: 8310 (Scopus), 11485 (Google scholar).
Cites mean/year (last 5 years): 952.
Q1 publications: 135.
h-Index: 49 (Scopus), 57 (Google scholar), 56 (ResearchGate).
i10 index: 205. **RG Score (ResearchGate):** 44.00.

[illegible] VIERNES, 31 DE MARZO DE 2023 — INFORMACIÓN

INF+ LOCAL Elche

Nueva etapa continuista en la UMH

▶La Junta Electoral de la Universidad proclama como rector a Juan José Ruiz, que fue el único candidato que se presentó a las elecciones ▶Ruiz confía en un equipo con solo dos caras nuevas y reestructura algunas de las áreas

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■ La Junta Electoral de la Universidad Miguel Hernández (UMH) de Elche publicó este jueves la proclamación definitiva como rector electo al profesor Juan José Ruiz, tras las elecciones celebradas el 22 y 23 de marzo. Un simple trámite tras haber sido el único candidato que se presentó a los comicios, obteniendo más del 84% de respaldo, una vez ponderados entre los diversos sectores los votos. De los 1.978 votos emitidos, 1.630 fueron a favor y 348 fueron en blanco. Un respaldo suficiente para poder llevar a cabo el programa electoral durante los, más que probables, próximos seis años (con la nueva Ley Orgánica del Sistema Universitario, que entrará en vigor en unos días).

Ruiz mantendrá una línea continuista, con todo lo que le ha funcionado en estos últimos cuatro años, en los que la UMH se ha convertido en una universidad referente en el país, que puede mirar sin complejos a otras de mayor tamaño. Mantendrá casi todo el equipo que le ha acompañado desde 2019. Eso sí, ha decidido reunificar el vicerrectorado de Transferencia e Investigación y recuperar el de Economía y Sociedad.

Entran dos caras nuevas, María Asunción Amorós, que se hará cargo del vicerrectorado de Cultura, Igualdad y Diversidad, y Ángel Carbonell, que estará al frente de Investigación y Transferencia. Un equipo de 12 personas, dos menos que en 2019, con siete hombres y cinco mujeres.

Rector

Juan José Ruiz
Es catedrático de Genética. Ha sido director de la Escuela Politécnica Superior de Orihuela (EPSO) y vicerrector de Infraestructuras. Desde 2019 ocupa el cargo de rector.

Gerencia

Emma Benlloch
Repite como gerente, cargo que ostenta desde 2013. Desde entonces, tanto Jesús Tadeo como Juan José Ruiz han confiado en ella. Esta licenciada en Ciencias Económicas y Empresariales asume la responsabilidad en la gestión del personal de administración y servicios y la materia económica y presupuestaria.

Secretaría General

Mercedes Sánchez
Tampoco habrá cambios en este área. Sánchez seguirá como secretaria general de la UMH. Profesora Titular de Derecho del Trabajo y la Seguridad Social, es experta en temas de igualdad, condiciones de trabajo y resolución de conflictos.

Economía y Sociedad

María José López
Asume este nuevo vicerrectorado, que tendrá un gran peso. Deja Transferencia. Profesora del área de Economía Aplicada, tiene experiencia en la coordinación de proyectos europeos, que también ha dirigido en COEPA. Aplica en la Universidad la gestión que llevó a cabo como edil del Ayuntamiento de Elche.

Planificación y R. Social

Domingo Orozco
Este médico se ocupó del área de Investigación y lo hará los próximos años de Planificación y Responsabilidad Social. Ha sido presidente de la Comisión Nacional de Medicina de Familia, académico de la Real Academia de Medicina de la CV, coordinador del Proyecto Valcronic de telemedicin y gerente de Fisabio.

Estudiantes y coordinación

José Juan López Espín
Este licenciado en matemáticas, ingeniero informático y periodista es una de las manos derechas de Juanjo Ruiz. Dirige el área de Comunicación que transmite al mundo lo que se hace de puertas para adentro en la Universidad. Aunque su investigación se centra en estadística computacional y en la búsqueda de modelos matemáticos aplicados en medicina, le gusta gestionar e innovar, y ha promovido proyectos como UMH Sapiens, la televisión universitaria o nuevas becas.

Profesorado

José Carlos Espigares
Este profesor de Ciencia Jurídica con tres sexenios de investigación es quien se ocupará, de nuevo, de la parte docente. Licenciado en Derecho por la Universidad de Granada y Doctor Europeo en Derecho por la Universidad de Bolonia tiene varios premios de investigación.

Cultura, Igualdad y Diversidad

María Asunción Amorós
Uno de los nuevos fichajes. Se hará cargo del vicerrectorado de Cultura, Igualdad y Diversidad. Esta catedrática de Biología Aplicada es miembro del Centro de Investigación e Innovación Agroalimentaria y Agroambiental. Fue vicerrectora de Ordenación Académica y Coordinación y Programación.

Infraestructuras

Pedro Vicente
Tiene el reto de culminar las obras en marcha de los nuevos edificios de la Universidad. Este ingeniero industrial es miembro del Instituto Universitario de Investigación en Ingeniería y ha realizado proyectos científicos en el Plan Nacional de I+D. Es especialista en eficiencia energética y energías renovables.

Estudios

Susana Fernández de Ávila
Tras pasar por IBM se incorporó a la UMH en su nacimiento, en 2007. Esta catedrática de Electrónica y doctora en Ciencias Físicas repite al frente de este vicerrectorado.

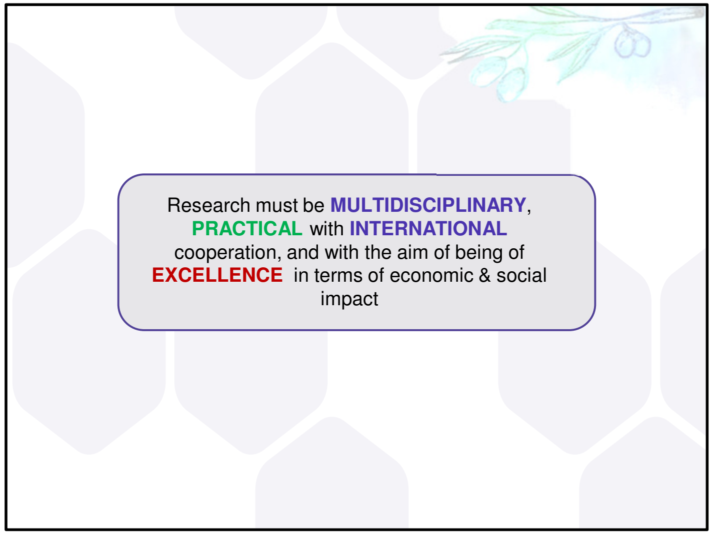
Investigación y Transferencia

Ángel Carbonell
La otra cara nueva del proyecto de Ruiz. Asume una cartera dividida en dos hasta ahora. Este doctor en Química y catedrático de Tecnología de Alimentos, es investigador del Ciagro-UMH. Coautor de más de 350 artículos científicos en revistas internacionales y fue director general de Ciencia e Investigación de la Generalitat de 2020 a 2022.

Cooperación

Vicente Micol
Es coautor de más de doscientos artículos científicos en revistas internacionales. Este catedrático de Bioquímica y Biología Molecular e investigador del IDiBE tiene dos premios nacionales de investigación.

▶ EQUIPO RECTORAL. 1 Ángel Carbonell. 2 Vicente Micol. 3 Susana Fernández de Ávila. 4 Mercedes Sánchez. 5 Juan José Ruiz. 6 Domingo Orozco. 7 María Asunción Amorós. 8 José Juan López Espín. 9 Emma Benlloch. 10 Pedro Vicente Quiles. 11 José Carlos Espigares. 12 María José López.



In my modest opinion, …

This concept is reflected in my CV and history. As you can see in this slide, I have written and published international manuscripts with more than 500 researchers, …

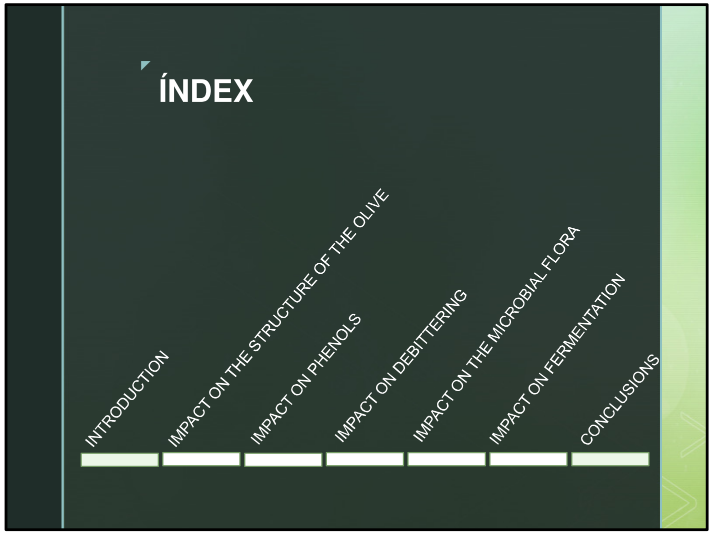
… Multi-center

IF YOU WANT TO GO FAST GO ALONE
IF YOU WANT TO GO FAR GO TOGETHER

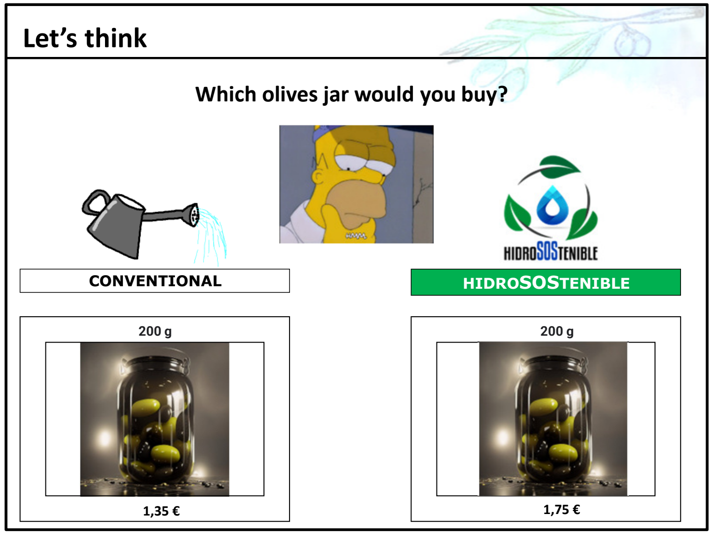
42 RESEARCH CENTERS/UNIVERSITIES

… from 42 centers

and 32 countries,



Let’s start with the introduction

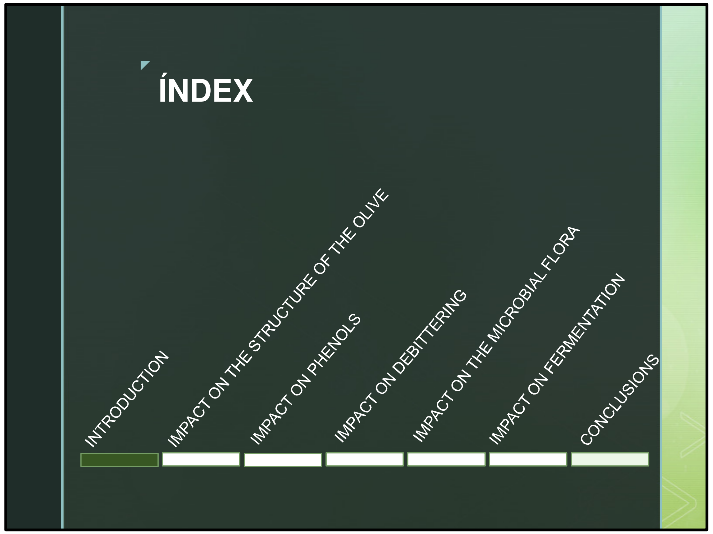


Before I start even with the Introduction section, I would like you to share with you an idea. Imagine you go to the supermarket and you have these two options for table olive:

1. You have this jar of 200 g of olives cultivated under "conventional" conditions and it cost you 1,35 euros.

2. Besides, you have a second option. This jar of 200 g of olives cultivated with a "lower amount of irrigation water", the quality is similar but it cost you 1,75 euros.

Which jar would you take home? … **Why?** Please, just think about it and we will answer these two questions at the end of the presentation.



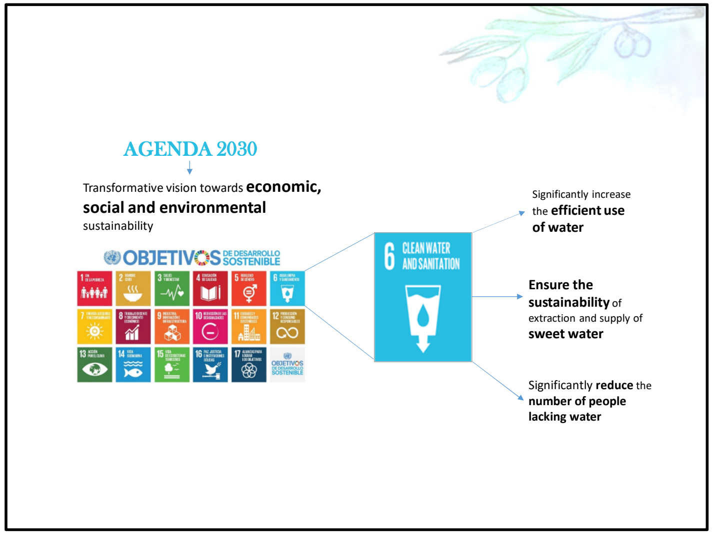
Let’s start with the introduction

Do we need to make an efficient use of irrigation water?

Is it compulsory??

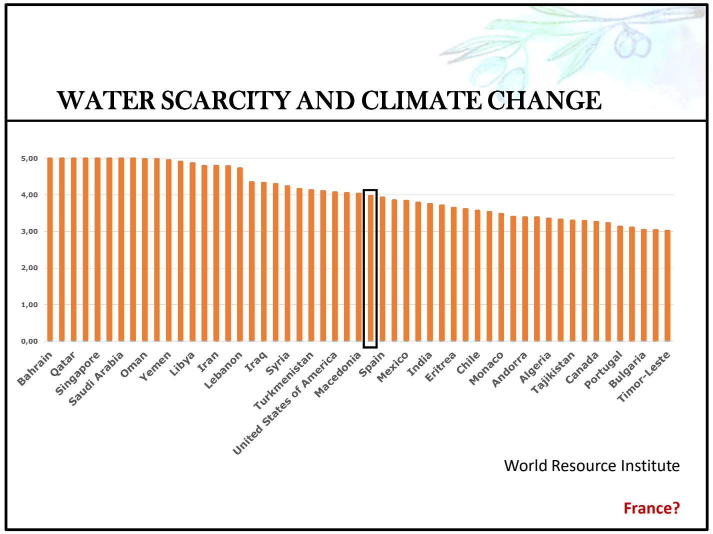
WATER SCARCITY AND CLIMATE CHANGE

"if we don't change our habits now, global demand of water could increase 50 % by 2030"

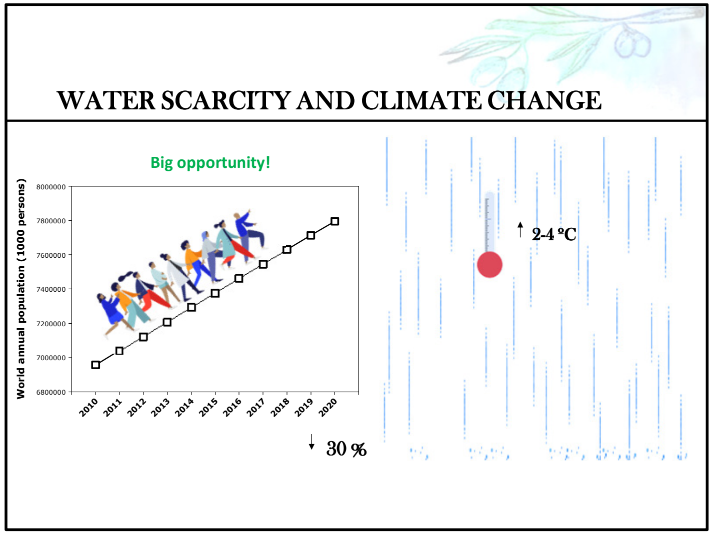


Then, the United Nations launches us in 2015 The 2030 Agenda for Sustainable Development that establishes a transformative vision towards economic, social and environmental sustainability until the year 2030.
By 2030, significantly increase the efficient use of water resources in all sectors and ensure the sustainability of freshwater extraction and supply to address water scarcity and significantly reduce the number of people suffering from lack of access water. https://www.fao.org/sustainable-development-goals/indicators/641/es/

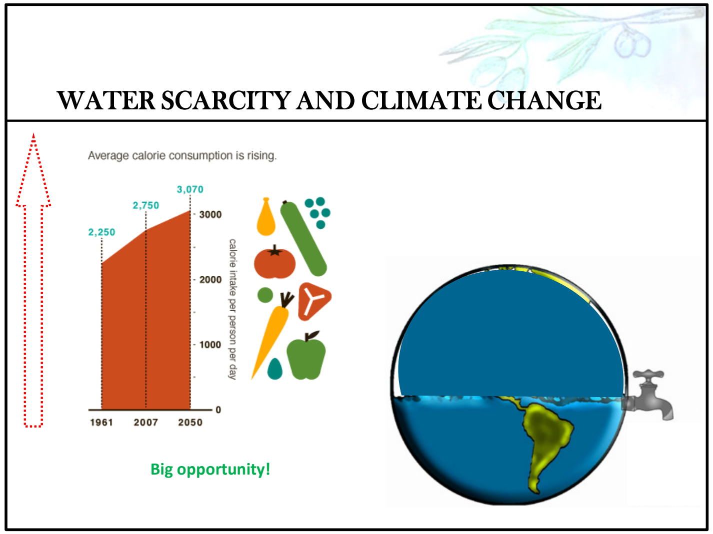
Luego, las Naciones Unidas nos lanza en 2015 La Agenda 2030 para el Desarrollo Sostenible que establece una visión transformadora hacia la sostenibilidad económica, social y ambiental hasta el año 2030.
De aquí a 2030, aumentar considerablemente el uso eficiente de los recursos hídricos en todos los sectores y asegurar la sostenibilidad de la extracción y el abastecimiento de agua dulce para hacer frente a la escasez de agua y reducir considerablemente el número de personas que sufren falta de agua. https://www.fao.org/sustainable-development-goals/indicators/641/es/



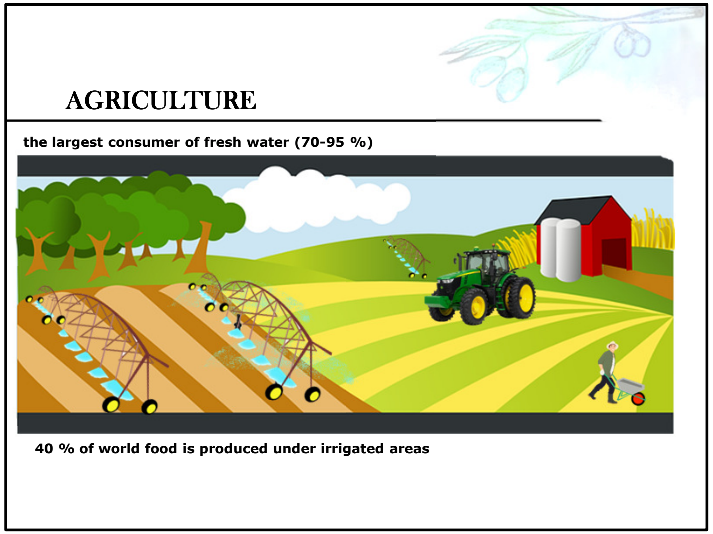
According to World Resource Institute water scarcity affects every continent and this graphic represents the most affected countries. As we can observe, Spain is one of these affected countries. France fortunately is not included here, but … desertification is going north and all countries must be aware of this enormous problem.



