Universidad de Jaén

III OLEA INTERNATIONAL PROJECT NETWORKING EVENT (S1)
Revision of Project Results

OLIVEN - Opportunities for olive oil value chain enhancement through the by-products valorisation

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Project Coordinator

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OLEA R&I PROJECT NETWORKING OLIVE SECTOR

PROJECT INFORMATION

FUNDING PROGRAMME

- ARIMNet (ERANET initiatives)

ARIMNet = Agricultural Research Innovation projects in the Mediterranean NETwork

- Call: ARIMNet2 2017 for **Young Researchers** from Mediterranean Countries
- Funding Institution: FP7 (European Union)
- Total Budget: 227.000 €
- Duration: 3 years (September 2018 – September 2021)

PROJECT INFORMATION

CONSORTIUM

- Partner 1 (Coordinator): University of Jaén (UJA), Spain
- Partner 2: Ankara University (AU), Turkey
- Partner 3: Olive Research Institute (ORI), Turkey
- Partner 4: L'Institut de l'Olivier (IO), Tunisia
- Partner 5: Direction Générale de la Production Agricole (DGPA), Tunisia
- External Colaborator: Circular Carbon (CIRCA), Spain-Argentina

3 Young Researchers

2 Young Researchers

2 Young Researchers

3 Young Researchers

1 Young Researcher

BACKGROUND

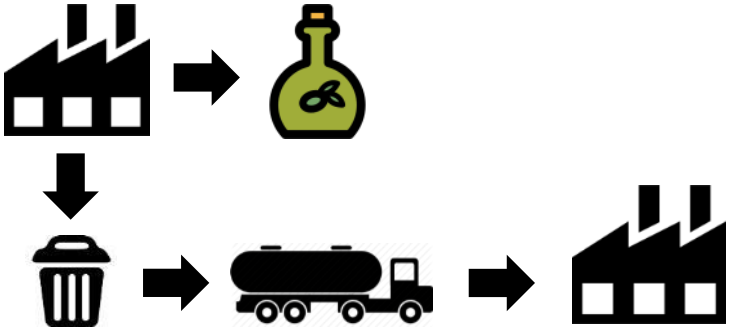
Electricity
Fuels
Chemicals
Water

Electricity
Fuels
Chemicals
Water

FARMING

PRUNINGS

PRODUCTION & WASTE TREATMENT

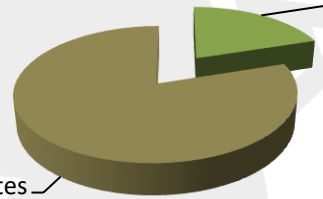


POMACE

STONES

WASTE WATER

100 kg olives produce > 80 kg of wastes



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BACKGROUND

More features of the olive oil sector…

	Area harvested (Ha)	Oil production (10^3 Tonnes)
Spain	2.507.684	1.251
Italy	1.143.363	429
Greece	927.955	346
Tunisia	1.746.360	280
Turkey	847.738	263
Morocco	919.385	140
Portugal	348.654	134
Syria	693.668	100
Algeria	343.113	80
Egypt	58.988	28

2017 HARVEST

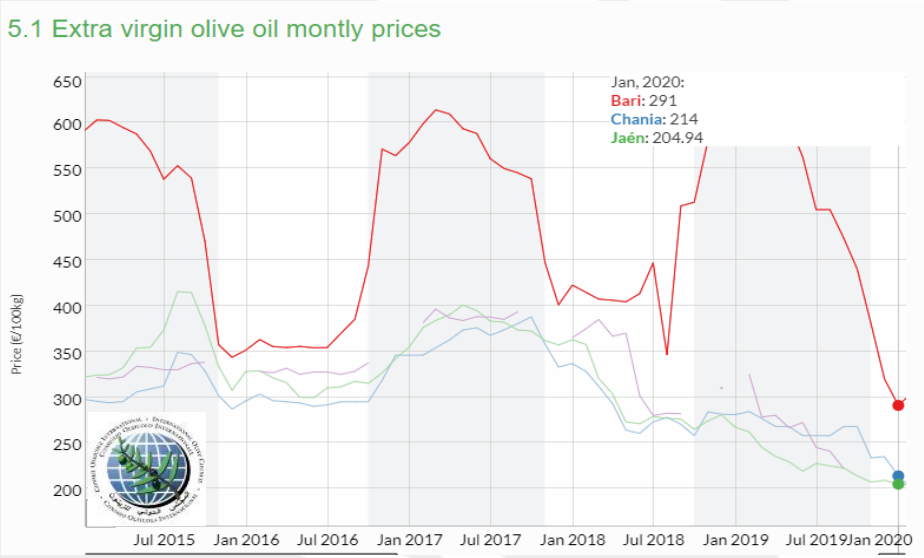
Top 10 in the Mediterranean region

- Largest producers in Mediterranean Countries (1.9 million olive farms)
- **Large amounts of waste** produced, mostly biomass.
- A sector that needs **modernisation** to face external challenges

BACKGROUND

Situation TODAY (before Coronavirus)

- Strong reduction of the virgin oil price (> 40 %)
- Social disturbances, strikes, poverty rises up for farmers and olive oil producers.
- Solution of the Governments → **More Subsidies**



Forbes

1309 views | Feb 7, 2020, 02:27am EST

Spanish Farmers Rise Up

EL PAÍS ECONOMY AND BUSINESS

AGRICULTURE ›

Why Spain's farmers are up in arms

Across the country, agricultural organizations are planning street action to draw attention to the precarious conditions of nearly one million businesses

Olive producers from Granada and Jaén block the A-44 highway in protest over prices last Thursday. FERMIN RODRIGUEZ / EL PAÍS

CHALLENGES

¿THE FUTURE OF AGRIFOOD SECTOR?

More Sustainability for 2030

- Reduction of pesticides (50 %)
- Reduction of fertilizers (20 %)
- Increasing of organic farms (25 %)
- Reduce soil nutrient loss by 50 %
- Promote Circular Economy

Forbes

EU Plans To Reduce Pesticides By 50%

The plan includes a target of reducing the use of pesticides by 50% in the next decade. The plan would also reduce sales of antimicrobials for farmed animals by 50%, and the use of fertilizers by 20%, by 2030. The share of organic farming would also be increased by 25% by 2030 - up from the current 8%.

EU executive sets 'landmark' target to triple organic farmland

The European Commission has proposed to increase the area of EU farmland dedicated to organic production to 25% by 2030 while cutting the use of pesticides and fertilisers across the board in a 'farm to-fork' strategy for sustainable food production.

Kyriakides: Curbing pesticide dependency to set a world sustainable standard

Currently renowned for producing safe, nutritious and high-quality foodstuffs, the European farming sector should also become a world standard for sustainability, according to the new Food Safety Commissioner Kyriakides.

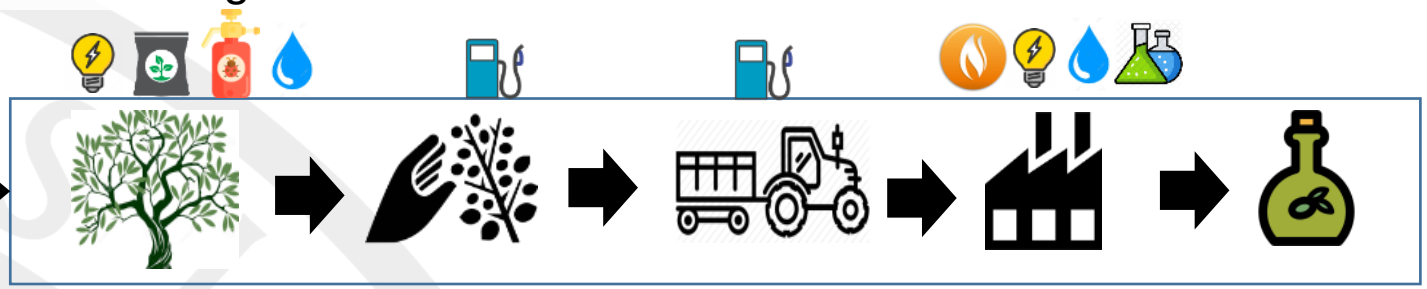
CHALLENGES

- **DIFFERENT SUPPLY CHAINS IN EACH COUNTRY**: olive oil process (2 and 3 phase, pressure), social, number and capacity of the olive mills, wastes, farming processes, etc.
- **FEW STUDIES** about **olive oil value chain** implementation.
- **NOT MEASURING OF WASTE VALORIZATION IMPACT** (e.g. LCA and LCC)
- Current **EUROPEAN FUNDS** are **not focused** on the real issues of the supply chain

OBJECTIVE

Main objective of OLIVEN

- Define **successful technologies for** olive industry **wastes/by-products valorisation** focusing on the **value chain enhancement.**



PRUNINGS

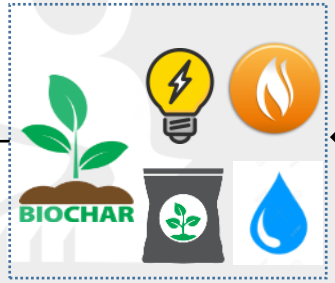
POMACE

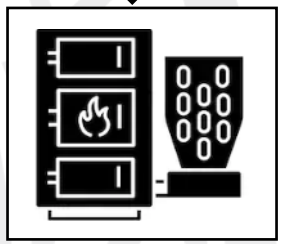
STONES

WASTE WATER

PRETREATMENT

VALUE-ADDED PRODUCTS





BAT
BEST AVAILABLE TECHNOLOGY

OBJECTIVE

Specific objectives

- **State-of-the-art** of the olive oil value chain and current wastes
- **Identify innovative and mature technologies** for olive wastes valorization. BATs → Best Available Technologies
- **Carry out a** Life Cycle Assessment (**LCA**) and Life Cycle Costing (**LCC**) of the current most representative olive oil value chain
  - From “cradle-to-gate”
- **Comparative LCA and LCC** analysis to evaluate the impact of the BATs
  - Future simulated scenarios
- **Install a demo-plant** in a real scenario
  - Knowledge transfer to the stakeholders

ACTIONS COMPLETED

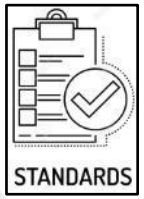
Work Packages

WP 1: INFORMATION COLLECTION

- ✓ State of the art most representative value chain and waste flows
- ✓ BATs = BEST AVAILABLE TECHNOLOGIES

WP 2: LIFE CYCLE INVENTORY

- ✓ Development of questionnaires
- ✓ Datasets – normalisation



WP 3: LCA & LCC IMPLEMENTATION

- ✓ Carbon Footprint and hotspots

WP 4: NEW SOLUTIONS FOR WASTES & BY-PRODUCTS VALORISATION

- ✓ What is the impact of BATs in the olive oil value chain?