And the situation is not getting better, but worst,
-due to the **global population growth** and
-the **climate change** which involves an **increase in average air temperature**
-and a **decrease of precipita**tions.



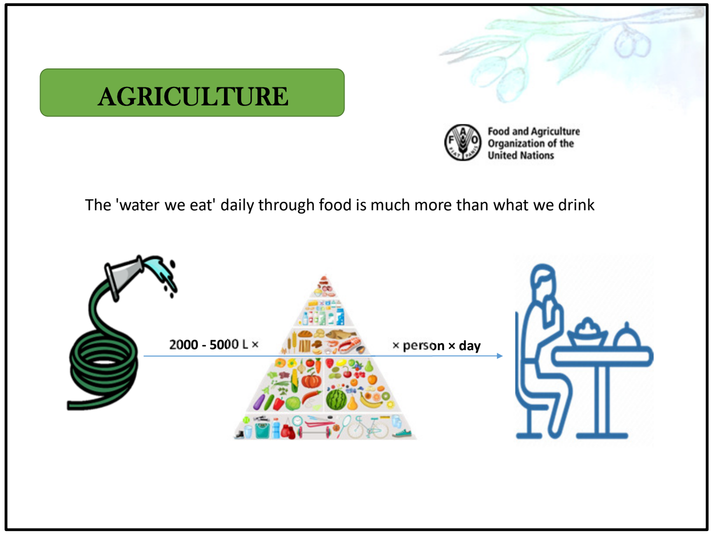
As a result,
-world food demand will rise
-and unfortunately, water, which is the basis for our food production, it is currently under heavy restrictions.



All these aspects guided us to the other reason to develop this research which is the **Agriculture**.

-This sector is the largest consumer of fresh water by far (70-95 %)

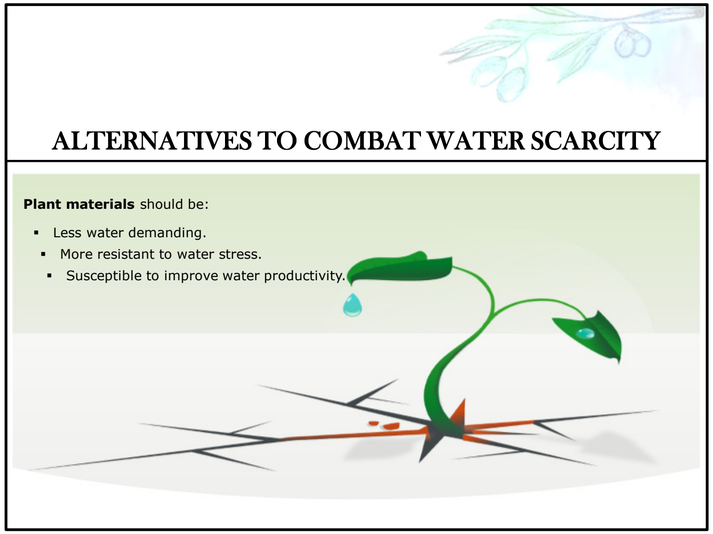
-because more than 40 % of world food is produced under irrigated areas.



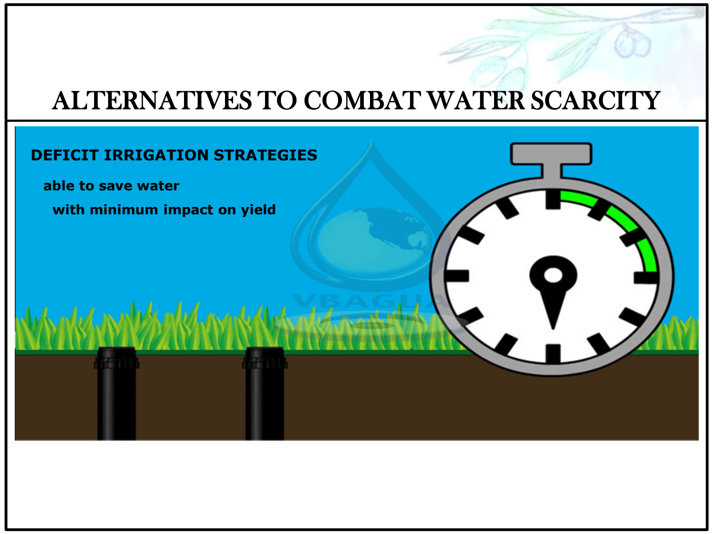
Did you know that, depending on the diet, we need from 2,000 to 5,000 liters of water to produce the food a person consumes daily?
Evidence suggests that two-thirds of the world's population could be living in water-scarce countries by 2025 if current consumption patterns continue.
To achieve a #ZeroHunger world by 2030, we must act now.

https://www.fao.org/fao-stories/article/en/c/1185405/

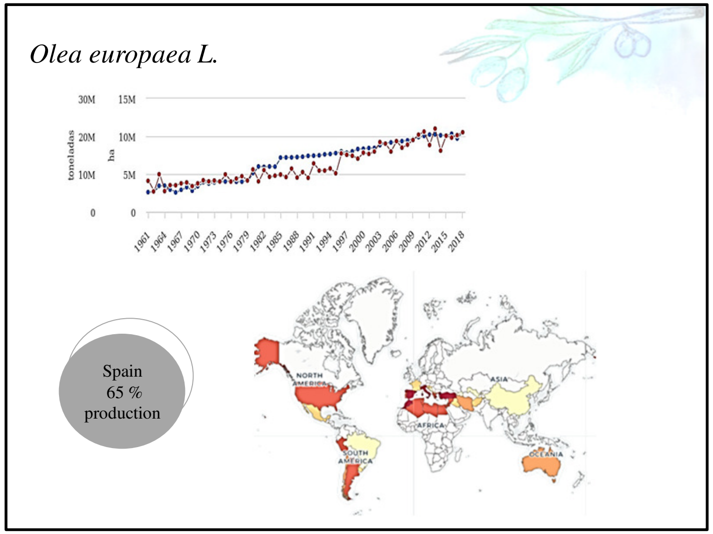
So, how can we do an efficient use of water?



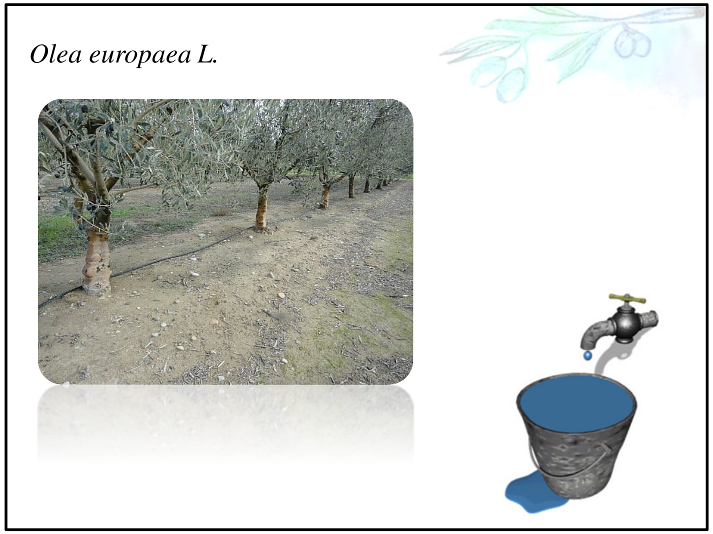
So, what agriculture can do to save water? We propose two alternatives,
-first of them is the **plant material** which should be
-less water demanding,
-more resistant to water stress and
-susceptible to improve the water productivity.



And the second alternative is **the use of deficit irrigation strategies** which can save water, with minimum impact on yield.

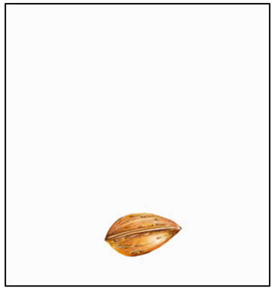


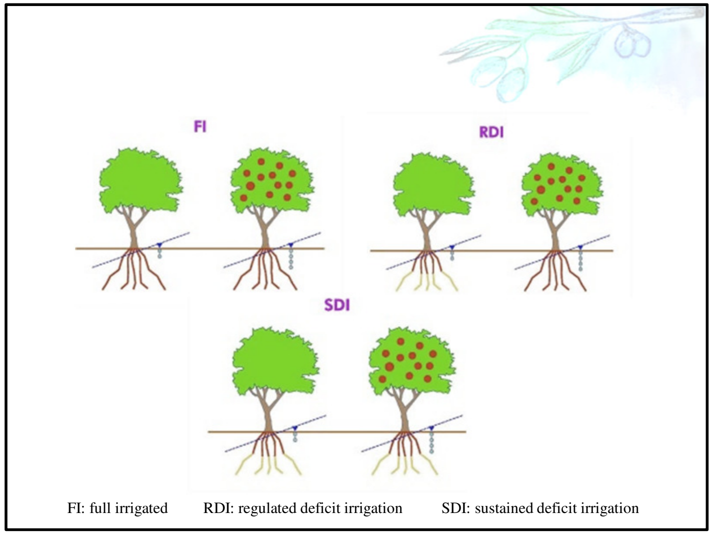
Due to this increase in population and demand, the olive tree has experienced an exponential increase in recent decades to supply market consumption, with Spain being the main producer in the world with a production of 9.8 million tons, followed by Italy, Morocco and Turkey.



2nd largest irrigated crop in Spain

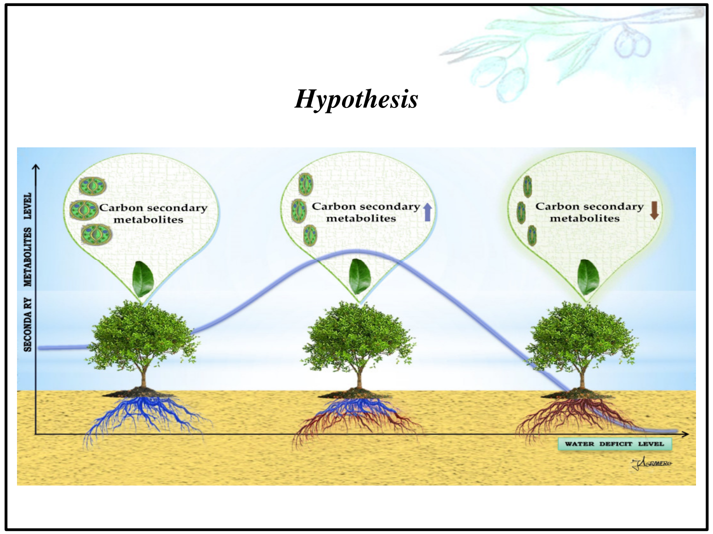
EXPECTED BENEFITS





For all these reasons, we think that the use of deficit irrigation strategies is a good option to save water with minimal losses in production. For example, Controlled Deficit Irrigation is a strategy that is based on the reduction of irrigation water in those phenological periods in which it is known that trees are more resistant to stress. While Sustained Deficit Irrigation consists of irrigating the entire cycle below the demand of the crop but using a frequency of contributions high enough to achieve uniform stress.

But, … let’s be carefully because …



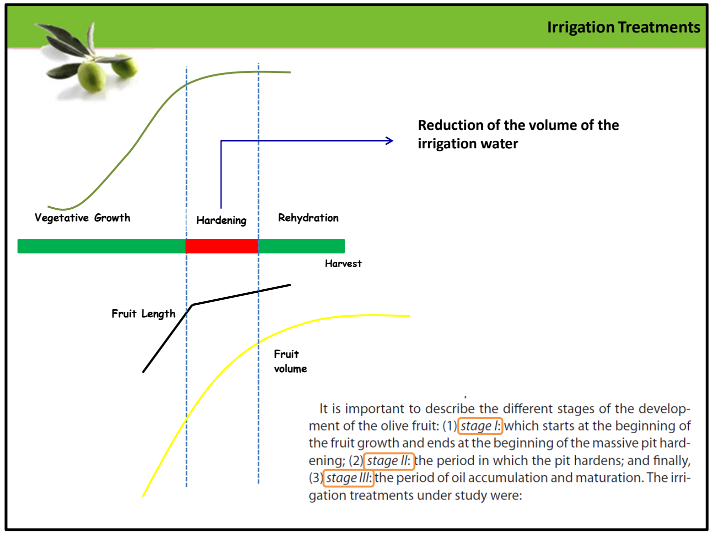
The hypothesis of all these studies is that the increase in the quality of table olives from olive trees that have been subjected to moderate deficit irrigation can be dangerous if the conditions are taken to the limit…

The University of Seville has carried out deficit irrigation strategies in various crops, which are almond, pistachio and pomegranate.

The quality of the fruits of these crops have been evaluated by the Miguel Hernández University, finding that, in general terms, with a MODERATE DEFICIENCY IRRIGATION, the total PUFA content increases, the intensity of some sensory attributes increases, and the acceptance by of consumers. From the union of these two concepts, the HidroSOStenible brand was born

Now, I Will explain all these sections using the Results generated by one of the PhD dissertations conducted within our research team, Dr. Lucía Sánchez

Table Olives



The olive development consists of three periods:

(i) **stage I**: it starts at the beginning of the fruit growth ending at the beginning of massive pit hardening;

(ii) **stage II**: period in which pit hardens; and finally,

(iii) **stage III**: period of oil accumulation and maturation.

Irrigation Treatments

- *Control* (*T0*): Irrigation was applied to supply the estimated crop evapo-transpiration (ETc); this means that a full replenishing of all the extracted soil water was conducted by addition of irrigation water.
- *RDI-1* (*T1, soft stress*): (1) Olive trees were under low water deficit conditions; in this way, trees were only irrigated when the TGR (trunk growth rate) was lower than 10 μm day^{-1} (this is half the value found in trees under fully irrigated conditions); (2) the same conditions as in stage I; and (3) finally at stage III, enough water was applied to reach a water status similar to that of T0 trees.
- *RDI-2* (*T2, moderate stress*): (1) During stage I, olive trees were under low water deficit conditions; trees were only irrigated when the TGR was lower than 10 μm day^{-1}; (2) trees were not irrigated during stage II; and (3) finally at stage III, enough water was applied to reach a water status similar to that of T0 trees.

Irrigation Treatments

Table 1
Irrigation and tree parameters [applied water (AW, mm), yield (t ha^{-1}), and trunk growth rate (TGR, μm day^{-1})] of '*Manzanilla*' olive trees as affected by regulated deficit irrigation treatments.

Irrigation parameter	Stage I	Stage II	Stage III	Total	Pooled std. deviation
ETc (mm)	248 a[a]	186 b	92 c	526	47
Irrigation treatment					
Parameter/Stage	T0	T1	T2	Pooled std. deviation	
AW (mm)					
Stage 1	229 a	128 b	111 b	17	
Stage 2	214 a	6 b	5 b	15	
Stage 3	97 a	37 b	45 b	21	
TGR (μm day^{-1})					
Stage 1	−2.10 a	−2.60 a	−6.30 a	4.4	
Stage 2	3.34 a	−14.80 b	−20.70 b	6.1	
Stage 3	6.07 b	31.52 a	28.21 a	14.8	
Yield (t ha^{-1})	6.6 a	5.0 a	5.9 a	2.4	

Control (T0): Irrigation to supply the **estimated crop evapotranspiration (ETc)**, i.e., based on fully replenishing all the extracted soil water.

RDI-1 (T1): (i) stage I, trees irrigated under non-limited conditions; (ii) stage II, trees under moderate water deficit conditions, they were no irrigated during this period; and, (iii) stage III,
water applied in order to provide a water status similar to T0 treatment.

RDI-2 (T2): (i) stage I, trees under low water deficit conditions. Trees were irrigated only when TGR was lower than 10 mm day1; this is half of the TGR in fully irrigated conditions (ii) stage II, trees under moderate water deficit conditions, they were no irrigated during this period; and, (iii) stage III, water applied in order to provide a water status similar to T0 treatment.

01 Manzanilla olive

The Manzanilla olive is grown mainly in the province of Seville, in southern Spain. It is one of the varieties most appreciated for its flavor and excellent quality as a table olive, both for the "Spanish" or "Sevillian" style green dressing and for its preparation in black.

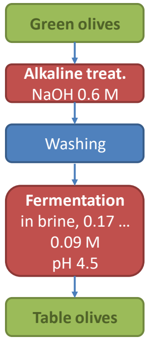
01 Whole

Olives can be tasted in numerous ways and in various formats. This versatility not only depends on the olive varieties and uses in the kitchen, but also on the way they are prepared in the production phase.

Olives processing

2.2. Sample processing

All '*Manzanilla*' olives from the three RDI treatments were completely hand-harvested at their mature-green stage in mid-September. The fruit of all trees for each of the three RDI treatments were systematically mixed and a sample of around 45 kg per treatment was used in the industrial processing. Fruits were transported next day to *Cooperativa Nuestra Señora de las Virtudes* (La Puebla de Cazalla, Seville, Spain), to be processed as table olives according to the Spanish style method. This delay between harvest and processing (1 day) is common in order to prevent the skin from sloughing or bursting during alkaline treatment (IOOC, 1990). Initially, raw olives were treated with a solution of NaOH (0.6 mol L^{-1}) until the lye penetrates three quarters through the flesh to remove oleuropein and increase the permeability of the fruits. Later, olives were washed with water to remove completely the NaOH residues. Finally, the fermentation was carried out for 4 months using different concentration of brine; it started with 0.17 mol L^{-1} NaCl and ended with 0.09 mol L^{-1}; the pH used was 4.5.



Weight, Size & Color

Table 2
Morphological parameters, CIE$L^*a^*b^*$ coordinates, and texture parameters of '*Manzanilla*' table olives as affected by regulated deficit irrigation treatments.

Parameter[a]	ANOVA[b]	T0	T1	T2	Pooled std. deviation
Fruit weight (g)	***	4.43 b[c]	4.60 a	4.30 b	0.13
Longitudinal diameter (mm)	***	2.3 a	2.1 b	2.0 b	0.1
Equatorial diameter (mm)	***	1.9 b	2.1 a	1.7 c	0.1
L^*	***	51.51 b	54.62 ab	56.14 a	1.93
a^*	NS	−1.94	−1.82	−1.87	0.57
b^*	***	28.61 b	31.87 b	38.39 a	3.16
Dry matter content (g dw kg^{-1} fw)	***	268 c	284 b	369 a	17
Puncture test, PT (N)	***	0.506 b	0.651 a	0.473 b	0.078
Magness–Taylor test, MTT (N)	**	6.533 a	5.401 b	5.135 b	0.871

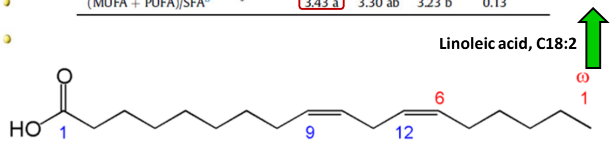
- A slight reduction in the irrigation water (**T1**) increased the **weight** of the olives.
- This weight increase was mainly due to an increase in the **equatorial diameter**.
- The less water, the **yellowness** is intensified while the greenness is constant.

Fatty Acids

Table 3
Oil content (g kg^{-1} dry weight, dw) and fatty acids profiles (% of total area) of '*Manzanillo*' table olives as affected by regulated deficit irrigation treatments.