WP5: DISSEMINATION AND TECHNOLOGY TRANSFER

- ✓ BAT in a real scenario (olive oil mill)
- ✓ Workshop → Diffusion to the stakeholders

RESULTS

WP 1: INFORMATION COLLECTION

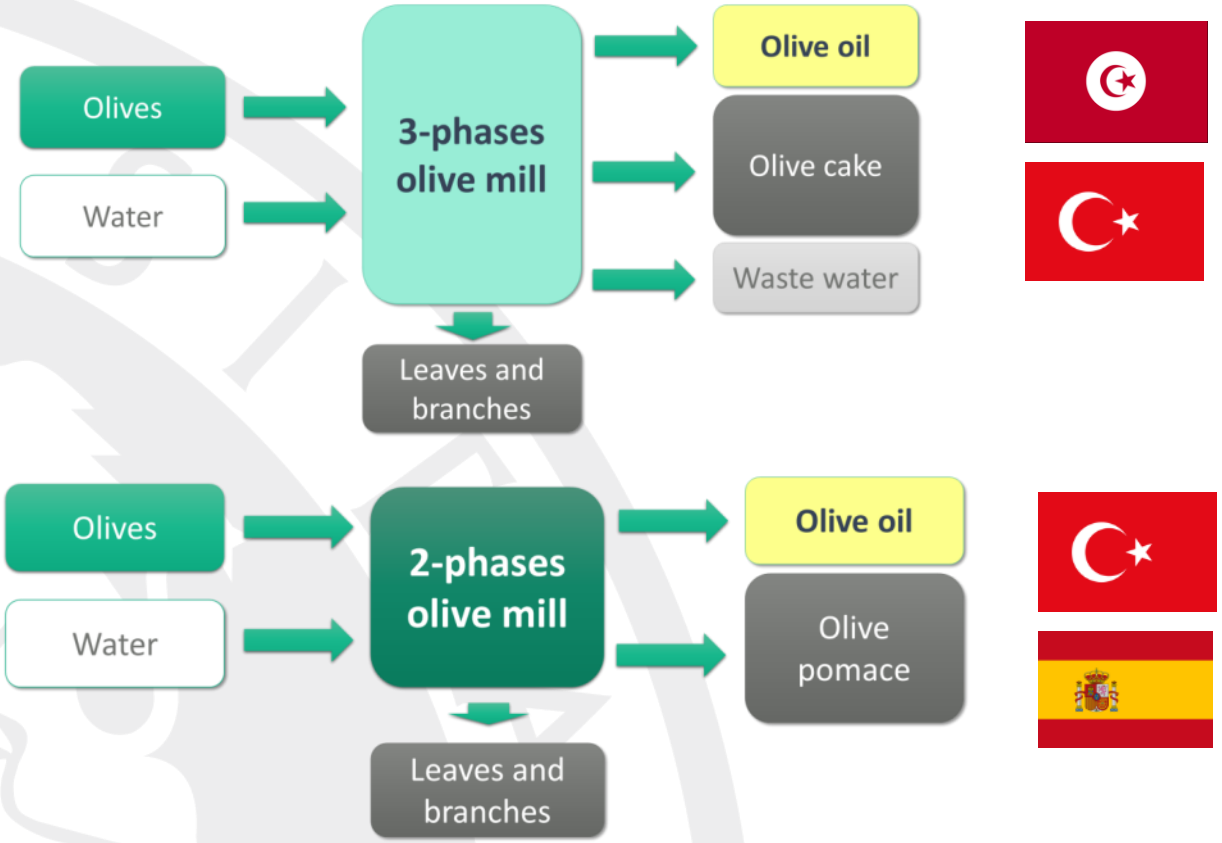
STATE OF THE ART **most representative value chain** in each country

	SPAIN	TUNISIA	TURKEY
Olive tree surface (ha)	2.470.711	1.846.830	864.428
Virgin olive oil production (AVG tons 2014-2019)	1.314.118	195.000	186.800
Most representative region	Andalusia	Sfax – Sahel	Aegean
Olive grove share	62,5 % 73,4 % dryland 26,63 % Irrigated	37,2 % 98,4 % dryland 1,6 % Irrigated	52,5% 58,0 % dryland 42,0 % Irrigated
Olive tree density (trees/ha)	130	< 40	250
Total of olive mills	1835 848 (Andalusia)	1721 1009 (Sfax-Sahel)	1229 398 (Eagean)
Main extraction process	2 phases (> 95 %)	3 phases (> 90%)	3 phases (55 %) 2 phases (45 %)