Parameter	ANOVA[a]	T0	T1	T2	Pooled std. deviation
Oil content (g kg^{-1} dw)	**	278 b[c]	341 a	273 b	51
C16:1	*	2.7 a	1.9 b	2.3 a	0.3
C16:0	NS	16.3	17.8	17.5	2.0
C18:2	***	4.9 b	7.4 a	5.4 b	1.6
C18:1	*	69.3 a	67.1 b	68.1 ab	1.4
C18:0	NS	5.2	4.9	5.2	0.5
C20:1	NS	0.6	0.3	0.5	0.4
C20:0	NS	1.0	0.6	1.0	0.4
SFA[b]	NS	22.6	23.3	23.6	1.1
MUFA[b]	*	72.6 a	69.3 b	70.9 ab	2.1
PUFA[b]	**	4.9 b	7.4 a	5.4 ab	1.6
(MUFA + PUFA)/SFA[b]	*	3.43 a	3.30 ab	3.23 b	0.13

Linoleic acid, C18:2



Volatile Compounds

	Compound	Control	T1 Area (%)	T2	
1	Ethanol	4.04	3.70	7.14	
2	Dimethylsulfide	3.50	7.35	9.17	→
3	Acetic acid	9.59	11.70	15.90	→
4	Heptane	4.30	7.63	5.06	
5	Propionic acid	0.28	0.46	0.60	→
6	Ethyl propanoate	0.11	0.19	0.17	
7	Propyl acetate	0.09	0.34	0.14	
8	Octane	3.25	4.63	5.73	→
9	2-Methylbutanoic acid	0.32	0.43	0.40	
10	Furfural	0.85	0.70	0.15	←
11	*cis*-3-Hexenol	5.99	2.33	4.76	
12	1-Hexanol	0.82	0.83	0.52	
13	*cis*-2-Heptenal	0.24	0.13	0.25	
14	Hexanoic acid	0.95	0.68	0.91	
15	Benzaldehyde	7.71	0.57	0.48	←
16	6-Methyl-5-hepten-2-one	0.18	0.29	0.41	→
17	β-Pinene	0.10	0.13	0.25	→
18	Octanal	0.43	0.39	0.31	
19	Hexyl acetate	0.27	0.23	0.33	
20	*p*-Cymene	0.14	0.19	0.10	

	Compound	Control	T1 Area (%)	T2	
21	Limonene	3.94	2.45	3.50	
22	*trans*-β-Ocimene	0.28	0.05	0.09	
23	Phenylacetaldehyde	0.30	0.46	0.36	
24	1-Octanol	2.64	0.67	1.73	
25	γ-Terpinene	0.46	1.86	0.34	
26	Guaiacol=2-Methoxy-phenol	2.53	1.71	0.47	←
27	Undecane	0.62	1.05	0.06	
28	Linalool	0.23	0.19	0.50	
29	Nonanal	1.62	1.77	1.71	
30	4,8-Dimethyl-1,3,7-Nonatriene	3.97	6.35	5.97	→
31	Phenethyl alcohol	1.75	0.82	2.33	
32	4-Ethylphenol	1.09	0.63	0.28	←
33	Ethyl octanoate	0.66	1.17	0.72	
34	1,4-Dimethoxy-benzene	7.97	6.25	8.07	
35	Tetrahydrogeraniol	8.58	13.72	6.61	
36	α-Citronellol	0.82	0.51	0.57	
37	Bornylene	0.41	0.20	0.55	
38	2-Decenal	9.97	11.76	6.20	
39	5-Hydroxymethylfurfural	0.72	0.99	1.13	
40	2-Decenal	0.54	1.58	0.48	
41	Tridecane	1.49	0.12	4.91	
42	Anethole	6.25	2.83	0.69	←

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28	Linalool	0.23	0.19	0.50	
29	Nonanal	1.62	1.77	1.71	
30	4,8-Dimethyl-1,3,7-Nonatriene	3.97	6.35	5.97	→
31	Phenethyl alcohol	1.75	0.82	2.33	
32	4-Ethylphenol	1.09	0.63	0.28	←
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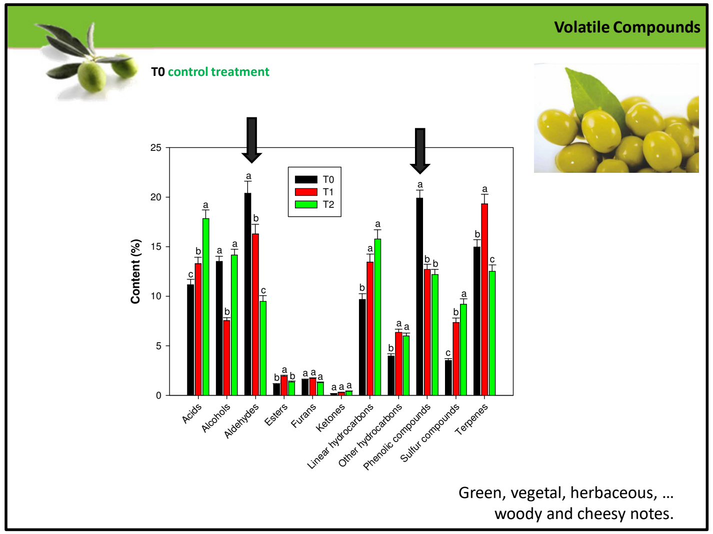
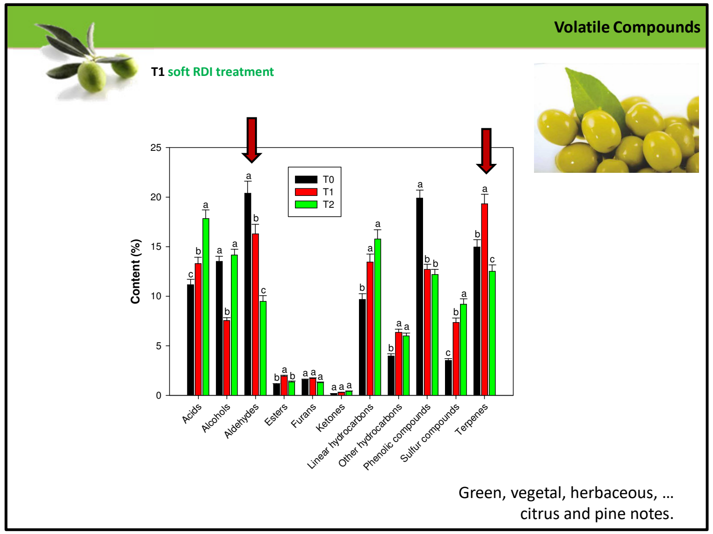


In general, **alcohols** (high in T0 and T2) are associated with **fruity** and candy flavor notes, **aldehydes** (highest in T0) with **green, vegetable and herbaceous notes**,

terpenes (highest in T1) with citrus and pine notes,

organic acids (highest in T2) with herbaceous and vinegar notes, and **phenolic compounds** with green, woody, and cheesy notes



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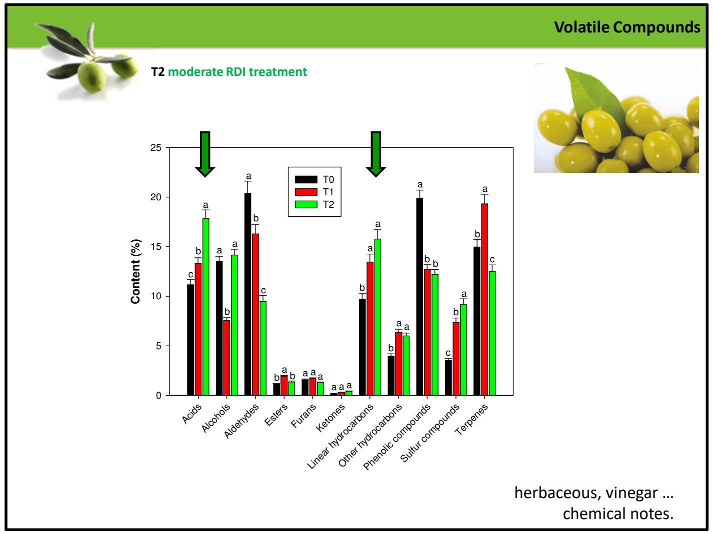

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organic acids (highest in T2) with **herbaceous** and vinegar notes, and **phenolic compounds** with **green, woody**, and cheesy notes.

Texture

PUNCTURE test

Treatment	Force (N)		Statistics
Control	**0.506**	*0.024*	b
T1	**0.651**	*0.034*	a
T2	**0.473**	*0.021*	b
			***
			(Tukey)

- This test is related to the **hardness** of the olive **skin/peel**.
- A slight reduction in the irrigation water results in a significant **increase of the skin hardness**.

MAGNESS-TAYLOR test

Treatment	Force (N)		Statistics
Control	**6.533**	*0.348*	a
T1	**5.401**	*0.253*	b
T2	**5.135**	*0.314*	b
			**
			(Tukey)

- This test is related to the **hardness** of the olive **pulp**.
- A reduction in the irrigation water results in significant **decreases of the pulp hardness**.

Descriptive Sensory

T1 soft-RDI treatment

Sample	FLAVOR					
	Salty	Bitter	Sour	Sweet	Green-Olive	Aftertaste
ANOVA	*	**	NS	**	**	***
T0	5.8 ab	4.8 b	1.6	1.9 b	6.8 a	6.5 b
T1	**6.9 a**	**6.8 a**	2.3	1.9 b	**7.1 a**	**7.9 a**
T2	5.5 b	4.4 b	2.7	**2.9 a**	5.7 b	6.1 b

- **T1** samples have the most intense **salty, bitter, green olive notes and aftertaste.**

Sample	TEXTURE			
	Hardness	Crunchiness	Fibrousness	Separation pulp-stone
ANOVA	**	NS	NS	*
T0	6.3 b	6.5	0	**7.9 a**
T1	**7.8 a**	6.0	0.1	6.9 b
T2	6.0 b	5.4	0.1	6.9 b

- **T1** samples are the hardest, agreeing with results from the puncture test, while the control samples have easy to remove stones.

Affective Test

T1 soft-RDI treatment

Satisfaction degree

Sample	Color	Flavor	Bitter	Salty	Hardness	Crunchiness	Aftertaste
ANOVA	**NS**	*****	**NS**	**NS**	**NS**	*****	**NS**
T0	6.1	**6.3 ab**	6.1	6.0	6.5	**6.2 ab**	6.5
T1	6.7	**6.9 a**	**6.7**	**6.7**	**6.8**	**6.9 a**	6.3
T2	6.2	**5.8 b**	5.9	6.1	6.3	**6.0 b**	5.8

- Consumers were, in general, very satisfied by the attributes of the **T1** samples. This satisfaction for specific attributes was reflected in the highest **GLOBAL satisfaction degree**:

  - T0 = 6.5 ab
  - **T1 = 6.9 a**
  - T2 = 6.0 b

Like it extremely
Like it very much
Like it moderately
Like it slightly
Neither like it nor dislike it
Dislike it slightly
Dislike it moderately
Dislike it very much
Dislike it extremely

Table olive grown under SOFT water stress, RDI-T1:

- Fruits: had highest weight,
- had intermediate yellow color,
- had the highest content of linoleic acid,
- highest skin hardness and intermediate pulp firmness,
- descriptive sensory: had the highest intensities of saltiness, bitterness, green olive note and aftertaste, and hardness, and
- consumers: had the highest satisfaction degree of flavor, bitterness, saltiness, hardness, crunchiness and global satisfaction degree.

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Quality attributes of table olives as affected by regulated deficit irrigation

M. Cano-Lamadrid [a], I.F. Girón [b, c], R. Pleite [d], F. Burló [a], M. Corell [c, e], A. Moriana [c, e], A.A. Carbonell-Barrachina [a, *]

[a] Universidad Miguel Hernández de Elche (UMH), Department of Agro-Food Technology, Ctra. Beniel, km 3.2, 03312, Orihuela, Alicante, Spain
[b] Instituto de Recursos Naturales y Agrobiología (CSIC), P.O. Box 1052, E-41080, Sevilla, Spain
[c] Unidad Asociada al CSIC de Uso sostenible del suelo y el agua en la agricultura (US-IRNAS), Carretera de Utrera, km 1, 41013, Sevilla, Spain
[d] Global Olive Consulting, 7 Contador Street, 41530, Morón de la Frontera, Sevilla, Spain
[e] Departamento de Ciencias Agroforestales, ETSIA, Universidad de Sevilla, Carretera de Utrera, km 1, 41013, Sevilla, Spain

Descriptive Sensory

Next year, **2014**

Research Article

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Antioxidant capacity, fatty acids profile, and descriptive sensory analysis of table olives as affected by deficit irrigation

Marina Cano-Lamadrid,[a*] Francisca Hernández,[b] Mireia Corell,[c,d] Francisco Burló,[a] Pilar Legua,[b] Alfonso Moriana[c,d] and Ángel A Carbonell-Barrachina[a]

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Irrigation Treatments

- *Control* (*T0*): Irrigation was applied to supply the estimated crop evapo-transpiration (ETc); this means that a full replenishing of all the extracted soil water was conducted by addition of irrigation water.
- *RDI-1* (*T1, soft stress*): (1) Olive trees were under low water deficit conditions; in this way, trees were only irrigated when the TGR (trunk growth rate) was lower than 10 μm day^{-1} (this is half the value found in trees under fully irrigated conditions); (2) the same conditions as in stage I; and (3) finally at stage III, enough water was applied to reach a water status similar to that of T0 trees.
- *RDI-2* (*T2, moderate stress*): (1) During stage I, olive trees were under low water deficit conditions; trees were only irrigated when the TGR was lower than 10 μm day^{-1}; (2) trees were not irrigated during stage II; and (3) finally at stage III, enough water was applied to reach a water status similar to that of T0 trees.

Irrigation Treatments

Table 1. Irrigation and tree parameters [applied water (AW, mm), yield (t ha^{-1}), and trunk growth rate (TGR, µm day^{-1})] of 'Manzanilla' olive trees as affected by regulated deficit irrigation treatment

	Stage		
Irrigation parameter	I	II	III
ETc (mm)	308^{a}	181^{b}	70^{c}
	Irrigation treatment		
Parameter and stage	T0	T1	T2
AW (mm)			
Stage I	108^{a}	72^{b}	62^{b}
Stage II	193^{a}	89^{b}	0^{c}
Stage II	68^{a}	46^{b}	44^{b}
TGR (µm day^{-1})			
Stage I	15.1^{b}	19.0^{a}	6.2^{c}
Stage II	1.6^{b}	4.7^{a}	−5.9^{c}
Stage II	3.8^{c}	7.4^{b}	9.8^{a}
Yield (t ha^{-1})	9.0^{a}	8.2^{a}	6.7^{b}

Values (mean of six replications) followed by the same letter, within the same row, were not significantly different ($P < 0.05$), according to Tukey's least significant difference test.

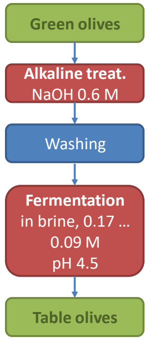
Control (T0): No stress.

RDI-1 (T1): SOFT stress.

RDI-2 (T2): MODERATE stress.

2.2. Sample processing

All '*Manzanilla*' olives from the three RDI treatments were completely hand-harvested at their mature-green stage in mid-September. The fruit of all trees for each of the three RDI treatments were systematically mixed and a sample of around 45 kg per treatment was used in the industrial processing. Fruits were transported next day to *Cooperativa Nuestra Señora de las Virtudes* (La Puebla de Cazalla, Seville, Spain), to be processed as table olives according to the Spanish style method. This delay between harvest and processing (1 day) is common in order to prevent the skin from sloughing or bursting during alkaline treatment (IOOC, 1990). Initially, raw olives were treated with a solution of NaOH (0.6 mol L^{-1}) until the lye penetrates three quarters through the flesh to remove oleuropein and increase the permeability of the fruits. Later, olives were washed with water to remove completely the NaOH residues. Finally, the fermentation was carried out for 4 months using different concentration of brine; it started with 0.17 mol L^{-1} NaCl and ended with 0.09 mol L^{-1}; the pH used was 4.5.



Weight, Size & Color

Table 2. Morphological parameters and CIE L^* a^* b^* coordinates of 'Manzanilla' table olives as affected by deficit irrigation treatment

Parameter	ANOVA	T0	T1	T2
Fruit weight (g)	***	4.20^{ab}	4.01^{b}	4.35^{a}
Longitudinal diameter (mm)	NS	20.3	19.3	20.3
Equatorial diameter (mm)	NS	16.6	16.9	17.5
L^*	*	50.8^{ab}	50.1^{b}	52.0^{a}
a^*	**	-1.75^{a}	-1.91^{ab}	-2.17^{b}
b^*	NS	26.4	24.9	26.4
DMC (g DW kg^{-1} FW)	***	248^{c}	359^{a}	331^{b}

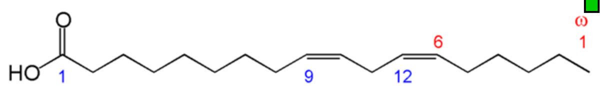
The number of replications for the analysis of weight, size, instrumental colour, oil content, and dry matter content (DMC) were 100, 100, 75, 3 and 5, respectively.
NS, not significant at $P < 0.05$; *, **, and ***, significant at $P < 0.05$, 0.01, and 0.001, respectively.
Values followed by the same letter, within the same row, were not significantly different ($P < 0.05$), according to Tukey's least significant difference test.

- A slight reduction in the irrigation water (**T1**) increased the **weight** of the olives.
- This weight increase was mainly due to an increase in the **equatorial diameter**.

Table 3. Oil content (g kg^{-1} DW) and fatty acids (% of total area) of 'Manzanilla' table olives as affected by deficit irrigation treatment

Parameter	ANOVA	T0	T1	T2
Oil content (g kg^{-1} DW)	***	261^{b}	404^{a}	278^{b}
C16:0 (%)	NS	17.1	16.4	16.7
C16:1 (%)	NS	1.54	1.69	1.53
C18:0 (%)	NS	3.66	3.65	4.27
C18:1 (%)	*	69.1^{b}	68.6^{b}	70.0^{a}
C18:2 (%)	**	6.10^{b}	7.31^{a}	4.96^{c}
C18:3 (%)	NS	1.25	1.18	1.27
C20:0 (%)	NS	0.81	0.71	0.86
C20:1 (%)	NS	0.53	0.46	0.46
SFA (%)	NS	21.5	20.8	21.8
MUFA (%)	*	71.1^{b}	70.7^{b}	72.0^{a}
PUFA (%)	**	7.34^{b}	8.49^{a}	6.23^{c}
(MUFA + PUFA)/SFA	NS	3.64	3.81	3.59

Linoleic acid, C18:2



Antioxidant Activity and consumer acceptance

Table 6. Antioxidant activity (mmol Trolox kg^{-1} FW) and total polyphenols content (mg GAE kg^{-1} DW) of 'Manzanilla' table olives as affected by deficit irrigation treatment

Parameter	ANOVA	T0	T1	T2
ABTS^{+} (mmol Trolox kg^{-1} FW)	NS	13.4	13.2	13.4
DPPH$^{\bullet}$ (mmol Trolox kg^{-1} FW)	NS	13.6	13.1	13.2
FRAP (mmol Trolox kg^{-1} FW)	NS	29.1	22.1	28.6
H-AA (mmol Trolox kg^{-1} FW)	NS	10.2	8.61	9.14
L-AA (mmol Trolox kg^{-1} FW)	NS	2.61	2.57	2.56
TPC (g GAE kg^{-1} FW)	NS	5.29	5.28	5.27

NS, not significant at $P < 0.05$.
Values are the mean of three replications.

Is this good or bad?

Table 7. Affective sensory analysis of 'Manzanilla' table olives as affected by deficit irrigation treatment

Parameter	ANOVA	T0	T1	T2
Fresh table olive flavour	NS	6.5	6.8	6.4
Bitterness	NS	6.3	6.4	6.1
Saltiness	NS	6.0	6.4	6.2
Hardness	NS	7.4	7.3	6.9
Crunchiness	NS	7.5	7.3	6.9
After-taste	NS	6.4	6.4	6.2
GLOBAL	NS	6.5	6.8	6.3

Consumers used a 9-point hedonic scale, where 1 = dislike extremely, 5 = neither like nor dislike, 9 = like extremely.
NS, not significant at $P < 0.05$.
Values are the mean of 100 consumers.