RESULTS

WP 1: INFORMATION COLLECTION

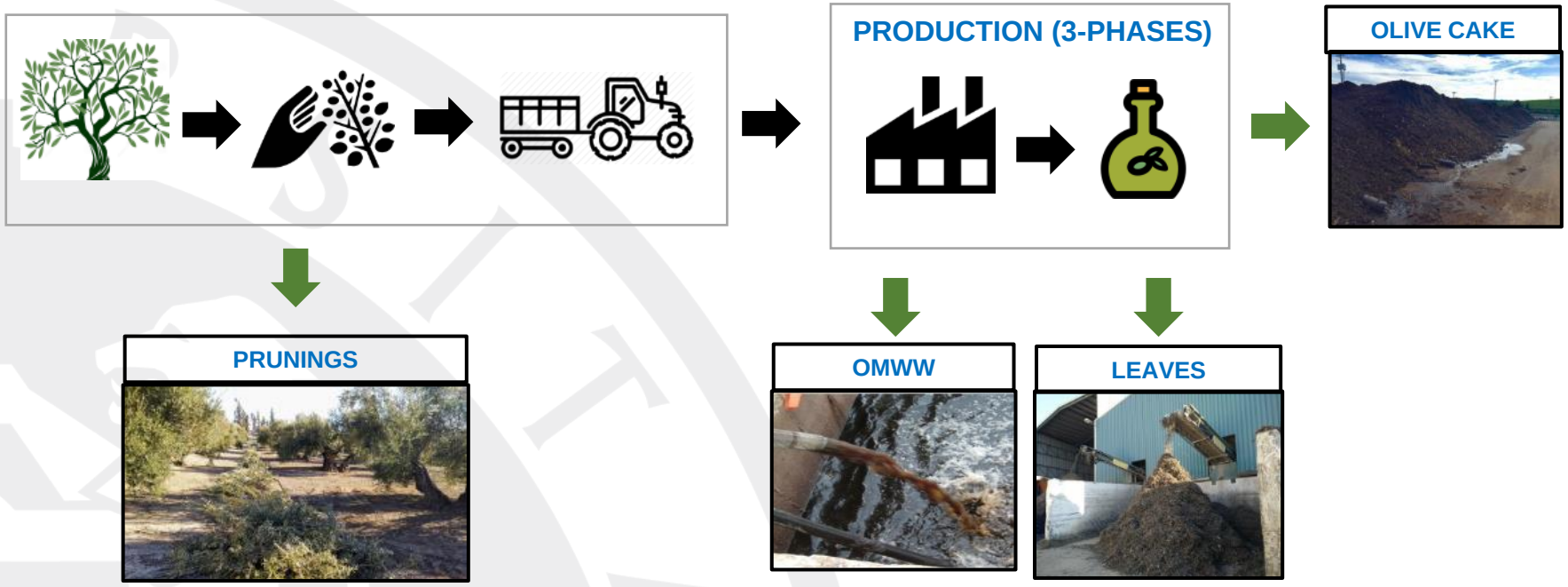
Different olive oil extraction process in each country



RESULTS

WP 1: INFORMATION COLLECTION

Different typology of wastes / by-products for each country



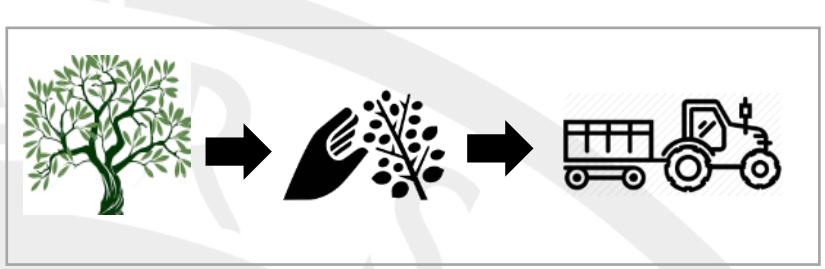
55 %

98 %

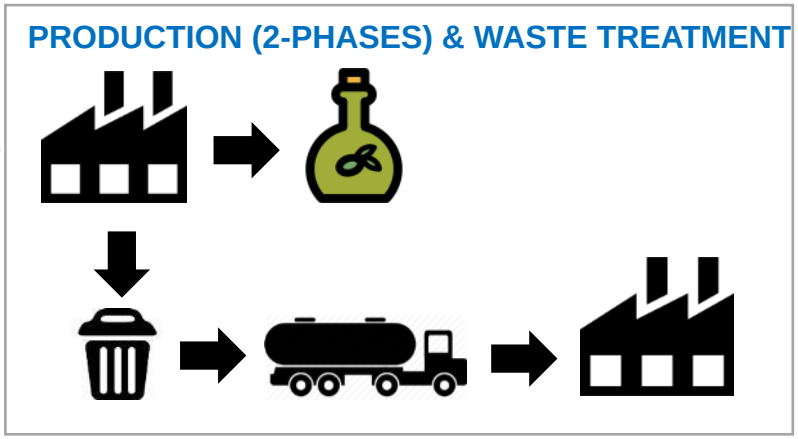
RESULTS

WP 1: INFORMATION COLLECTION

Different typology of wastes / by-products for each country



PRODUCTION (2-PHASES) & WASTE TREATMENT



PRUNINGS

STONES

LEAVES

2 PHASE POMACE

45 %

≈ 100 %

RESULTS

WP 1: INFORMATION COLLECTION

What is the current valorization of these wastes / by-products?

By-products

- **Olive pits/stones**
- **Olive cake (3-phase)**

→ Established valorization pathways

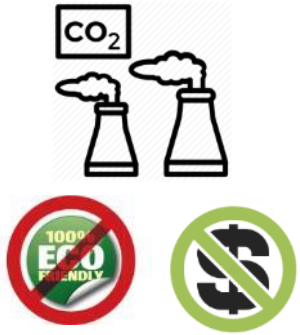
Wastes

- **Prunings**
- **Leaves and branches**
- **Waste water (OMWW)**

→ No potential valorization

- **2-phase olive pomace**
  - High moisture content
  - High phenolic content

→ Inefficient valorization (e.g. Case of Spain)



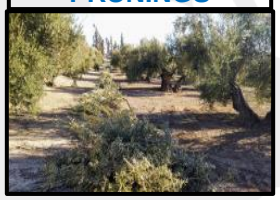
RESULTS

WP 1: INFORMATION COLLECTION

Revision of **BEST AVAILABLE TECHNOLOGIES** (BATs) and not yet BATs

Biomass Gasification

PRUNINGS



OLIVE CAKE

STONES

2 phase POMACE (DRY)

- Renewable Electricity (15 %)
- Renewable Heat (60-65 %)
- BIOCHAR (20-25 %)

BIOCHAR

- Soil amendment
- Extremely porous **activated carbon**
- Absorbs water and nutrients (up to 5 times its weight)
- High cation exchange capacity
- Improve the soil microbial life

RESULTS

WP 1: INFORMATION COLLECTION

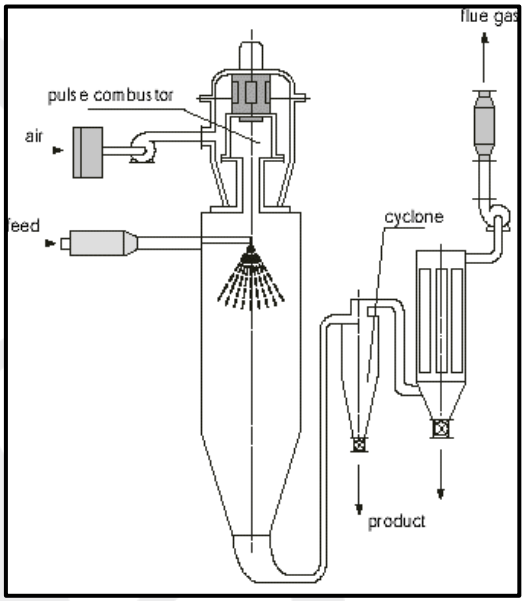
Revision of **BEST AVAILABLE TECHNOLOGIES** (BATs) and not yet BATs

Pulse Drying Combustion

2 PHASE POMACE (WET)

OMWW

NATURAL GAS



BIOFERTILIZER
(high degree of solubility)

RESULTS

WP 1: INFORMATION COLLECTION

Revision of BEST AVAILABLE TECHNOLOGIES (BATs) and not yet BATs

Solar drying (greenhouses and solar stills)

2 PHASE POMACE (WET)

OMWW

COMPOST

STILL WATER

COMPOST

RESULTS

WP 1: INFORMATION COLLECTION

COMPARING ASPECTS	GASIFICATION	PULSE DRYING COMBUSTION	SOLAR DRYING
SUITABLE WASTES AND BY-PRODUCTS	✔ PITS/STONES ✔ TREE PRUNING (wood) ✔ 3 PHASE POMACE ✔ 2 PHASE POMACE (dry) ✘ OMWW	✘ PITS/STONES ✘ TREE PRUNING (wood) ✘ 3 PHASE POMACE ✔ 2 PHASE POMACE (raw) ✔ OMWW	✘ PITS/STONES ✘ TREE PRUNING (wood) ✘ 3 PHASE POMACE ✔ 2 PHASE POMACE (raw) ✔ OMWW
MATURITY LEVEL (TRL)	🙂 MARKETED (TRL > 9)	🙂 MARKETED (TRL 7-9)	☹ NOT MARKETED (TRL 4-6)
TECHNOLOGY COST	🙂 550 €/kW (thermal) 🙂 2500 €/kW (electric)	☹ 1500 €/kW (thermal)	✘ NOT AVAILABLE YET
PRODUCTS	• ELECTRICITY • HEAT • BIOCHAR	• BIOFERTILIZER (soluble)	• BIOFERTILIZER • STILL WATER
STAKEHOLDERS	✔ FARMERS ✔ OLIVE MILL OWNERS ✔ EXTRACTORS	✘ FARMERS ✔ OLIVE MILL OWNERS ✔ EXTRACTORS	✘ FARMERS ✔ OLIVE MILL OWNERS ✘ EXTRACTORS