DEVELOPMENT OF THE hydroSOStainable INDEX

SUSTAINABLE LABELING

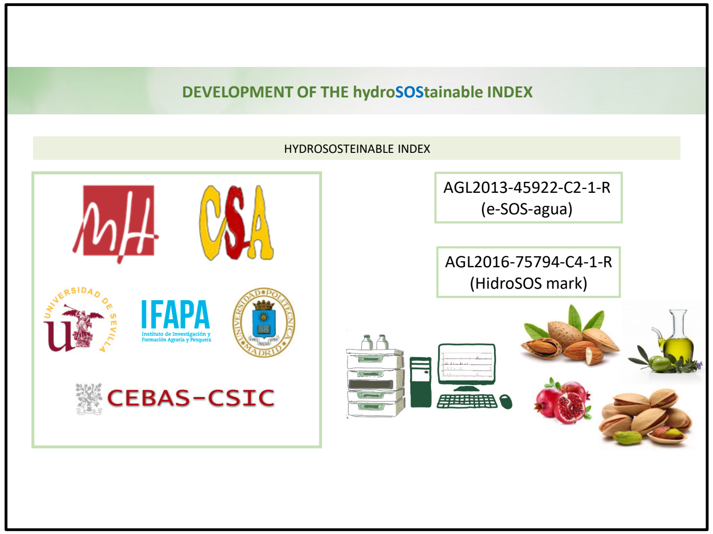
At the United Nations Conference on Environment and Development, it was recognized that sustainable labeling is useful for creating incentives for those products and processes that are friendly to the environment.

DEVELOPMENT OF THE hydroSOStainable INDEX

HIDROSOSTENIBLE

CSA

Galpagro



El desarrollo de este índice ha sido posibles gracias a la investigación llevada a cabo por el grupo de investigación de Calidad y Seguridad Alimentaria de la UMH, y sus colaboradores (Universidad de Sevilla, Centro de Edafología y Biología aplicada del Segura (CEBAS-CSIC), Universidad Politécnica de Madrid e Instituto de Investigación y Formación Agraria y Pesquera (IFAPA)), a través de los proyectos **AGL2013-45922-C2-1-R (e-SOS-agua**

PUBLICATION 1

Scientia Horticulturae 257 (2019) 108661

Contents lists available at ScienceDirect

Scientia Horticulturae

journal homepage: www.elsevier.com/locate/scihorti

Evaluation of growers' efforts to improve the sustainability of olive orchards: Development of the hydroSOStainable index

M. Corell[a,b], M.J. Martín-Palomo[a,b], P. Sánchez-Bravo[c], T. Carrillo[d], J. Collado[c], F. Hernández-García[c], I. Girón[e,b], L. Andreu[a,b], A. Galindo[a], Y.E. López-Moreno[a], A. Centeno[f], D. Pérez-López[f], A.A. Carbonell-Barrachina[c], A. Moriana[a,b,*]

[a] Universidad de Sevilla, Departamento de Ciencias Agroforestales. Crta de Utrera Km 1. 41013 Sevilla, Spain
[b] Unidad asociada al CSIC de "Uso sostenible del suelo y el agua en la agricultura (US-IRNAS)", Sevilla, Spain
[c] Universidad Miguel Hernández (Elche), Escuela Politécnica Superior de Orihuela (EPSO), Departamento de Tecnología Agroalimentaria, Grupo Calidad y Seguridad Alimentaria (CSA), Carretera de Beniel, km 3,2, 03312, Orihuela, Alicante, Spain
[d] Galpagro. I+D Department, Carretera de los Cansinos S/N, 14820 Santa Cruz, Córdoba, Spain
[e] Instituto de Recursos Naturales y Agrobiología (IRNAS-CSIC). P.O. Box 1052, E-41080 Sevilla, Spain
[f] Dpto. Producción Agraria, CEIGRAM-Universidad Politécnica de Madrid, Av. Puerta de Hierro, 2, 28040 Madrid, Spain

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

HYDROSOS INDEX, ORCHARDS

The key concept in the hydroSOS irrigation index is the irrigation scheduling based on RDI.

- Hydraulic
- Horticultural

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

HYDROSOS INDEX, ORCHARDS

Hydraulic indicators

- Type of irrigation
- Number and flow of drips/micro sprinklers.
- Irrigation frecuency.
- Water distribution uniformity.

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

HYDROSOS INDEX, ORCHARDS

Horticultural indicators

- Not directly related with irrigation scheduling.
- Indicators of the moment when the water stress occurs.
- Indicators of water stress.

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

HYDROSOS INDEX, ORCHARDS

Hydraulic

- Not directly related to the irrigation scheduling
  - Source of irrigation water.
  - Soil management.
  - Water quality.
  - Water use efficiency.

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

HYDROSOS INDEX, ORCHARDS

Horticultural

- Indicators of the moment when the water stress occurs.
  - Water restriction period (Rapoport *et al.*, 2013)
  - Water saving.

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

HYDROSOS INDEX, ORCHARDS

Horticultural

- Indicators of water stress.
  - Indicators used.
  - Measurement frequency.
  - Sampling.
  - Water stress level.

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

Table 3
Horticultural indicators of the hydroSOS index which evaluate when (grey,) and how (white) the water stress is performed. Levels and marks.

INDICATORS	LEVEL	MARK
Approaches to determine pit hardening	*Yes*	5
Duration of irrigation restriction	*Until last week Aug/Feb*	5
	Until second week Aug/Feb	2
	Until last week July/Jan	1
Water saving in pit hardening	*>50%*	10
	30-50%	7
	30-40%	5
	10-20%	2
Approaches for irrigation scheduling	*Plant and soil measurements*	5
	Crop models	2
Measurements frequency	*Continuous*	10
	Discrete	8
Sampling	*100% surface*	10
	75-100% surface	8
	50-75% surface	4
	25-50% surface	2
Number of data	*All surface*	10
	10 data for each zone or at least 80% surface	8
Water stress level	*Midday stem water potential between -2 to -3.9MPa*	5

Los diferentes indicadores se traducen en una puntuación cuya suma genera un sistema de 4 etiquetas.

DEVELOPMENT OF THE hydroSOStainable INDEX, ORCHARD

A — > 85

HIDROSOSTENIBLE

B — 65-85

Important effort but not HYDROSOS yet.

C — 50-65

Poor management or important issues.

D — < 50

Water wasteful orchard. No interest in water sustainability

Table 4
Labels of the hydroSOS index.

LABEL	POINTS	COMMENTS
A	> 85	HYDROSOS
B	65-84.9	Important effort but not HYDROSOS yet
C	50-64.9	Poor management or important issues
D	50 <	Water wasteful orchard. No interest in water sustainability.

PUBLICATION 2

water

MDPI

Article

Criteria for HydroSOS Quality Index. Application to Extra Virgin Olive Oil and Processed Table Olives

Paola Sánchez-Bravo [1], Jacinta Collado-González [1], Mireia Corell [2], Luis Noguera-Artiaga [1], Alejandro Galindo [2,3], Esther Sendra [1], Francisca Hernández [4], María José Martín-Palomo [2,3] and Ángel Antonio Carbonell-Barrachina [1,*]

1 Department of Agro-Food Technology, Universidad Miguel Hernández de Elche, 03312 Alicante, Spain; paola.sb94@gmail.com (P.S.-B.); jacintacollado@gmail.com (J.C.-G.); lnoguera@umh.es (L.N.-A.); esther.sendra@umh.es (E.S.)

2 Departamento de Ciencias Agroforestales, Universidad de Sevilla, 41013 Sevilla, Spain; mcorell@us.es (M.C.); agalindoegea@gmail.com (A.G.); mjpalomo@us.es (M.J.M.-P.)

3 Unidad asociada al CSIC de "Uso sostenible del suelo y el agua en la agricultura (US-IRNAS)", 41013 Sevilla, Spain

4 Department of Plant Sciencies and Microbiology, Escuela Politécnica Superior de Orihuela, 03312 Alicante, Spain; francisca.hernandez@umh.es

* Correspondence: angel.carbonell@umh.es

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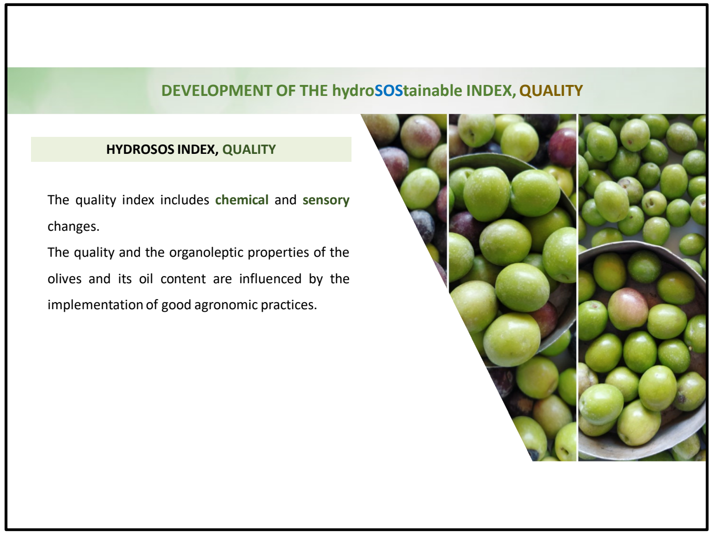


Los métodos señalados como idóneos para el análisis de los indicadores fueron aquellos ampliamente utilizados por los miembros expertos de los grupos de investigación participantes en los proyectos anteriormente mencionados y los comúnmente utilizados en la bibliografía (Cano-Lamadrid *et al.*, 2015; Fernandes-Silva *et al.*, 2013; ISO-12966-2, 2017; ISO-12966-4, 2015).

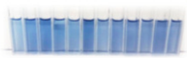
Sin embargo, se pueden utilizar otros métodos estandarizados, proporcionando resultados similares y válidos. La calidad y propiedades organolépticas de las aceitunas y su contenido en aceite están influenciadas por la implementación de buenas prácticas agronómicas

DEVELOPMENT OF THE hydroSOStainable INDEX, QUALITY

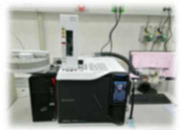
HYDROSOS INDEX, QUALITY

Total phenolic compounds

Folin-Ciocalteu method



Fatty acids



NORM ISO-12966

GC-FID

DEVELOPMENT OF THE hydroSOStainable INDEX, QUALITY

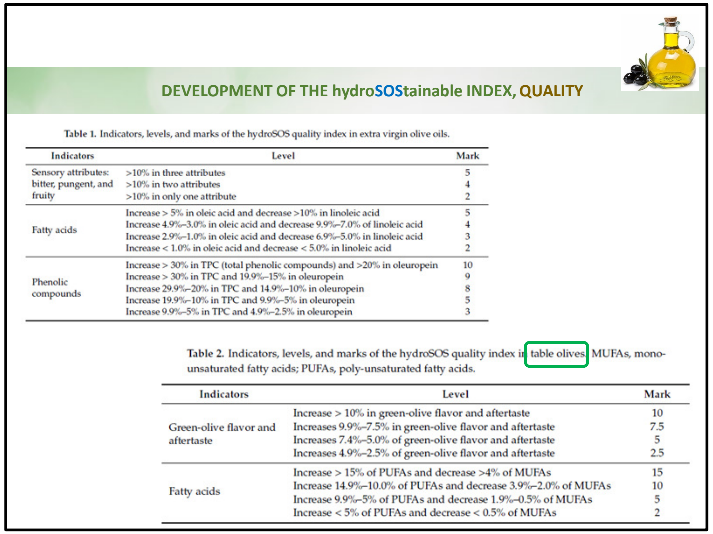
HYDROSOS INDEX, QUALITY

Descriptive sensory analysis

- 8 trained panelists.
- 100 mL of oil or 15 g of olives
- Numeric scales (0.5 increments)

0: Extremely low intensity

10:Extremely high intensity



DEVELOPMENT OF THE hydroSOStainable INDEX, QUALITY

Table 1. Indicators, levels, and marks of the hydroSOS quality index in extra virgin olive oils.

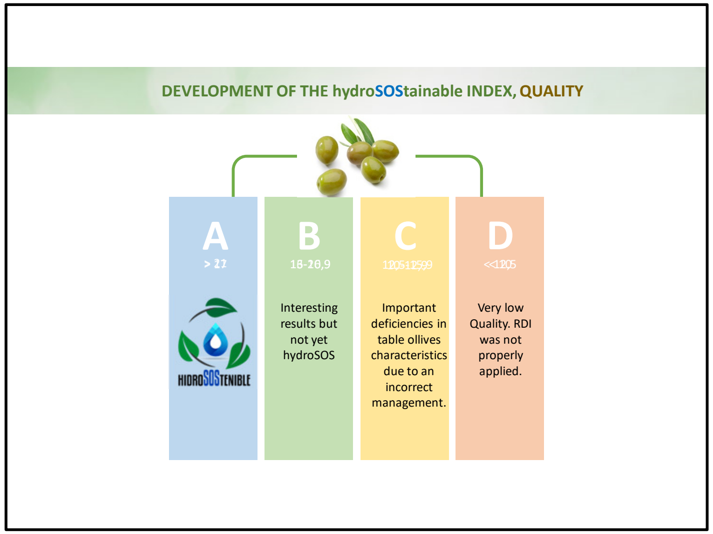
Indicators	Level	Mark
Sensory attributes: bitter, pungent, and fruity	>10% in three attributes	5
	>10% in two attributes	4
	>10% in only one attribute	2
Fatty acids	Increase > 5% in oleic acid and decrease >10% in linoleic acid	5
	Increase 4.9%–3.0% in oleic acid and decrease 9.9%–7.0% of linoleic acid	4
	Increase 2.9%–1.0% in oleic acid and decrease 6.9%–5.0% in linoleic acid	3
	Increase < 1.0% in oleic acid and decrease < 5.0% in linoleic acid	2
Phenolic compounds	Increase > 30% in TPC (total phenolic compounds) and >20% in oleuropein	10
	Increase > 30% in TPC and 19.9%–15% in oleuropein	9
	Increase 29.9%–20% in TPC and 14.9%–10% in oleuropein	8
	Increase 19.9%–10% in TPC and 9.9%–5% in oleuropein	5
	Increase 9.9%–5% in TPC and 4.9%–2.5% in oleuropein	3

Table 2. Indicators, levels, and marks of the hydroSOS quality index in table olives. MUFAs, mono-unsaturated fatty acids; PUFAs, poly-unsaturated fatty acids.

Indicators	Level	Mark
Green-olive flavor and aftertaste	Increase > 10% in green-olive flavor and aftertaste	10
	Increases 9.9%–7.5% in green-olive flavor and aftertaste	7.5
	Increases 7.4%–5.0% of green-olive flavor and aftertaste	5
	Increases 4.9%–2.5% of green-olive flavor and aftertaste	2.5
Fatty acids	Increase > 15% of PUFAs and decrease >4% of MUFAs	15
	Increase 14.9%–10.0% of PUFAs and decrease 3.9%–2.0% of MUFAs	10
	Increase 9.9%–5% of PUFAs and decrease 1.9%–0.5% of MUFAs	5
	Increase < 5% of PUFAs and decrease < 0.5% of MUFAs	2

Al igual que en el índice hidroSOS de Riego, los indicadores se traducen en una puntuación que genera 4 etiquetas. **La suma TOTAL es de 20 puntos** para el Aceite de oliva virgen extra.

Etiqueta A (> 17 puntos). HidroSOStenible.
Etiqueta B (entre 13-16,9 puntos). Resultados interesantes, pero no HidroSOS.
Etiqueta C (entre 10-12.9 puntos). Importantes deficiencias en las características del aceite de oliva por una incorrecta gestión del riego.
Etiqueta D (< 10 puntos). Muy baja calidad. EL RDC no ha sido aplicado correctamente.



Las etiquetas para el caso de las aceitunas son exactamente iguales a las del aceite y lo único que varía es la puntuación para obtener cada una de ellas, ya que el total en este caso es de 25 puntos.

Puntuación TOTAL de 25 puntos
Aceitunas de mesa:
Etiqueta A (> 21 puntos). HidroSOStenible.
Etiqueta B (entre 16-20,9 puntos). Resultados interesantes, pero no HidroSOS.
Etiqueta C (entre 12,5-15.9 puntos). Importantes deficiencias en las características de las aceitunas de mesa por una incorrecta gestión del riego.
Etiqueta D (< 12,5 puntos). Muy baja calidad. EL RDC no ha sido aplicado correctamente.

DEVELOPMENT OF THE hydroSOStainable INDEX, QUALITY

SUMMARY

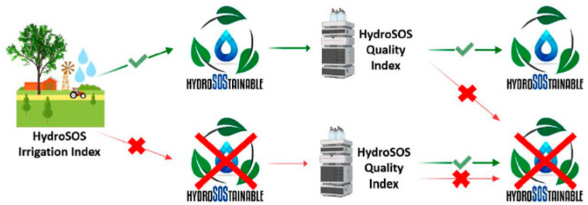
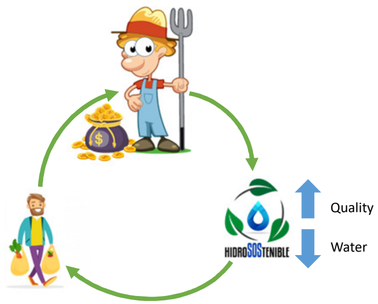


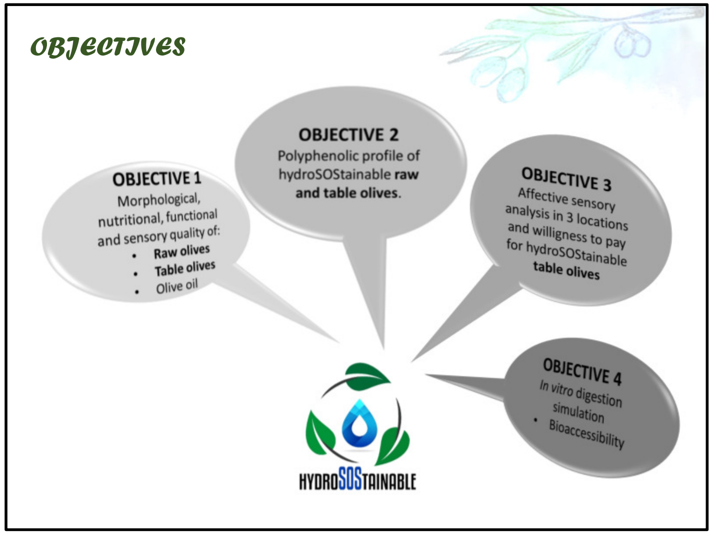
Figure 1. HydroSOStainable index: two complementary indices.

hydroSOS products



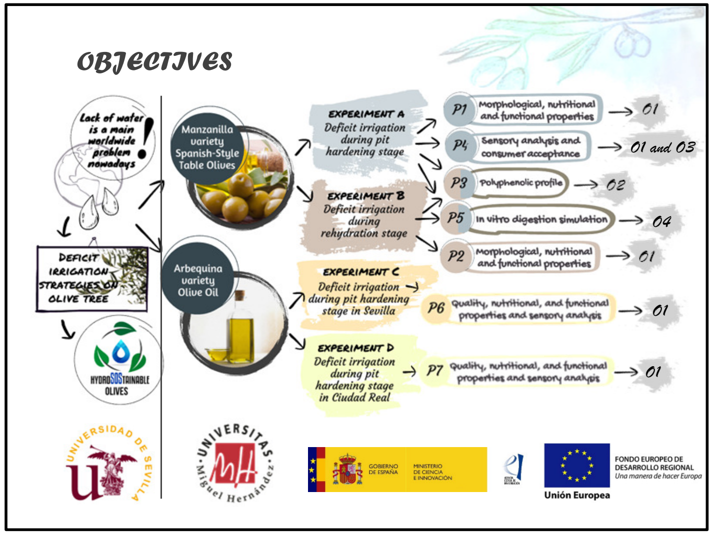
Big opportunity!