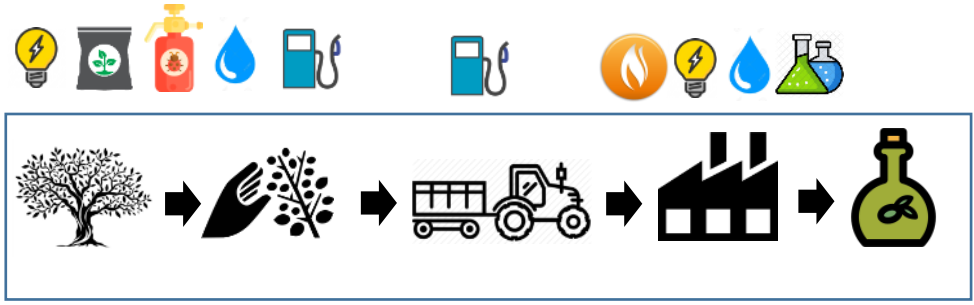
RESULTS

WP 2: LIFE CYCLE INVENTORY

- Development of normalized questionnaires according to ISO 14040 and 14044
- **Product Environmental Footprint Category Rules** for Olive Oil (EC)

SURVEYS

- face to face interviews
- phone calls
- mails
- web page



PRUNINGS

POMACE
STONES
OMWW
LEAVES

More questions…

- Olives harvested?
- Type of cultivation?
- Organic or Traditional?
- Irrigation system?
- Distances (km)
- Type of transport (tractor, trailer, truck)
- Type of fuels
- Consumables, etc.
- Virgin olive oil produced

RESULTS

WP 2: LIFE CYCLE INVENTORY

Some data reported during the last harvests

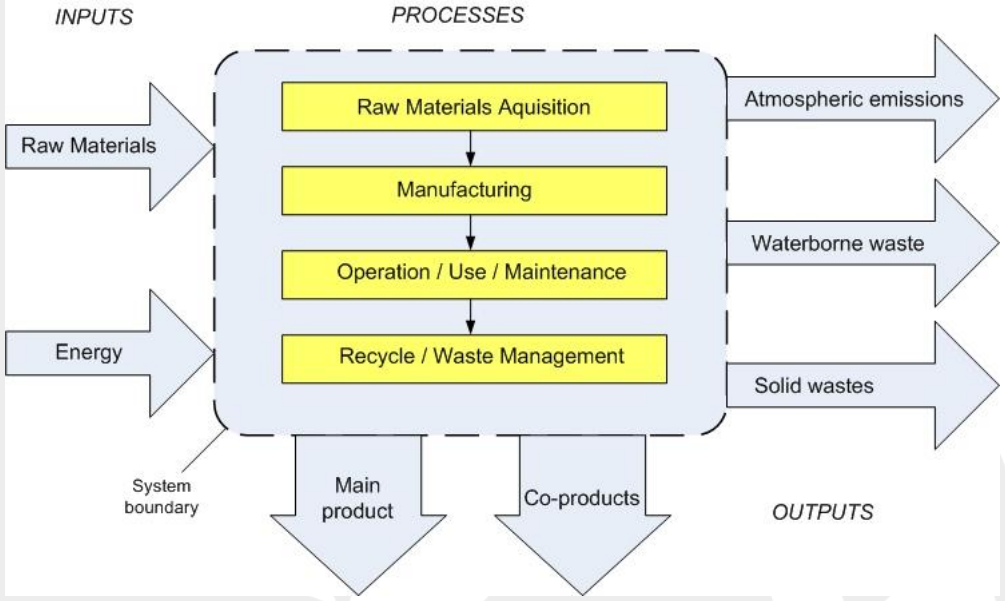


	TURKEY	TUNISIA	SPAIN
Nº of Harvests	2017-2020	2017-2020	2017-2020
Nº of farmers surveyed	45	35	62
Ha surveyed	1600	1500	≈ 3500 – 4000
Dryland	52 %	90 %	58 %
Irrigated	48 %	10 %	42 %
Number of mills surveyed	6	32	12
2 PHASES	33 %	10 %	100 %
3 PHASES	66 %	90 %	0

RESULTS

WP 3: LIFE CYCLE ASSESSMENT (LCA)

The LCA approach is a tool that allows to **evaluate the life cycle of an activity, process or product** following all the phases of its existence (pre-production, production, distribution, use, recycling and final disposal) **to identify the most environmental burden processes (*HOTSPOTS*)**



The **Carbon Footprint** is a measure of the **total greenhouse gas emissions** (CO_2 eq) **associated,** directly or indirectly, **to a product.**

The **carbon footprint certification** is a real label that provides products with a distinctive element, synonymous with environmental quality.

RESULTS

WP 3: LIFE CYCLE ASSESSMENT (LCA)

How to achieve homogenization of environmental profiles and perform fair comparisons.

CPC code: 21537
Registration Number: S-P-00386

EPD®

The EPD **– Environmental product declaration**, specific for Olive Oil industry sector.

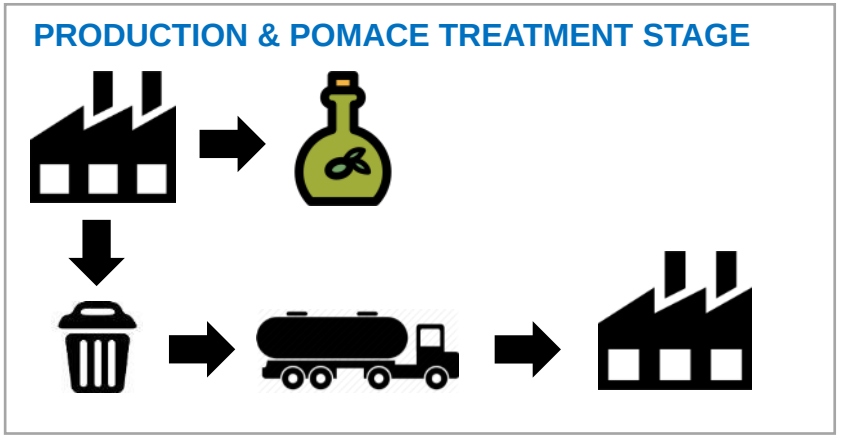
The **Product Environmental Foot Category Rules**

Sustainable production and consumption
Best environmental management practice
Climate change mitigation
Organic food and sustainable agriculture

RESULTS

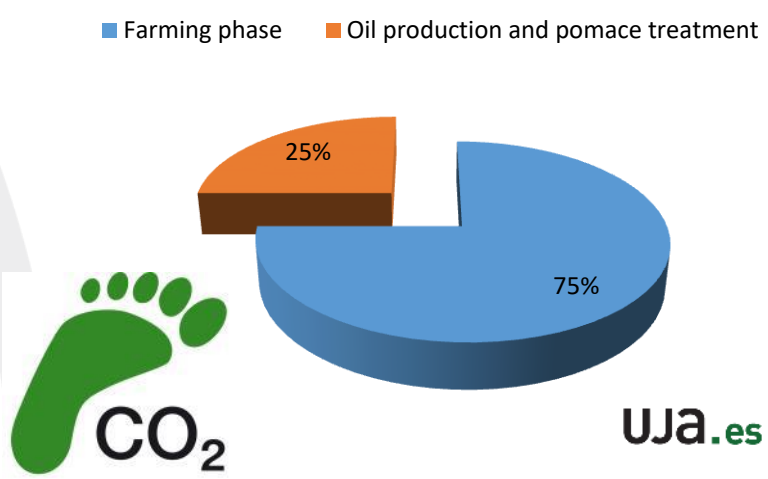
WP 3: LIFE CYCLE ASSESSMENT (LCA)

Preliminary results for SPAIN



CARBON FOOTPRINT

- Total **CF = 2.4 Kg CO_2 eq/kg** virgin olive oil.
- Around 75 % of the CO_2 emission occurs in the farming phase
- 25 % of the emissions in industrial phase



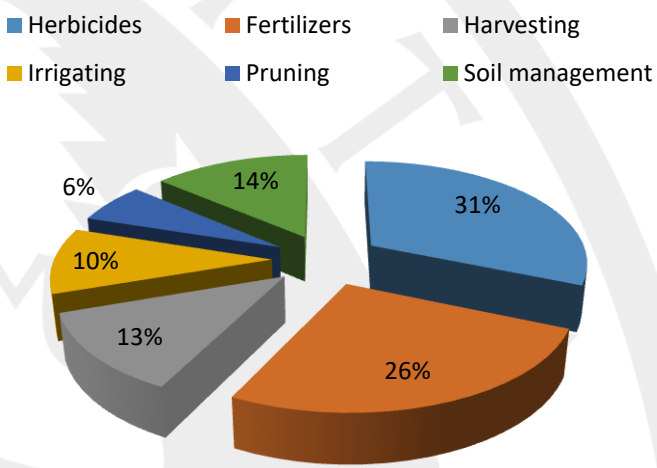
RESULTS

WP 3: LIFE CYCLE ASSESSMENT (LCA)

FARMING STAGE

350 g CO_2 eq.

CF in farming (uptream)



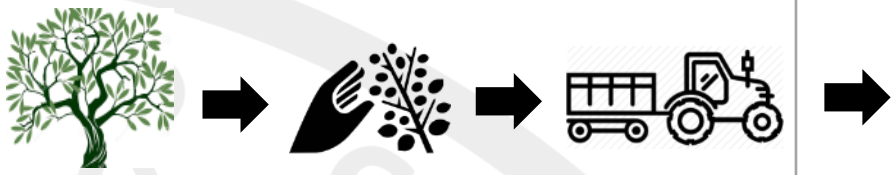
Olive Carbon Footprint

- **4085 kg olives / hectare**
- **4,85 kg of olives / kg of olive oil**
- **Efficiency 21,4%**