Agradecer a los miembros del tribunal por haber aceptado formar parte del mismo y por su DEDICACIÓN PARA EVALUAR MI TESIS DOCTORAL, LA CUAL VOY A PASAR A EXPONER



For which, the specific objectives are:

- To determine the morphological, nutritional, functional and sensory quality of raw and seasoned hydro-sustainable olives and olive oil.
- To study the polyphenolic profile of raw and seasoned hydro-sustainable olives.
- To analyze consumer acceptance of hydroSUSTAINABLE olives in different locations.
- To study the bioaccessibility of phenols and antioxidant activity after simulating an in vitro digestion of hydro-sustainable olives



7 publicaciones científicas publicadas en JCR que dan respuesta a los objetivos planteados en esta tesis

4 Q1
1 Q2
2 Q3

PUBLICATIONS

PUBLICATION 1

Sánchez-Rodríguez, L., Corell, M., Hernández, F., Sendra, E., Moriana, A., Carbonell-Barrachina, Á.A. 2019. Effect of Spanish-style processing on the quality attributes of *HydroSOStainable* ***GREEN OLIVES***. *Journal of Science of Food and Agriculture*. 99(4):1804-1811. DOI: 10.1002/jsfa.9373.

Published: 31 October 2018

Publisher: Wiley, 111 River St, Hoboken 07030-5774, NJ USA

ISSN: 0022-5142

Research Domain: Agriculture, Multidisciplinary; Chemistry. Applied; Food Science & Technology

JCR® category	Quartile in Category	Rank	Impact Factor	5-year impact factor
Agriculture, Multidisciplinary	Q1	9/57	2.422	2.733

PUBLICATIONS

PUBLICATION 2

Sánchez-Rodríguez, L., Lipan, L., Andreu, L., Martín-Palomo, M.J., Carbonell-Barrachina, Á.A., Hernández, F., Sendra, E. 2019. Effect of regulated deficit irrigation on the quality of raw and **TABLE OLIVES**. *Agricultural Water Management*. 221:415-421. DOI: 10.1016/j.agwat.2019.05.014

Published: 20 July 2019

Publisher: Elsevier Science BV, PO Box 211, 1000 AE Amsterdam, Netherlands

ISSN: 0378-3774

Research Domain: Agriculture; Water Resources

JCR® category	Quartile in Category	Rank	Impact Factor	5-year impact factor
Water Resources	Q1	10/94	4.021	4.469

PUBLICATIONS

PUBLICATION 3

Sánchez-Rodríguez, L., Cano-Lamadrid, M., Carbonell-Barrachina, Á.A., Wojdyło, A., Sendra, E., Hernández, F. 2019. Polyphenol Profile in "Manzanilla" **TABLE OLIVES** as affected by water deficit during specific phenological stages and Spanish-style processing. *Journal of Agricultural and Food Chemistry*. 67: 661-670. DOI: 10.1021/acs.jafc.8b06392.

Published: 20 December 2018

Publisher: ACS Publications 1155 Sixteenth St NW Washington DC 20036

ISSN: 0021-8561

Research Domain: Chemistry, applied; Foods Science & Technology; Agriculture, Multidisciplinary.

JCR® category	Quartile in Category	Rank	Impact Factor	5-year impact factor
Food Science & Technology	Q1	28/135	3.571	3.991

PUBLICATIONS

PUBLICATION 4

Sánchez-Rodríguez, L., Cano-Lamadrid, M., Carbonell-Barrachina, Á.A., Sendra, E., Hernández, F. 2019. Volatile composition, sensory profile and consumer acceptability of hydroSOStainable **TABLE OLIVES**. *Foods*. 8: 470. DOI: 10.3390/foods8100470

Published: 10 October 2019

Publisher: MDPI St. Alban-Angale, 66 Basel, Switzerland 4052

ISSN: 2304-8158

Research Domain: Food Science & Technology.

JCR® category	Quartile in Category	Rank	Impact Factor	5-year impact factor
Food Science & Technology	Q1	27/139	4.092	n/a

PUBLICATIONS

PUBLICATION 5

Sánchez-Rodríguez, L., Cano-Lamadrid, M., Carbonell-Barrachina, Á.A., Sendra, E., Hernández, F. 2020. Impact of gastrointestinal in vitro digestion and deficit irrigation on antioxidant activity and phenolic content bioaccessibility of "Manzanilla" **TABLE OLIVES**. *Journal of Food Quality*. Volume 2020, Article ID 6348194, 6 pages DOI: 10.1155/2020/6348194

Published: 10 October 2019

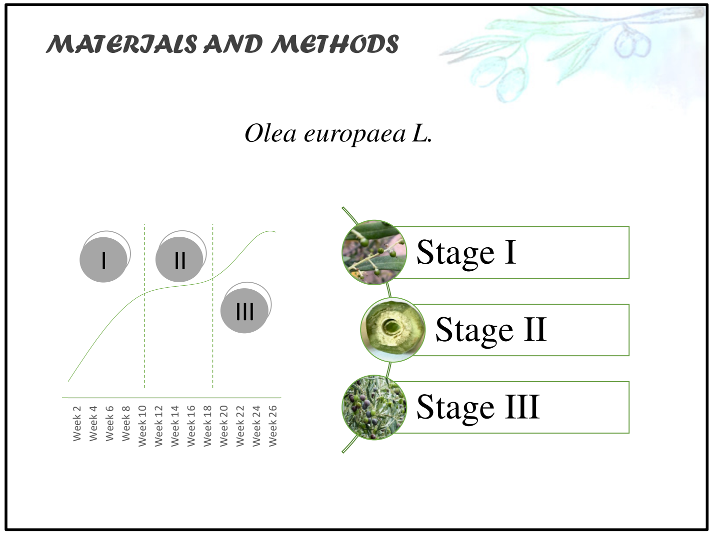
Publisher: Wiley, 111 River St, Hoboken 07030-5774, NJ USA

ISSN: 2304-8158

Research Domain: Food Science & Technology.

JCR® category	Quartile in Category	Rank	Impact Factor	5-year impact factor
Food Science and Technology	Q3	83/139	1.763	1.781

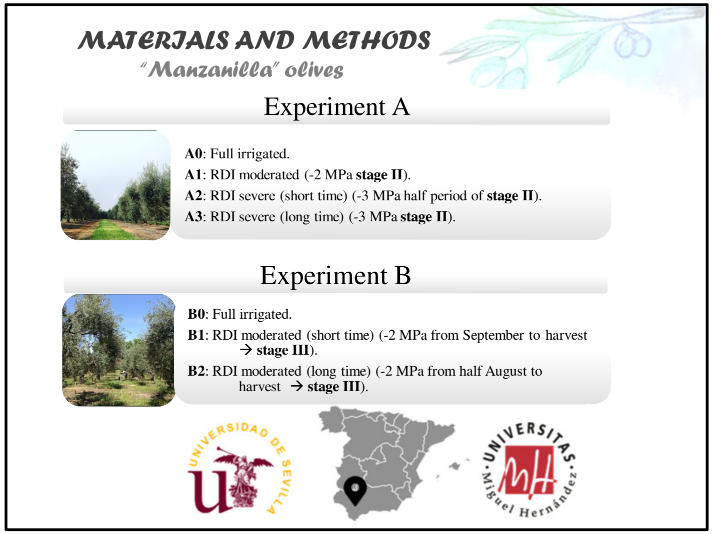
MATERIALS AND METHODS



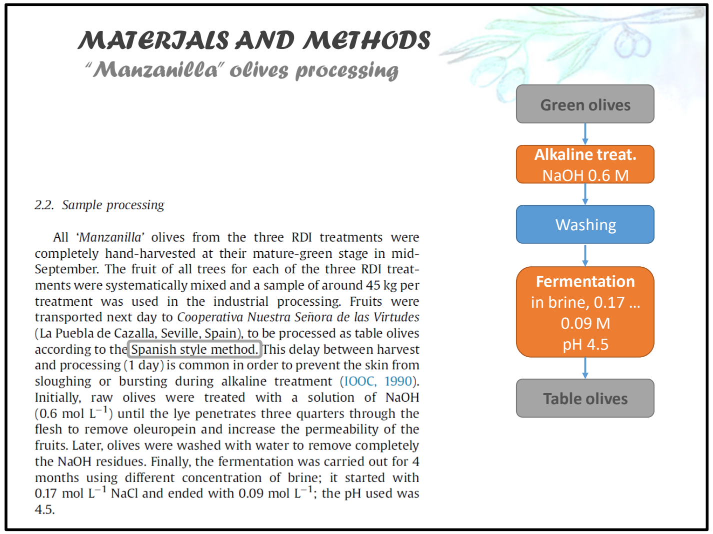
During the growth of the fruit, 3 phenological states can be distinguished:

1. which lasts approximately 10 weeks and goes from the setting of the fruit until the hardening of the bone begins
2. with a duration of 7 weeks, which includes the hardening of the bone and the growth of the size of the fruit stops
3. it can last between 9 and 17 weeks since it is the phase of maturation and accumulation of oil, so depending on the final use of the olive, it will be harvested before or after.

I will begin by explaining the materials and methods used in the case of olives of the "Manzanilla" variety.



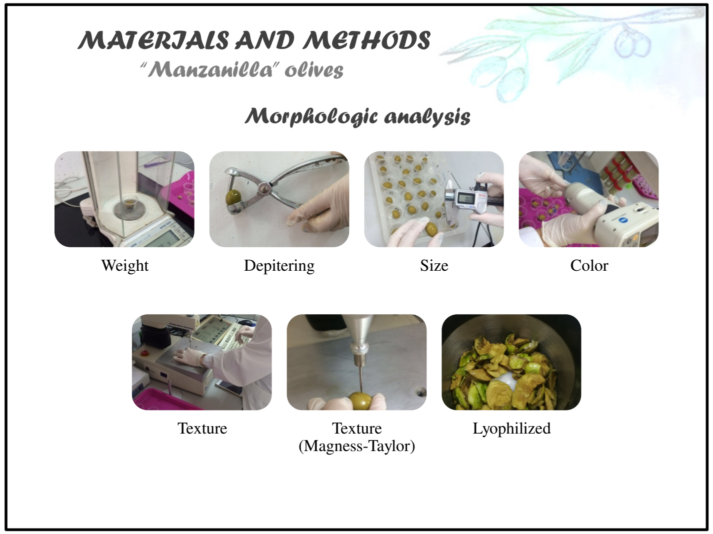
A → stage 2 because it is the least likely to affect production since fruit growth is paralyzed
B → stage 3 because it is the most sensitive phase and we wanted to know what the effects on quality were, even thinking that it would surely affect productivity in some way.



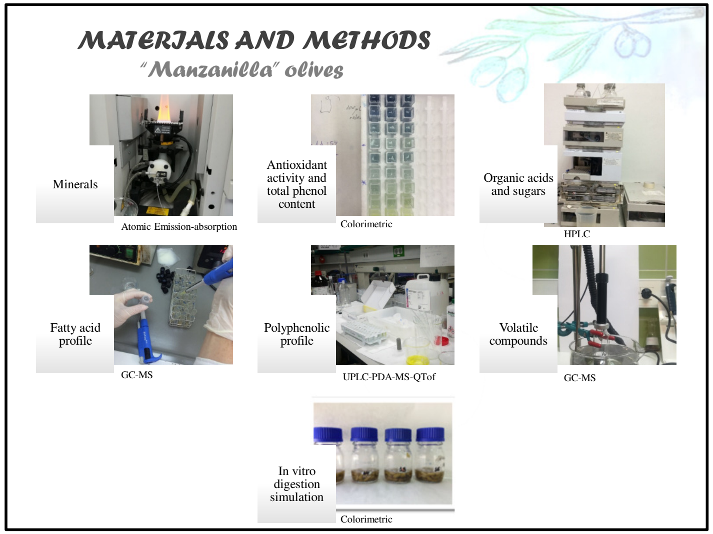
2.2. Sample processing

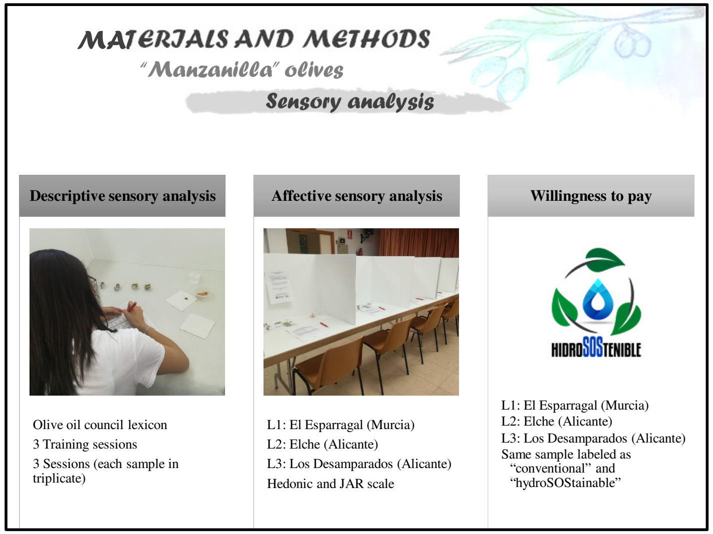
All '*Manzanilla*' olives from the three RDI treatments were completely hand-harvested at their mature-green stage in mid-September. The fruit of all trees for each of the three RDI treatments were systematically mixed and a sample of around 45 kg per treatment was used in the industrial processing. Fruits were transported next day to *Cooperativa Nuestra Señora de las Virtudes* (La Puebla de Cazalla, Seville, Spain), to be processed as table olives according to the Spanish style method. This delay between harvest and processing (1 day) is common in order to prevent the skin from sloughing or bursting during alkaline treatment (IOOC, 1990). Initially, raw olives were treated with a solution of NaOH (0.6 mol L^{-1}) until the lye penetrates three quarters through the flesh to remove oleuropein and increase the permeability of the fruits. Later, olives were washed with water to remove completely the NaOH residues. Finally, the fermentation was carried out for 4 months using different concentration of brine; it started with 0.17 mol L^{-1} NaCl and ended with 0.09 mol L^{-1}; the pH used was 4.5.

The first analyzes that were carried out were the morphological ones, the weight of the whole olive and the bone, the equatorial and longitudinal diameter, the color, the texture analyzed by two different methods to differentiate the texture of the pulp and the skin, and also Part of the olives were freeze-dried to preserve them for further analysis.



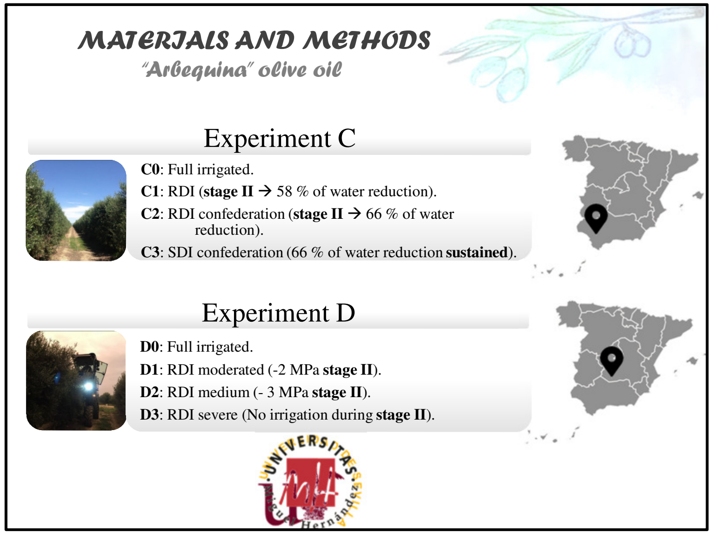
The first analyzes that were carried out were the morphological ones, the weight of the whole olive and the bone, the equatorial and longitudinal diameter, the color, the texture analyzed by two different methods to differentiate the texture of the pulp and the skin, and also Part of the olives were freeze-dried to preserve them for further analysis.


MATERIALS AND METHODS
"Manzanilla" olives
Minerals
Atomic Emission-absorption
Antioxidant activity and total phenol content
Colorimetric
Organic acids and sugars
HPLC
Fatty acid profile
GC-MS
Polyphenolic profile
UPLC-PDA-MS-QTof
Volatile compounds
GC-MS
In vitro digestion simulation
Colorimetric



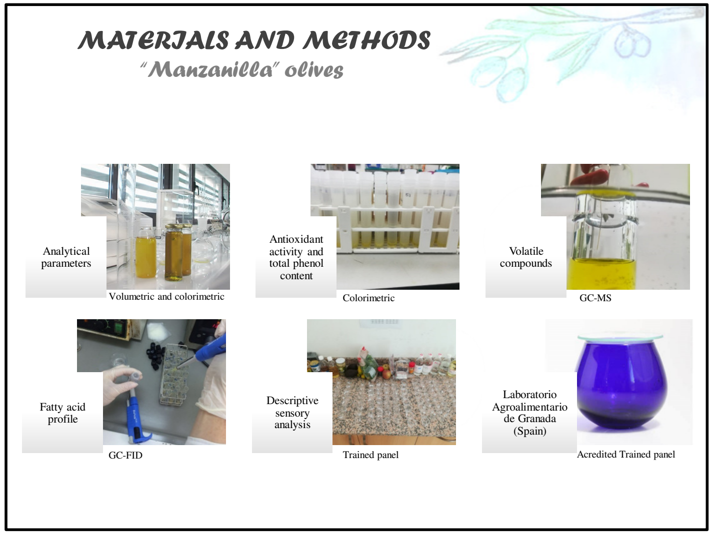
Regarding the sensory analysis, a descriptive analysis was carried out with a trained tasting panel and the lexicon of the international olive oil council was used, an affective analysis was carried out in three locations, two of them representing the population that lives in the countryside and the other to the city population. In the same way, the study of willingness to pay was carried out in order to study the effect of the hydroSOStainable logo. For this, the same olives were used and labeled differently, some with the hydroSOStainable logo and others as Conventional, and information was given to consumers on the hydroSOStenible concept.

Next, I will explain the tests that have been carried out on olive oil.
I know that this conference is about "table olives" but I want to highlight few results on olive oil, and need to explain what has been done.

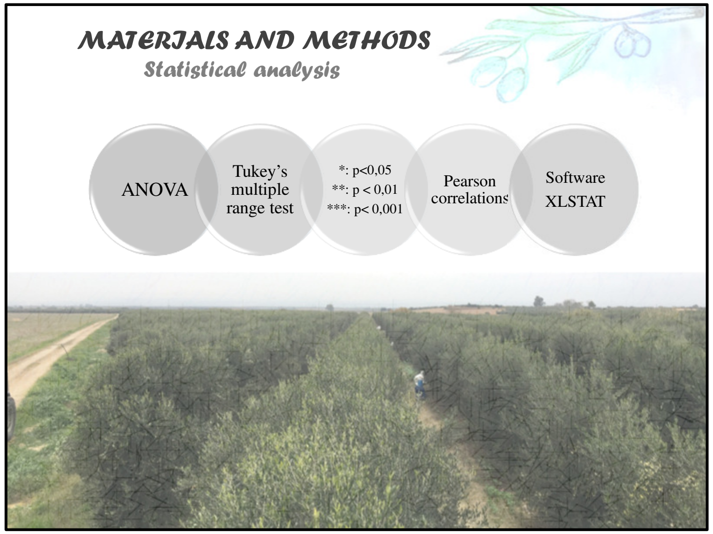


In experiment C, located in Seville, we have 4 treatments, first with a control, then C1 in which a 58% reduction in irrigation was applied during stage 2. In C2 the reduction was 66%. in stage 2 and in C3 the irrigation water was also reduced by 66 % but this time during the entire cultivation period.

In experiment D, which was carried out in Ciudad Real, there was also a control and 3 deficit irrigation treatments. In D1 a water stress of -2 Mpa was applied in stage 2, in D2 the stress was -3MPa and in D3 irrigation was directly eliminated in stage 2.



GRANADA → CATEGORIZAR



Data were analyzed using a one-way analysis of variance using Tukey's multiple range test. Significant differences were considered at these 3 levels. Pearson correlations were also performed to study the correlations between variables. All statistical analyzes were performed using the XLSTAT software.

RESULTS AND DISCUSSION


“Manzanilla” olives

RESULTS AND DISCUSSION

"Manzanilla" olives

Experiment A

A0: Full irrigated.
A1: RDI moderated (-2 MPa stage II).
A2: RDI severe (short time) (-3 MPa half period of stage II).
A3: RDI severe (long time) (-3 MPa stage II).