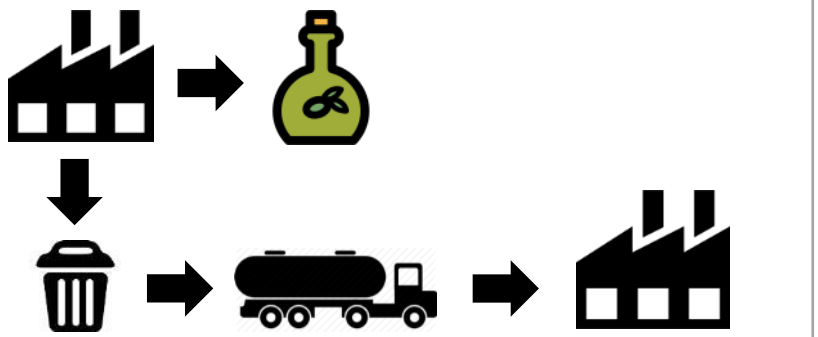
RESULTS

WP 3: LIFE CYCLE ASSESSMENT (LCA)

FARMING STAGE



PRODUCTION & POMACE TREATMENT STAGE

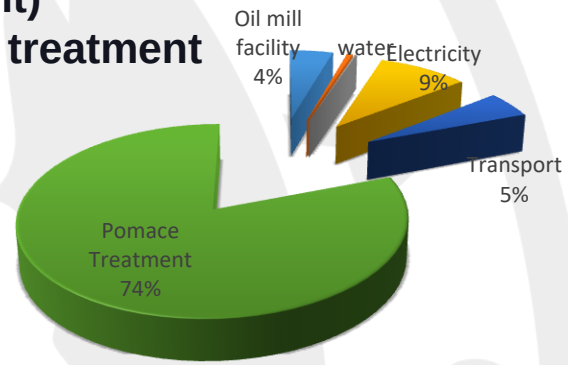


CF in farming (uptream)

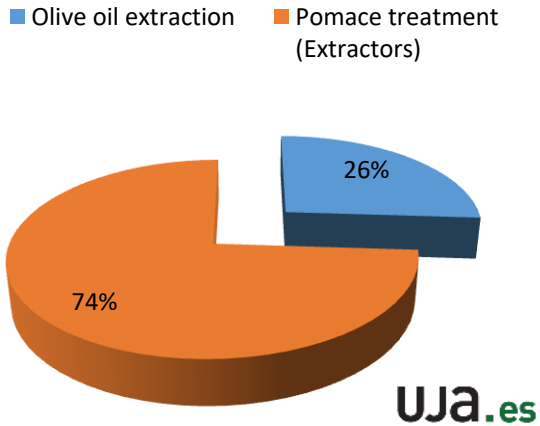
Production and pomace treatment

Olive Oil Carbon Footprint

- **Electricity**
- **Wastes / By-products (80% in weight)**
- **Emissions of treatment**



Climate change



RESULTS

WP 5: DISSEMINATION AND TECHNOLOGY TRANSFER

- Demonstration of a **gasification plant** in a real scenario (olive mill)
- **Impact Workshop** (July or September 2020): Training and dissemination
- OBJECTIVE → Technology transfer for stakeholders

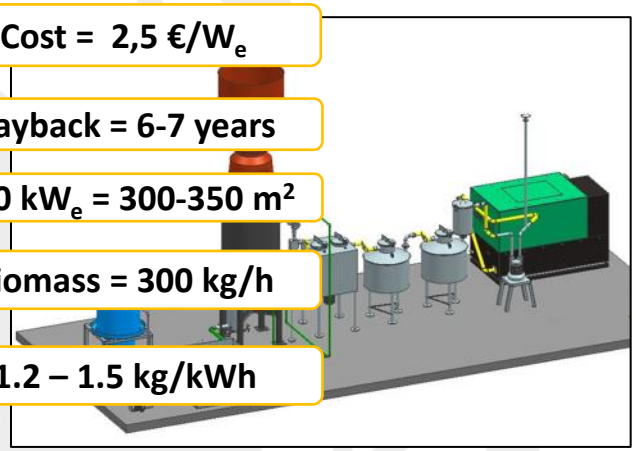
Cost = 2,5 €/W_e

Payback = 6-7 years

250 kW_e = 300-350 m^2

Biomass = 300 kg/h

1.2 – 1.5 kg/kWh



Access to new markets for stakeholders

Renewable electricity
Direct reduction of bills (> 75%)

Heat
(Mill owners can dry the olive pomace in-situ)

Biochar production
(Soil amendment)

CARBON FOOTPRINT REDUCTION

CO_2

EU Ecolabel www.ecolabel.eu

SALES

EFQM Recognised for Excellence 5 Star - 2017

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RESULTS

WP 5: DISSEMINATION AND TECHNOLOGY TRANSFER

Who are the major, influential and impacted actors of the project?

MAJOR ACTORS

EXTRACTORS
FARMERS
MILL OWNERS

INFLUENTIAL ACTORS

POLICY MAKERS
PUBLIC ADMINISTRATIONS
FUNDING AGENCIES

Gasifier

Power generation genset

Exhausted pomace

Biochar

Questions?

dvera@ujaen.es
www.ujaen.es/departamentos/ingele/oliven

OLEA
R&I PROJECT NETWORKING
OLIVE SECTOR

Thanks for your attention!