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Irrigation treatments

	Treatment	Min ψ_{stem} (MPa)	SI (MPa × day)
ANOVA			
	2015	***	***
	2016	***	*
Multiple range test Tukey			
2015	A0	-1.76 a	1.4 b
	A1	-1.96 ab	2.7 ab
	A2	-1.84 ab	1.2 b
	A3	-2.4 b	4.7 a
Multiple range test Tukey			
2016	A0	-2.34 a	29.6 b
	A1	-2.76 ab	62.6 ab
	A2	-2.74 ab	50.4 ab
	A3	-3.52 b	87.4 a

Fruit load in 2015 was 15 % that of 2016.

two campaigns
A3 was the one that registered the highest stress values. The differences that are observed between both years may be due to the **load of the trees**, since in 2015 the load was 15 % than in 2016.
The results do not show both years because the differences were not significant and the average of the two years of cultivation was made.

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Morphological analysis

	Fruit weight (g)	Pit weight (g)	Fruit/pit ratio	Equatorial diameter (mm)	Longitudinal diameter (mm)	DMC (g dw kg^{-1} fw)	Texture PT (N)	Texture MTT (N)	Colour L^*	Colour a^*	Colour b^*
ANOVA											
Irrigation RO	***	***	***	**	*	**	***	***	*	***	NS
Irrigation TO	***	***	***	*	*	*	***	**	**	*	**
Spanish-style processing	***	NS	***	*	*	*	***	**	**	***	**
Multiple range test Tukey Raw Olives											
A0	4.43 b	0.76 a	5.83 b	19.3 b	21.3 a	328 b	1.28 b	13.1 b	57.3 ab	-12.9 a	38.3
A1	4.45 b	0.73 a	6.09 ab	19.2 b	21.3 a	341 a	1.35 b	12.9 b	56.9 b	-12.5 a	38.0
A2	4.66 a	0.74 a	6.29 ab	19.5 a	21.5 a	321 b	1.44 b	10.2 c	57.2 b	-12.4 a	37.9
A3	4.13 c	0.64 b	6.45 a	19.7 a	20.4 b	341 a	2.54 a	19.1 a	59.9 a	-19.1 b	38.2
Multiple range test Tukey Table Olives											
A0	4.20 a	0.75 a	5.60 a	19.0 ab	19.5 a	330 b	1.07 b	6.52 b	55.6 b	0.64 ab	36.4 ab
A1	4.02 a	0.73 a	5.51 a	18.7 b	19.2 a	338 a	1.28 b	5.95 b	55.3 b	0.54 b	36.9 a
A2	3.97 a	0.73 a	5.44 a	18.8 ab	18.9 a	332 b	1.40 b	4.92 c	55.4 b	0.70 a	36.2 b
A3	2.81 b	0.61 b	4.60 b	19.2 a	14.9 b	341 a	1.85 a	7.25 a	56.4 a	0.62 ab	37.0 a
Multiple range test Tukey Spanish-Style processing											
Raw olives	4.42 a	0.72	6.14 a	19.4 a	21.1 a	317 a	1.65 a	13.8 a	57.8 a	-14.2 b	38.1 a
Table olives	3.75 b	0.71	5.28 b	18.9 b	18.1 b	309 b	1.40 b	6.03 b	55.7 b	0.62 a	36.7 b

A3 RDI severe long-time treatment

The moderate stress caused the larger size of the olives and, on the other hand, the severe stress reduced the size and produced rounded-shape olives.

Previous studies also reported similar results, with a tendency to decrease the size of "Manzanilla" olives with severe irrigation treatments.

The effect of processing led to a decrease in all the morphological parameters analyzed, which is due to the osmotic effect of sodium chloride and the LEACHING of the compounds to the fermentation liquid and brine.

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Mineral analysis

	Macro-elements			Micro-elements	
	Ca (g kg^{-1} fw)	K (g kg^{-1} fw)	Mg (g kg^{-1} fw)	Zn (mg kg^{-1} fw)	Cu (mg kg^{-1} fw)
ANOVA					
Irrigation RO	NS	NS	NS	NS	NS
Irrigation TO	NS	NS	NS	NS	NS
Spanish-style processing	***	***	NS	NS	NS
Multiple range test Tukey Raw Olives					
A0	0.47	4.96	0.13	2.07	1.72
A1	0.51	4.84	0.14	2.17	1.87
A2	0.54	4.70	0.12	2.29	2.06
A3	0.54	4.75	0.13	2.07	1.62
Multiple range test Tukey Table Olives					
A0	0.40	0.95	0.15	2.01	1.98
A1	0.27	1.07	0.14	2.12	1.72
A2	0.40	1.10	0.13	1.83	1.45
A3	0.37	1.12	0.14	2.19	1.80
Multiple range test Tukey Spanish-Style processing					
Raw olives	0.52 a	4.81 a	0.13	2.15	1.79
Table olives	0.36 b	1.06 b	0.14	2.03	1.74

The mineral composition of the olives was not affected by the water deficit, although a decrease in Calcium and Potassium could be observed when going from raw to seasoned olives. **Other authors also observed this decrease, specifically they observed that the greatest loss occurred during the washings in the Spanish-style dressing, due to its great solubility.**

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Antioxidant activity and total phenol content

	ABTS⁺ (mmol Trolox kg^{-1} fw)	DPPH• (mmol Trolox kg^{-1} fw)	FRAP (mmol Trolox kg^{-1} fw)	TPC (g GAE kg^{-1} fw)
ANOVA				
Irrigation RO	NS	NS	NS	NS
Irrigation TO	NS	NS	NS	NS
Spanish-style processing	***	***	***	***
Multiple range test Tukey Raw Olives				
A0	27.1	48.7	24.8	19.4
A1	26.3	48.9	25.1	19.6
A2	26.3	48.1	24.5	20.4
A3	26.3	49.2	24.7	19.6
Multiple range test Tukey Table Olives				
A0	6.67	9.55	15.5	5.77
A1	6.88	9.38	15.2	5.81
A2	6.70	9.71	15.2	5.74
A3	6.87	9.75	15.3	5.82
Multiple range test Tukey Spanish-Style processing				
Raw olives	26.5 a	48.7 a	24.8 a	19.8 a
Table olives	6.78 b	9.60 b	15.3 b	5.79 b

!

The antioxidant activity and the total content of polyphenols were not affected by the irrigation treatments applied in stage 2 either. High concentrations were found in the raw olives, which decreased after processing. **The antioxidant activity and total phenols can be affected by the state of ripeness of the olives and the production method used. In fact, other authors found that the acid medium causes the diffusion of various polyphenols, such as hydroxytyrosol or the degradation of some others.**

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Organic acids and sugars

Raw olives

Irrigation treatment	Citric acid	Tartaric acid	Malic acid	Succinic acid	Sucrose	Glucose	Fructose
	(g kg^{-1} fw)						
ANOVA							
	NS	NS	NS	NS	NS	NS	NS
Multiple range test tukey							
A0	0.25	0.12	0.43	0.14	1.59	2.55	1.34
A1	0.30	0.11	0.48	0.15	1.83	3.07	1.54
A2	0.27	0.11	0.45	0.16	1.75	1.84	1.30
A3	0.27	0.11	0.47	0.20	1.71	2.75	1.39

Table olives

Irrigation treatment	Phytic acid	Lactic acid	Acetic acid	Maltoheptaose	Mannitol	Glycerol
	(g kg^{-1} fw)					
ANOVA						
	NS	NS	NS	NS	NS	NS
Multiple range test Tukey						
A0	7.53	1.64	0.53	2.30	3.15	1.23
A1	6.44	1.57	0.63	2.10	2.52	0.91
A2	6.82	1.61	0.66	2.14	2.58	0.89
A3	6.73	1.59	0.64	2.10	2.55	0.90

The profile of organic acids and sugars found in raw olives was totally different from that found in seasoned ones, but in both cases, water stress had no effect on the concentrations of these compounds. Changes in these profiles are due to fermentation. **In the bibliography, similar profiles can be found in different olive varieties, both for raw and seasoned ones.**

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Polyphenolic profile

Raw olives

A3 RDI severe long-time treatment

	Hydroxytyrosol glucoside	Caffeoyl-6'-secologanoside	Oleoside	Elenolic acid glucoside	Oleuropein aglycone	Quercetin-3-*O*-rutinoside
	(mg eq quercetin-3-*O*-rutinoside 100 g^{-1} fw)					
ANOVA						
Irrigation RO	NS	*	**	*	*	*
Tukey Multiple Range Test						
Irrigation RO						
A0	3.88	4.00 b	119 b	2.94 b	84.2 a	25.5 a
A1	3.74	3.96 ab	164 a	2.94 b	81.5 a	29.7 a
A2	2.96	5.27 a	91.7 c	1.38 c	68.1 c	14.8 b
A3	3.94	3.32 bc	124 b	3.01 a	74.8 b	27.4 a

	Luteolin-3-*O*-rutinoside	Verbascoside	Oleoside di-glucoside	Dihydro-oleuropein	Oleuropein diglucoside	Caffeoyl-6'-secologanoside	Oleuropein	Comselogoside	Luteolin	Ligstroside	2''-Hydroxyoleuropein
	(mg eq luteolin-3-*O*-rutinoside 100 g^{-1} fw)										
ANOVA											
Irrigation RO	*	*	*	**	*	*	*	*	*	*	*
Tukey Multiple Range Test											
Irrigation RO											
A0	36.2 a	26.4 a	43.5 a	1.26 b	3.27 ab	6.22 a	211 ab	4.52 a	9.14 a	14.8 a	6.84 c
A1	38.2 a	31.5 a	36.0 a	6.36 a	3.83 a	4.65 b	230 a	1.75 c	8.17 ab	12.9 b	8.10 b
A2	26.7 b	27.4 a	29.4 b	6.49 a	2.91 ab	4.53 b	187 b	2.66 b	7.03 b	13.9 ab	9.55 a
A3	32.9 ab	15.8 b	31.6 b	2.94 b	1.78 b	5.37 ab	224 a	2.01 bc	6.48 b	13.2 b	9.09 ab

HYDROXYTYROSOL NS
All irrigation treatments increase 2-hydroxyoleuropein, **which may be due to decreased concentration of oleuropein aglycone.**
SEVERE STRESS LOW →

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Polyphenolic profile

A1 RDI moderate treatment

A3 RDI severe long-time treatment

Table olives

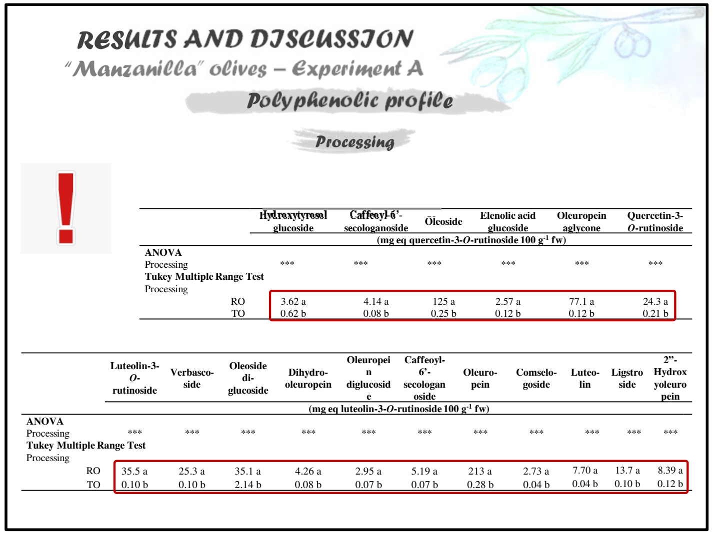
	Hydroxytyrosol glucoside	Caffeoyl-6'-secologanoside	Oleoside	Elenolic acid glucoside	Oleuropein aglycone	Quercetin-3-*O*-rutinoside
	(mg eq quercetin-3-*O*-rutinoside 100 g^{-1} fw)					
ANOVA						
Irrigation TO	NS	*	**	*	NS	NS
Tukey Multiple Range Test						
Irrigation TO						
A0	0.68	0.08 ab	0.22 b	0.10 b	0.09	0.24
A1	0.67	0.15 a	0.33 a	0.18 a	0.17	0.20
A2	0.60	0.04 b	0.23 b	0.08 b	0.11	0.17
A3	0.56	0.05 b	0.24 b	0.14 a	0.11	0.23

	Luteolin-3-*O*-rutinoside	Verbascoside	Oleoside di-glucoside	Dihydro-oleuropein	Oleuropein diglucoside	Caffeoyl-6'-secologanoside	Oleuropein	Comselogoside	Luteolin	Ligstroside	2''-Hydroxyoleuropein
	(mg eq luteolin-3-*O*-rutinoside 100 g^{-1} fw)										
ANOVA											
Irrigation TO	NS	NS	**	NS	NS	NS	*	*	*	*	*
Tukey Multiple Range Test											
Irrigation TO											
A0	0.14	0.12	1.67 c	0.16	0.08	0.07	0.27 b	0.12 b	0.10 a	0.12 a	0.13 a
A1	0.09	0.12	3.14 a	0.10	0.10	0.08	0.60 a	0.20 a	0.02 b	0.11 a	0.13 a
A2	0.10	0.08	2.20 b	0.06	0.08	0.08	0.19 bc	0.11 b	0.02 b	0.12 a	0.17 a
A3	0.09	0.08	1.58 c	0.02	0.04	0.06	0.09 c	0.03 c	0.05 b	0.06 b	0.07 b

HYDROXYTYROSOL NS

Moderate stress → increase in some compounds

Same trend as raw olives → severe stress → decreased concentration → **other authors also found that severe stress caused a drop in the concentration of some polyphenols and reported that it may be due to increased activity of PHENYLALANINE in the trees**

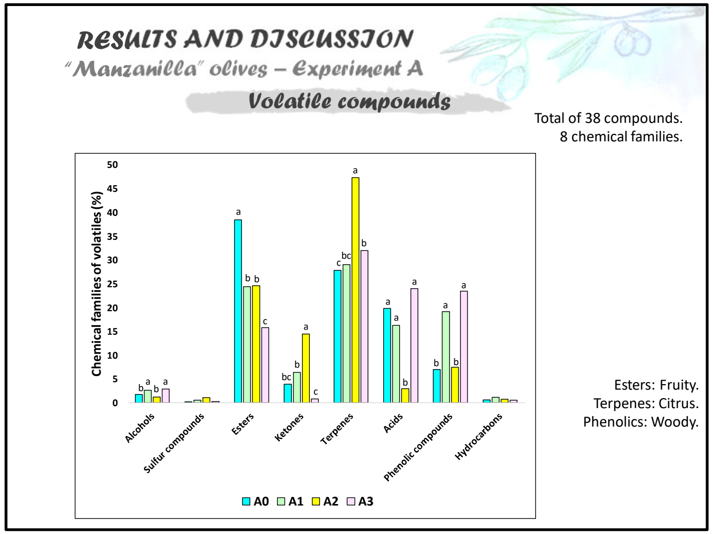


	Hydroxytyrosol glucoside	Caffeoyl-6'-secologanoside	Oleoside	Elenolic acid glucoside	Oleuropein aglycone	Quercetin-3-*O*-rutinoside
	(mg eq quercetin-3-*O*-rutinoside 100 g^{-1} fw)					
ANOVA						
Processing	***	***	***	***	***	***
Tukey Multiple Range Test						
Processing						
RO	3.62 a	4.14 a	125 a	2.57 a	77.1 a	24.3 a
TO	0.62 b	0.08 b	0.25 b	0.12 b	0.12 b	0.21 b

	Luteolin-3-*O*-rutinoside	Verbascoside	Oleoside di-glucoside	Dihydro-oleuropein	Oleuropein diglucoside	Caffeoyl-6'-secologanoside	Oleuropein	Comselogoside	Luteolin	Ligstroside	2''-Hydroxyoleuropein
	(mg eq luteolin-3-*O*-rutinoside 100 g^{-1} fw)										
ANOVA											
Processing	***	***	***	***	***	***	***	***	***	***	***
Tukey Multiple Range Test											
Processing											
RO	35.5 a	25.3 a	35.1 a	4.26 a	2.95 a	5.19 a	213 a	2.73 a	7.70 a	13.7 a	8.39 a
TO	0.10 b	0.10 b	2.14 b	0.08 b	0.07 b	0.07 b	0.28 b	0.04 b	0.04 b	0.10 b	0.12 b

When comparing the total content of the raw olives with the seasoned ones, as occurred in the previous determinations, a great decrease is observed due to the osmotic effect, the treatment with soda and salt, and lactic fermentation.

LEACHING



Regarding the volatile profile, a total of 38 compounds were identified, which are summarized in 8 families.
The content of esters and terpenes stand out compared to the others and also the great variation of the control in the case of esters, since in this sample it is the predominant family, while in the rest, in hydro-sustainable olives, the predominant family is that of terpenes.
Other authors found some changes in the volatile profile in table olives of the Kornoiki and Manzanilla variety but with different irrigation treatments.

In general, alcohols (high in T0 and T2) are associated with fruity and candy flavor notes, aldehydes (highest in T0) with green, vegetable and herbaceous notes,

terpenes (highest in T1) with **citrus and pine notes**,

organic acids (highest in T2) with herbaceous and vinegar notes, and phenolic compounds with green, woody, and cheesy notes

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Sensory analysis

A3 RDI severe long-time treatment

Descriptive sensory analysis

	Appearance		Flavor						Texture		
Sample	Color	Green-olive flavor	Saltiness	Bitterness	Sourness	Sweetness	Aftertaste	Off-flavor	Hardness	Crunchiness	Fibrousness
ANOVA											
	**	*	NS	*	***	NS	*	NS	***	***	NS
Multiple Range Tukey Test											
A0	6.5 a	6.5 ab	5.9	5.8 a	2.4 b	2.9	5.9 ab	0.0	7.8 a	7.3 a	0.3
A1	5.4 b	6.9 a	5.0	3.8 ab	3.0 b	2.1	5.9 ab	0.0	6.6 a	5.6 a	0.8
A2	5.9 ab	6.4 ab	5.9	4.0 ab	2.6 b	2.2	5.6 b	0.0	7.2 a	6.1 a	0.3
A3	5.7 ab	6.2 b	4.9	2.8 b	6.9 a	1.7	8.1 a	0.0	3.5 b	1.7 b	0.4

Affective sensory analysis

	Color	Flavor	Bitterness	Saltiness	Sourness	Hardness	Crunchiness	Fibrousness	Aftertaste	Overall
ANOVA†										
	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Multiple Range Tukey Test										
A0	6.2	6.6	6.3	6.2	6.3	7.0	6.7	6.5	6.6	6.5
A1	6.7	6.6	6.3	6.0	6.0	6.7	6.6	6.6	6.2	6.4
A2	6.5	6.3	5.7	6.3	5.8	6.5	6.6	6.5	6.2	6.4
A3	6.5	5.9	5.7	5.9	5.8	6.3	6.5	6.5	5.9	5.7

A previous study carried out with Ascolana olives also showed a decrease in bitterness with water stress and in Nocellara del Belice olives the intensities of green olive aroma, acidity and sweetness were reduced.

Regarding the affective study, the consumers did not show significant differences in any locality between the irrigation treatments, although it should be noted that on a scale of 1 to 9, the general scores obtained were quite good.

In a price study with Manzanilla olives, consumers rated deficit irrigation olives with better aroma, crunchiness and aftertaste

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Sensory analysis

Consumer willingness to pay

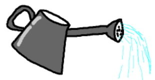
		Green-olive flavor	Saltiness	Hardness	Overall
ANOVA Test					
Logo effect		***	NS	NS	*
Location		***	NS	NS	*
Logo effect vs Location		***	NS	NS	*
Multiple Range Tukey Test Logo effect					
	Conventional	6.7 b	6.4	6.6	6.5 b
	HydroSOS logo	8.0 a	7.4	7.0	7.4 a
Multiple Range Tukey Test Location					
Location	L1	7.7 a	6.6	6.9	6.9 b
	L2	7.0 b	7.1	7.2	7.3 a
	L3	7.3 ab	7.0	6.3	6.0 b
Multiple Range Tukey Test Logo effect vs Location					
Conventional	L1	7.1 ab	5.9	6.5	6.3 ab
	L2	7.0 ab	6.6	7.3	7.6 a
	L3	5.9 c	6.7	5.9	5.6 b
HydroSOS logo	L1	8.3 a	7.2	7.3	7.5 a
	L2	6.9 b	7.7	7.0	7.1 ab
	L3	8.7 a	7.2	6.8	7.7 a

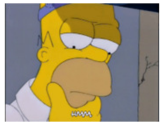
HIDROSOSTENIBLE

L1 and L3 rural environment
L2 urban environment

Now it is the moment to tell me your choice

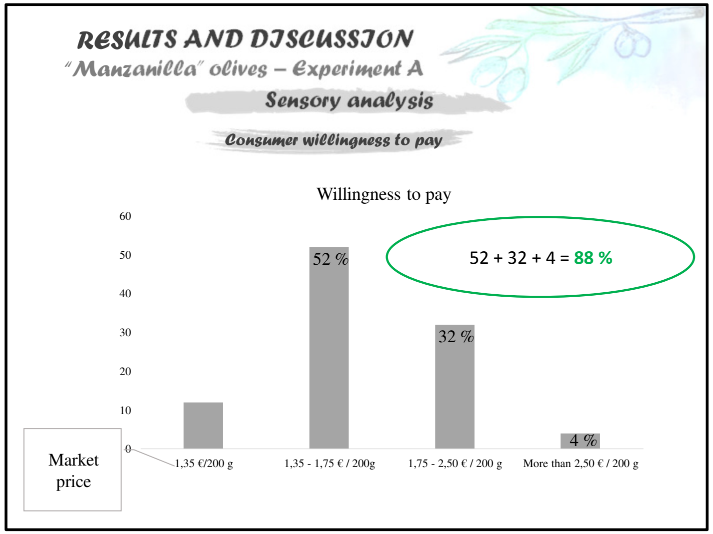
Which olives jar would you buy?



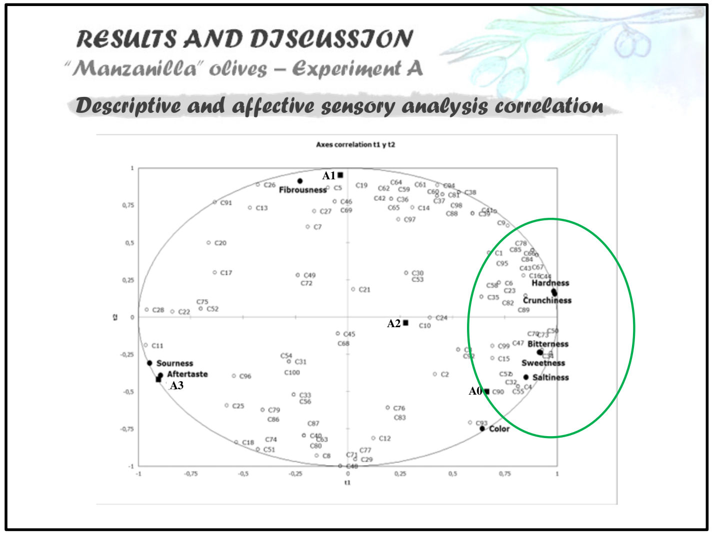


HIDROSOSTENIBLE

CONVENCIONAL	HIDROSOSTENIBLE
200 g	200 g
	
1,35 €	1,75 €

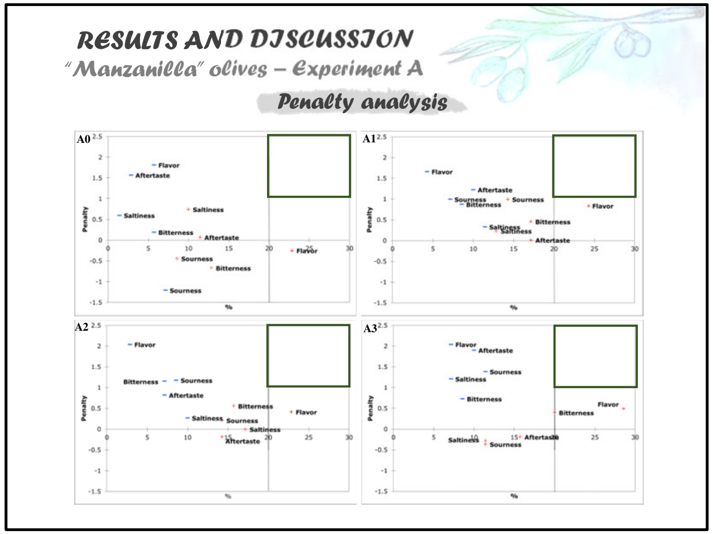


88% indicated that they would be willing to pay more than the market price (€1.35 per 200g)
52% between 1.35 and 1.75
32% between 1.75 and 2.50
4% more than 2.50



This analysis makes it possible to identify the purchase drivers, which are the ones that are grouped at this extreme.

FUTURE ACCEPTANCE OF WATER SUSTAINABLE OLIVES



A penalty analysis was also carried out with the four samples WHICH GIVES US INFORMATION ON WHETHER THERE IS SOME POINT OF IMPROVEMENT ACCORDING TO THE TASTES OF THE CONSUMERS It can be seen that no attribute was marked as improvable, which coincides with the previous results of the affective study. In a previous study with hydroSUSTAINABLE almonds, the same thing happened and consumers did not highlight any changes.

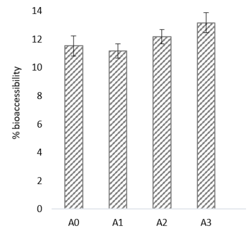
RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

In vitro digestion simulation

	Antioxidant activity (mmol Trolox eq kg^{-1})															TPC (g GAE kg^{-1})				
	ABTS$^{+\bullet}$					DPPH$^{\bullet}$					FRAP									
	TM	SF	RF	Total	% var	TM	SF	RF	Total	% var	TM	SF	RF	Total	% var	TM	SF	RF	Total	% var
EXPERIMENT A																				
ANOVA[†]	NS	**	NS	*		NS	***	NS	*		NS	NS	NS	NS		NS	**	NS	NS	
A0	6.61	1.34 b[‡]	0.11	1.45 b	-78.1	12.1	0.51 ab	0.08	0.59 ab	-95.1	15.4	1.06	0.20	1.25	-91.9	6.17	0.70 b	0.42	1.13	-81.7
A1	7.48	1.56 ab	0.13	1.69 ab	-77.4	13.0	0.60 a	0.26	0.87 a	-93.3	16.0	0.75	0.22	0.97	-93.9	6.46	0.72 a	0.33	1.05	-83.7
A2	7.07	1.43 ab	0.11	1.53 b	-78.4	12.5	0.37 bc	0.09	0.47 ab	-96.2	14.8	0.89	0.23	1.12	-92.4	5.90	0.72 a	0.28	0.99	-83.2
A3	7.19	1.71 a	0.25	1.98 a	-72.5	11.2	0.25 c	0.00	0.19 b	-98.3	15.5	0.95	0.22	1.17	-92.5	5.47	0.72 a	0.30	1.02	-81.4

TM: test matrix; SF: soluble fraction; RF: residual fraction; Total: SF+RF; % var: % variation



In the antioxidant activity of the ABTS and DPPH trials, small changes were observed in the deficit irrigation treatments.
The percentage of variation showed a great decrease in concentration compared to the matrix extracted in the laboratory, which may be due to the acidic conditions of digestion that can cause the degradation of antioxidants and polyphenols. **Previous studies determined that only 25% of oleuropein and 20% of comselogoside are stable during digestion.**
Regarding the percentage of bioaccessibility, no significant differences were found between samples. Previous studies also showed a low bioaccessibility of polyphenols and antioxidants in "Cornecuelo" olives.

RESULTS AND DISCUSSION

"Manzanilla" olives

Experiment B

B0: Full irrigated.
B1: RDI moderated (short time) (-2 MPa from september to harvest → stage III).
B2: RDI moderated (long time) (-2 MPa from half august to harvest → stage III).

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment B

Irrigation treatments

Stress parameter	2015				2016				ANOVA	2015	2016
	ANOVA	B0	B1	B2	ANOVA	B0	B1	B2			
Min ψ_{stem} (MPa)	NS	-2.07	-1.99	-2.20	NS	-2.44	-2.44	-2.66	***	-2.08 b	-2.51 a
SI (MPa x day)	NS	34.3	26.4	33.8	*	75.7 ab	62.9 b	85.5 a	**	31.5 b	74.8 a

In this experiment, the results of both campaigns will be shown due to the great difference between them.
In this experiment, the large variabilities caused by external factors such as soil, climate, rain, etc., caused the stress in 2016 to be higher than in 2015. Although, due to this variability, statistically significant differences are not shown , the stress of treatment B2 was the highest.

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment B

Morphological analysis

		2015				2016						
		ANOVA	B0	B1	B2	ANOVA	B0	B1	B2	ANOVA	2015	2016
Raw olives												
Fruit weight (g)		NS	5.03	5.27	5.07	NS	3.40	3.06	3.05	***	5.13 a	3.17 b
Pit weight (g)		NS	0.89	0.82	0.85	NS	0.65	0.62	0.62	***	0.85 a	0.63 b
Fruit/pit ratio		NS	5.65	6.43	6.00	NS	5.24	4.90	4.89	***	6.04 a	5.03 b
Equatorial diameter (mm)		NS	19.4	19.7	19.5	NS	16.4	16.1	15.9	NS	19.5	19.5
Longitudinal diameter (mm)		NS	23.5	23.6	23.5	NS	19.7	19.6	19.2	***	23.5 a	16.1 b
Texture	Puncture Test (N)	NS	2.67	2.36	2.85	NS	2.57	2.86	2.85	NS	2.71	2.75
	Magness Taylor (N)	**	19.2 a	9.02 b	10.7 b	***	17.7 a	10.3 b	10.4 b	NS	12.5	12.8 b
Color	*L**	NS	55.9	57.7	57.3	NS	59.9	58.6	59.9	NS	56.9	59.5
	*a**	NS	-18.8	-18.4	-18.3	NS	-19.2	-17.8	-18.9	NS	-18.5	-18.7
	*b**	NS	37.9	39.6	39.3	NS	41.1	39.5	41.3	NS	38.9	40.7
Table olives												
Fruit weight (g)		*	5.51 a	4.75 b	5.07 ab	NS	2.87	2.98	2.82	***	5.11 a	2.89 b
Pit weight (g)		NS	0.87	0.79	0.83	NS	0.60	0.61	0.59	***	0.83 a	0.60 b
Fruit/pit ratio		NS	6.33	6.01	6.11	NS	4.76	4.87	4.76	***	6.16 a	4.79 b
Equatorial diameter (mm)		NS	18.4	18.9	18.2	NS	15.9	15.7	15.5	***	18.5 a	15.7 b
Longitudinal diameter (mm)		***	22.4 b	23.2 a	22.1 b	NS	20.0	19.4	19.4	***	22.6 a	19.6 b
Texture	Puncture Test (N)	NS	1.21	1.06	1.23	NS	1.24	1.10	1.22	NS	1.17	1.18
	Magness Taylor (N)	NS	8.29	8.92	10.1	*	8.59 b	9.16 b	10.5 a	NS	9.10	9.44
Color	*L**	NS	53.3	51.6	55.4	NS	54.6	55.7	57.9	NS	53.4	56.1
	*a**	**	1.17 ab	1.65 a	0.78 b	NS	1.43	1.19	0.87	NS	1.20	1.16
	*b**	*	34.2 b	33.6 b	37.6 a	NS	33.3	33.8	36.2	NS	35.1	34.4

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment B

Antioxidant activity and total phenol content

	2015				2016				ANOVA	2015	2016
	ANOVA	B0	B1	B2	ANOVA	B0	B1	B2			
Raw olives											
$ABTS^+$ (mmol Trolox kg^{-1})	***	28.6 a	24.9 b	28.1 a	*	27.6 ab	25.2 b	28.8 a	NS	27.2	27.2
$DPPH^·$ (mmol Trolox kg^{-1})	***	48.9 b	52.0 a	46.7 c	*	47.70 b	53.94 a	48.58 b	**	49.5 b	50.1 a
FRAP (mmol Trolox kg^{-1})	***	24.3 b	23.7 c	28.4 a	**	23.6 b	23.2 b	27.9 a	***	25.5 a	24.9 b
TPC (g GAE kg^{-1})	***	32.4 a	21.4 b	32.2 a	***	32.6 a	21.6 b	33.4 a	***	28.6 b	29.2 a
Table olives											
$ABTS^+$ (mmol Trolox kg^{-1})	NS	9.04	9.10	9.19	NS	8.74	9.41	9.34	NS	9.11	9.16
$DPPH^·$ (mmol Trolox kg^{-1})	***	7.41 b	8.61 a	8.42 a	*	7.31 c	9.64 a	8.62 b	NS	8.15	8.52
FRAP (mmol Trolox kg^{-1})	*	19.2 a	18.1 b	20.1 a	**	19.1 a	17.8 b	19.3 a	NS	19.1	18.73
TPC (g GAE kg^{-1})	***	5.46 b	5.87 a	5.82 a	**	5.46 c	5.90 a	5.83 b	NS	5.72	5.73

When comparing these results with experiment A, it can be affirmed the importance of the stage in which deficit irrigation is applied on the synthesis of antioxidant compounds, since when applying water stress in stage 2 no significant differences were found. Other authors did find significant differences in the FRANTOIO variety in the concentration of POLYPHENOLS, when applying irrigation during the bone hardening phase.

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment B

Fatty acid profile

Fatty acid (%)	2015				2016				ANOVA	2015	2016
	ANOVA	B0	B1	B2	ANOVA	B0	B1	B2			
Raw olives											
Palmitic acid (C16:0)	NS	16.2	16.9	16.8	NS	18.6	17.8	18.2	*	16.6 b	18.2 a
Stearic acid (C18:0)	NS	2.72	2.59	2.85	**	2.90 b	3.01 b	3.40 a	**	2.72 b	3.11 a
Oleic acid (C18:1)	NS	73.4	70.7	70.5	*	68.8 b	70.7 a	69.5 ab	NS	71.5	69.7
Linoleic acid (C18:2)	NS	5.08	6.82	6.69	NS	5.62	4.37	4.88	NS	6.19	4.95
Linolenic acid (C18:3)	NS	0.94	0.94	1.11	NS	1.30	1.26	1.16	*	0.99 b	1.24 a
Araquidic acid (C20:0)	NS	0.42	0.38	0.48	NS	0.44	0.56	0.60	NS	0.43	0.53
Σ SFA	NS	19.3	19.9	20.1	NS	21.9	21.4	22.2	**	19.8 b	21.8 a
Σ MUFA	NS	73.4	70.7	70.5	*	68.8 b	70.7 a	69.5 ab	NS	71.5	69.7
Σ PUFA	NS	6.01	7.75	7.79	NS	6.92	5.63	6.04	NS	7.18	6.20
(MUFA+PUFA)/SFA	NS	4.11	3.94	3.89	NS	3.45	3.57	3.40	NS	3.98	3.47
Table olives											
Palmitic acid (C16:0)	NS	16.9	16.8	16.5	*	18.7 a	17.7 b	17.0 b	***	16.7 b	17.8 a
Stearic acid (C18:0)	NS	2.74	2.93	2.84	NS	2.73	2.62	3.06	NS	2.84	2.80
Oleic acid (C18:1)	NS	70.82	69.28	70.47	*	70.1 b	70.3 b	71.4 a	*	70.2 b	70.6 a
Linoleic acid (C18:2)	NS	6.41	7.87	7.23	NS	6.72	7.53	6.87	NS	7.17	7.04
Linolenic acid (C18:3)	NS	1.02	0.94	0.99	NS	1.18	1.26	1.29	**	0.98 b	1.24 a
Araquidic acid (C20:0)	NS	0.47	0.46	0.45	NS	0.48	0.49	0.46	NS	0.46	0.48
Σ SFA	**	20.1 a	20.2 a	19.7 b	*	22.0 a	20.8 b	20.5 b	***	20.0 b	21.1 a
Σ MUFA	NS	70.82	69.28	70.47	*	70.1 b	70.3 b	71.4 a	*	70.2 b	70.6 a
Σ PUFA	NS	7.42	8.81	8.22	NS	7.90	8.79	8.16	**	8.15 b	8.28 a
(MUFA+PUFA)/SFA	**	3.89 b	3.86 b	3.99 a	*	3.57 b	3.81 a	3.87 a	***	3.91 a	3.75 b

2015 with less stress → NS

Something similar occurred in previous studies when deficit irrigation was applied in stage 2, therefore, water stress could cause an improvement in the lipid profile of table olives.

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment B

Organic acids and sugars

Raw olives

Organic acid or sugar ($g\ kg^{-1}$ fw)		2015				2016				ANOVA	2015	2016
		ANOVA	B0	B1	B2	ANOVA	B0	B1	B2			
Organic acids	Citric acid	NS	0.255	0.255	0.230	NS	0.253	0.263	0.237	NS	0.247	0.251
	Tartaric acid	**	0.140 a	0.067 b	0.084 b	*	0.143 a	0.066 b	0.083 b	NS	0.097	0.098
	Malic acid	NS	0.490	0.487	0.432	NS	0.516	0.487	0.450	NS	0.469	0.484
	Succinic acid	*	0.500 a	0.144 b	0.137 b	*	0.505 a	0.145 b	0.137 b	NS	0.260	0.262
Sugars	Sucrose	NS	1.758	1.696	1.677	NS	1.764	1.690	1.677	NS	1.710	1.710
	Glucose	NS	3.905	3.283	3.482	NS	3.915	3.427	3.528	NS	3.556	3.623
	Fructose	NS	1.455	1.626	1.934	NS	1.478	1.756	1.966	NS	1.672	1.733

Table olives

Organic acids	Phytic acid: 6.42 g kg−1 fw
	Lactic acid: 1.50 g kg−1 fw
	Acetic acid: 0.79 g kg−1 fw
Sugars	Maltoheptaose: 2.03 g kg−1 fw
	Mannitol: 2.46 g kg−1 fw
	Glycerol: 0.77 g kg−1 fw

Regarding the profile of organic acids and sugars, only tartaric and succinic were slightly decreased with deficit irrigation in raw olives. In the case of table olives, as in experiment A, the profile changed due to the fermentation process and no significant differences were found between samples.

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment B

Polyphenolic profile

Raw olives

	Hydroxytyrosol glucoside	Caffeoyl-6'-secologanoside	Oleoside	Elenolic acid glucoside	Oleuropein aglycone	Quercetin-3-*O*-rutinoside
	(mg eq quercetin-3-*O*-rutinoside 100 g^{-1} fw)					
ANOVA						
Irrigation RO	NS	*	*	*	NS	NS
Tukey Multiple Range Test						
Irrigation RO						
B0	4.99	10.4 a	94.7 b	4.92	70.6 b	61.1 a
B1	5.28	6.33 b	99.9 b	3.70	80.4 ab	51.2 b
B2	5.21	7.01 b	166 a	4.73	89.0 a	55.9 ab

	Luteolin-3-*O*-rutinoside	Verbascoside	Oleoside diglucoside	Dihydro-oleuropein	Oleuropein diglucoside	Caffeoyl-6'-secologanoside	Oleuropein	Comselogoside	Luteolin	Ligstroside	2''-Hydroxyoleuropein
	(mg eq luteolin-3-*O*-rutinoside 100 g^{-1} fw)										
ANOVA											
Irrigation RO	*	*	*	*	NS	*	*	**	*	*	*
Tukey Multiple Range Test											
Irrigation RO											
B0	44.8 b	13.9 b	31.3 a	2.93 a	3.21	2.06 b	209 b	1.01 b	6.48 b	8.92 b	4.98 b
B1	51.7 ab	12.0 b	31.0 a	1.77 b	2.50	3.84 a	219 ab	3.89 a	7.96 a	10.6 a	5.16 b
B2	61.8 a	18.9 a	25.5 b	3.13 a	2.51	2.18 b	228 a	0.33 c	6.12 b	9.45 ab	8.88 a

HYDROXYTYROSOL NS

Other authors reported the increase in tyrosol and its derivatives as a consequence of deficit irrigation, which agrees with the results of this experiment.

RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment A

Polyphenolic profile

Table olives

	Hydroxytyrosol glucoside	Caffeoyl-6'-secologanoside	Oleoside	Elenolic acid glucoside	Oleuropein aglycone	Quercetin-3-*O*-rutinoside
	(mg eq quercetin-3-*O*-rutinoside 100 g^{-1} fw)					
ANOVA						
Irrigation TO	NS	NS	*	*	NS	NS
Tukey Multiple Range Test						
Irrigation TO						
B0	0.77	0.19	0.88 a	0.19 b	0.18	0.39
B1	0.72	0.16	0.54 ab	0.30 ab	0.12	0.39
B2	0.70	0.23	0.39 b	0.38 a	0.12	0.40

	Luteolin-3-*O*-rutinoside	Verbasco-side	Oleoside di-glucoside	Dihydro-oleuropein	Oleuropein diglucoside	Caffeoyl-6'-secologanoside	Oleuro-pein	Comselo-goside	Luteo-lin	Ligstroside	2''-Hydroxyoleuropein
	(mg eq luteolin-3-*O*-rutinoside 100 g^{-1} fw)										
ANOVA											
Irrigation TO	*	NS	*	*	NS	NS	*	*	NS	NS	NS
Tukey Multiple Range Test											
Irrigation TO											
B0	0.20 b	0.09	7.17 ab	0.11 ab	0.15	0.14	0.45 ab	0.13 ab	0.05	0.18	0.34
B1	0.34 a	0.09	7.83 a	0.08 b	0.11	0.09	0.25 b	0.16 a	0.04	0.17	0.35
B2	0.18 b	0.11	6.82 b	0.18 a	0.13	0.13	0.53 a	0.08 b	0.03	0.18	0.30

HYDROXYTYROSOL NS

There was also an increase in the concentration of some polyphenols DERIVED FROM TYROSOL

RESULTS AND DISCUSSION

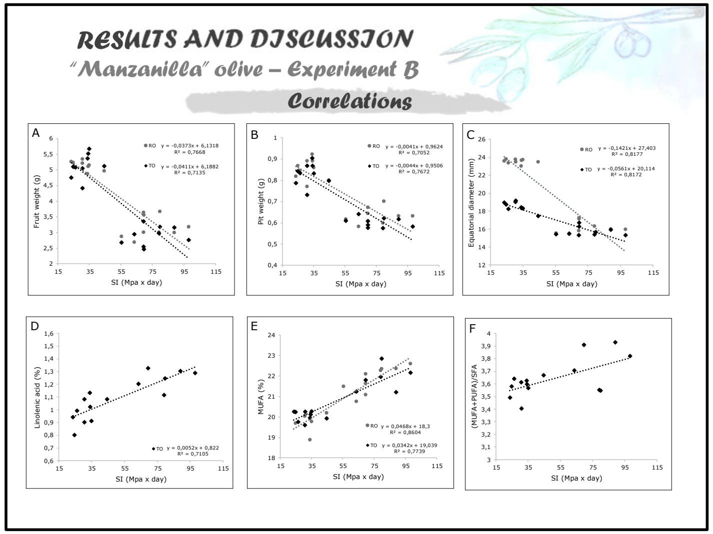
"Manzanilla" olives – Experiment B

Polyphenolic profile

Processing

	Hydroxytyrosol glucoside	Caffeoyl-6'-secologanoside	Oleoside	Elenolic acid glucoside	Oleuropein aglycone	Quercetin-3-*O*-rutinoside
	(mg eq quercetin-3-*O*-rutinoside 100 g^{-1} fw)					
ANOVA						
Processing	***	***	***	***	***	***
Tukey Multiple Range Test						
Processing						
RO	5.16 a	7.91 a	120 a	4.44 a	80.0 a	56.1 a
TO	0.73 b	0.19 b	0.60 b	0.28 b	0.14 b	0.39 b

	Luteolin-3-*O*-rutinoside	Verbascoside	Oleoside di-glucoside	Dihydro-oleuropein	Oleuropein diglucoside	Caffeoyl-6'-secologanoside	Oleuropein	Comselogoside	Luteolin	Ligstroside	2''-Hydroxyoleuropein
	(mg eq luteolin-3-*O*-rutinoside 100 g^{-1} fw)										
ANOVA											
Processing	***	***	***	***	***	***	***	***	***	***	
Tukey Multiple Range Test											
Processing											
RO	52.8 a	14.9 a	29.2 a	2.61 a	2.74 a	2.69 a	219 a	1.74 a	6.85 a	9.64 a	6.34 a
TO	0.24 b	0.09 b	7.27 b	0.12 b	0.13 b	0.12 b	0.41 b	0.12 b	0.04 b	0.17 b	0.33 b



AND WHAT HAVE WE LEARNED?

After all the trials shown, the correlations with the stress integral were studied, although no statistical differences were found in the morphological parameters, a negative correlation was found between the weight of the olive, the stone weight and the equatorial diameter and the integral. of stress. Therefore, the greater the stress integral applied in stage 3, the smaller the size of the fruit, although the pulp/stone ratio will be maintained as a consequence of the decrease in the weight of both.Regarding linoleic acid, MUFAs, and the ratio of unsaturated fatty acids to saturated ones, the correlation found was positive, therefore, the higher the stress, the higher the content of linolenic acid, MUFAs, and the better unsaturated/saturated ratio.

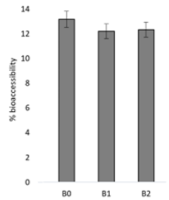
RESULTS AND DISCUSSION

"Manzanilla" olives – Experiment B

In vitro digestion simulation

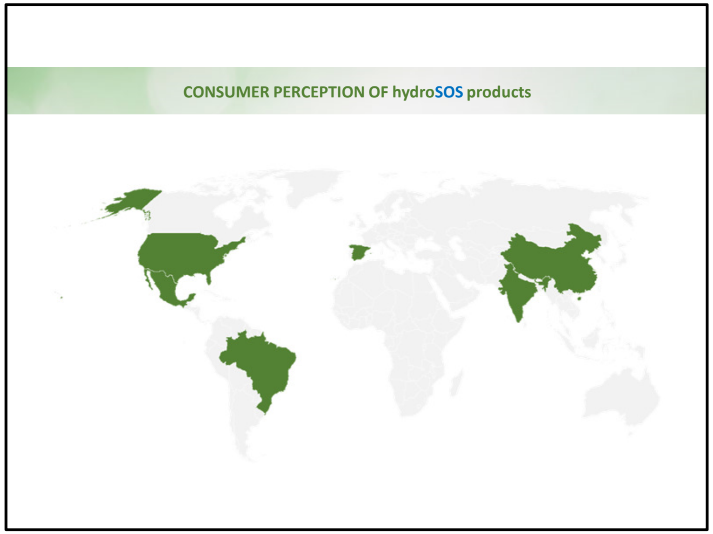
	Antioxidant activity (mmol Trolox eq kg^{-1})															TPC (g GAE kg^{-1})				
	ABTS$^{\bullet+}$					DPPH$^{\bullet}$					FRAP									
	TM	SF	RF	Total	% var	TM	SF	RF	Total	% var	TM	SF	RF	Total	% var	TM	SF	RF	Total	% var
	EXPERIMENT B																			
ANOVA	NS	NS	NS	NS		*	NS	NS	NS		**	NS	NS	NS		**	NS	NS	NS	
B0	8.74	1.23	0.05	1.29	-85.2	7.31 c	0.47	0.00	0.47	-93.6	19.1 a	0.99	0.22	1.21	-93.7	5.46 c	0.72	0.23	0.95	-82.6
B1	9.41	1.54	0.07	1.62	-82.8	9.64 a	0.34	0.00	0.34	-96.5	17.8 b	1.12	0.24	1.36	-92.4	5.90 a	0.72	0.34	1.05	-82.2
B2	9.34	1.26	0.06	1.32	-85.9	8.62 b	0.31	0.00	0.31	-96.4	19.3 a	1.12	0.24	1.36	-93.0	5.83 b	0.72	0.24	0.96	-83.5

TM: test matrix; SF: soluble fraction; RF: residual fraction; Total: SF+RF; % var: % variation



After in vitro digestion simulation, in this experiment **no significant differences were found** between irrigation treatments nor in the percentage of bioaccessibility of polyphenols.

Las preguntas se organizaron en 5 niveles:



The study was carried out using an online survey, run through the Qualtrics platform (Provo, UT, USA). Six countries were selected (USA, China, Mexico, Brazil, Spain and India) based on availability
of databases and to represent large population countries on 4 continents.

No specific criteria regarding food habits or behavior towards the environment were used to qualify the respondents.

The survey was completed by 3600 consumers (50% self-identified men and

women; 600 consumers per country). Four age ranges were selected (25% of participants for each age range), clearly dierentiated: 18–23 years (centennials); 24–41 years (millennials); 42–52 years (gen X) and 53–73 years (baby boomers).

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ELSEVIER

Consumer understanding of sustainability concept in agricultural products

Paola Sánchez-Bravo[a], Edgar Chambers V[b], Luis Noguera-Artiaga[a], Esther Sendra[a], Edgar Chambers IV[b], Ángel A. Carbonell-Barrachina[a,*]

[a] Universidad Miguel Hernández de Elche (UMH). Escuela Politécnica Superior de Orihuela (EPSO). Department of Agro-Food Technology. Research Group "Food Quality and Safety (CSA)". Carretera de Beniel, Km 3.2, 03312 Orihuela, Alicante, Spain
[b] Kansas State University. Center for Sensory Analysis and Consumer Behavior. Manhattan, KS 66502, United States

agronomy

MDPI

Article

How Consumers Perceive Water Sustainability (HydroSOStainable) in Food Products and How to Identify It by a Logo

Paola Sánchez-Bravo[1], Edgar Chambers V[2], Luis Noguera-Artiaga[1], Esther Sendra[1], Edgar Chambers IV[2] and Ángel A. Carbonell-Barrachina[1,*]

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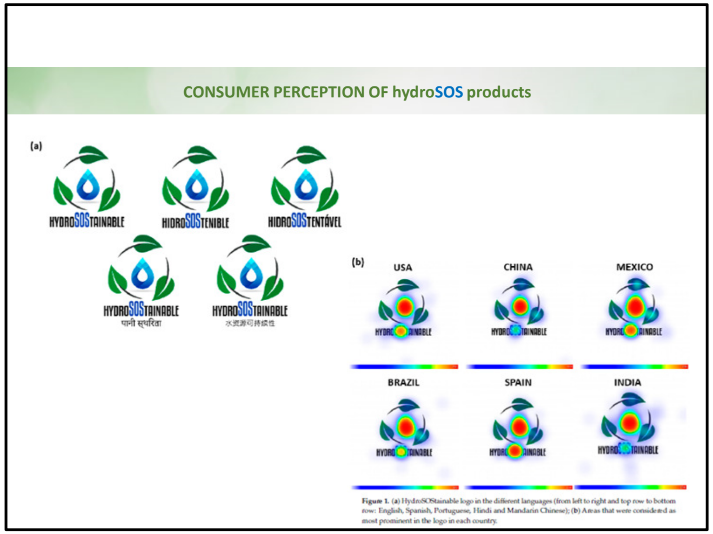

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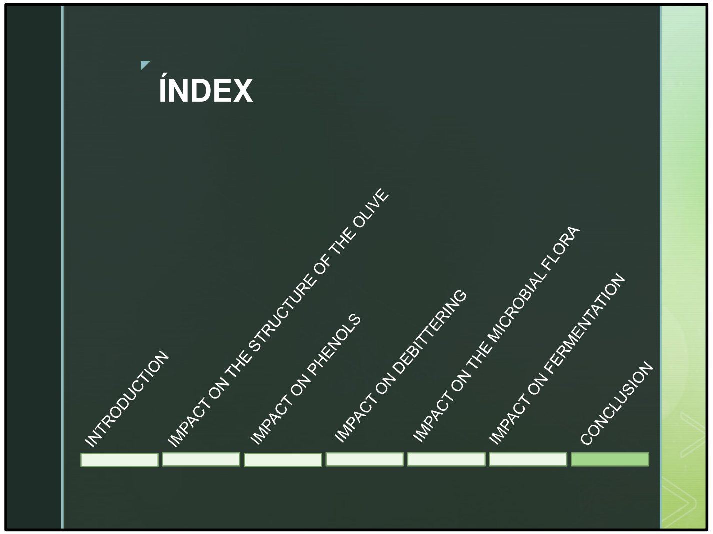
CONCLUSIONS

- In general, consumers associate **sustainable production with organic products** and, in turn, associate organic products with higher quality and health benefits.
- In all countries, consumers think that the food categories in which the most water can be saved throughout their production and distribution chain are those related to primary consumption, such as **cereals and vegetables**. This finding clearly shows that consumers do not associate food processing with water consumption.
- The **logo** proposed for the **hydroSOStainable products** was valued positively, especially by the **young generations**, and it was considered useful for the identification of these sustainable foods.



Let’s start with the introduction

CONCLUSIONS

- ✓ **Morphological quality** of **hydroSOStainable olives** showed some changes as compared with control. In Experiment A, RDI strategies produced rounder, harder, lighter and greener olives while in Experiment B the size was slightly reduced but the pulp proportion was maintained.

- ✓ Regarding **mineral composition, antioxidant activity, TPC and organic acids and sugars** of Experiment A, the hydroSOStainable olives showed the same values than control, nutritional and functional quality was maintained and RDI strategies did not affected olives quality.

- ✓ Several **volatile compounds** were affected by the RDI treatments, as well as the intensity of some sensory descriptors. As Experiment B, when RDI was highest, antioxidant activity, TPC and MUFA content were increased. It was also found a **positive correlation** between de SI and the FRAP assay to determine antioxidant activity in several olive samples in both experiments.

RDI: regulated dficit irrigation; TPC: total phenolic content; MUFA: Monounsaturated fatty acids; SI: stress integral

CONCLUSIONS

- ✓ With respect to **hydroSOStainable olives oil**, both experiments showed an **increase of MUFAs** and **decreased SFAs**, improved, balanced **volatile profiles** and **sensory attributes** when the water restriction was applied during pit hardening in a moderate stress.
- ✓ The **Spanish-style processing** produced a decreased in the concentration of all **polyphenols** due to the osmosis effect during fermentation and brining. HydroSOStainable olives polyphenol profile was improved when trees were submitted to a moderate stress in both experiments. HydroSOStainable TO are healthier for consumers due to an increase of some polyphenols such as oleuropein.
- ✓ **Affective sensory analysis** was carried out with TO of Experiment A in three locations. Consumers preferred TO with **hydroSOStainable logo** and were willed to pay a higher price for them. The logo created an effect on consumers as they marked these TO with higher green-olive flavor and overall liking.

MUFA: Monounsaturated fatty acids; TO: table olives

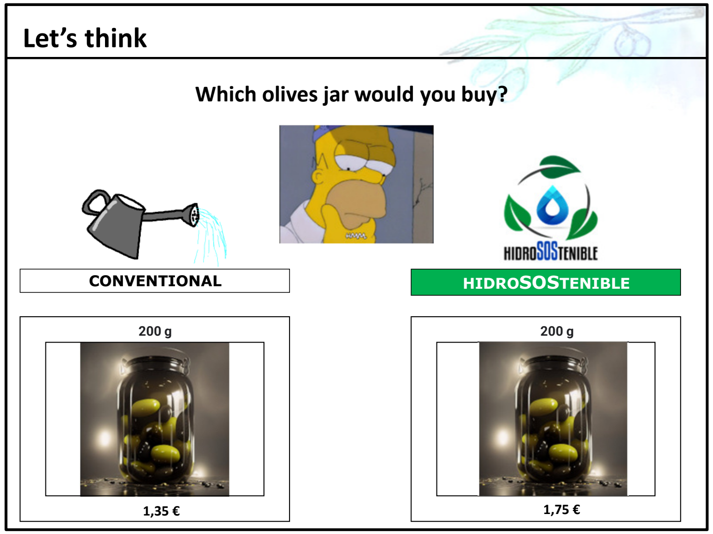
CONCLUSIONS

- ✓ **Antioxidant activity and phenolic content after *in vitro* gastrointestinal digestion** simulation showed different behavior in Experiment A and B. In the first (A), small differences were found for TPC, $ABTS^{+}$ and $DPPH^{\cdot}$ assays between irrigation treatments but in the latter, no differences were found. As a whole, a total amount of 1 g GAE kg^{-1} was extracted after digestion, so ~12 % of bioaccessible polyphenols were found on control and hydroSOStainable TO. Eating 10 hydroSOStainable TO per day involve the daily intake of 40 mg of bioaccessible polyphenols for protective effect against chronic diseases, which involves the 7 % of the daily recommendations.

Therefore, it could be concluded that, **if the water reduction is applied during pit hardening stage (Experiment A), fruit size and yield are maintained with no significant differences in composition, and when the water deficit is applied during rehydration stage (Experiment B), olive size is reduced but improved the functional quality of olives.**

FUTURE RESEARCH

- ✓ Study the effect of the irrigation treatments studied in this thesis in **more olive varieties and locations**. It would be good to study different varieties at the same location and repeat the study in other locations to be able to study the effect of water stress in the varieties and also how the location affects.
- ✓ It would be interesting to check the quality of the table olives after each one of **the stages of the production chain**; this is, after the alkalinization, after the different washing steps, and after each step of the fermentation (after each change of brine).
- ✓ Following the study of phenols bioaccessibility, it would be interesting to study the phenols **bioavailability**.



Before I start even with the Introduction section, I would like you to share with you an idea. Imagine you go to the supermarket and you have these two options for table olive:

1. You have this jar of 200 g of olives cultivated under "conventional" conditions and it cost you 1,35 euros.

2. Besides, you have a second option. This jar of 200 g of olives cultivated with a "lower amount of irrigation water", the quality is similar but it cost you 1,75 euros.

Which jar would you take home? … **Why?** Please, just think about it and we will answer these two questions at the end of the presentation.

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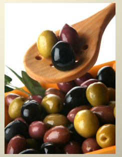

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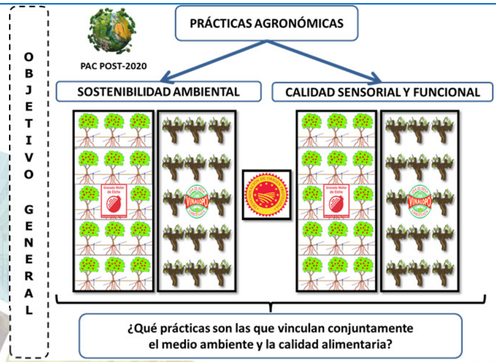
EVALUATION OF AGRONOMIC PRACTICES ON ENVIRONMENTAL SUSTAINABILITY AND SENSORY AND FUNCTIONAL QUALITY APLIED TO PDO GRANADA MOLLAR AND UVA EMBOLSADA DEL VINALOPÓ



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AGROALNETX 2022/040

TÍTULO DEL PROYECTO: **Estrategias HidroSOStenibles en frutales de hueso: Caso a estudio el albaricoquero**	ACRÓNIMO: **HidroSOStoneFruit**

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EuroDisBioFood

European Dimension of Internationalization of Doctoral Study in Biotechnology and Food Sciences

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The priority objective of EuroDisBioFood

- is to promote the internationalization of doctoral study programs in English focused on biotechnology and food sciences with the strategic goal of the preparatory phase of the JointDegree study program at PhD. level at the Slovak University of Agriculture in Nitra (SUA) and foreign universities Wroclaw University of Environmental and Life Sciences (WUELS) in Poland, Miguel Hernández University of Elche (MHU) in Spain and University of Molise (UM) in Italy.


Merci pour votre
attention