



FrontAg Nexus

**Pushing the frontiers
of climate-smart
agriculture in the
Mediterranean**



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Co-funded by
the European Union

Pushing the frontiers of climate-smart agriculture in the Mediterranean

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BGU Indoor Brackish Water Aquaponics

TECHNOLOGY TYPE

Aquaponics

LEAD PARTNER

אוניברסיטת בן-גוריון בנגב
جامعة بن غوريون في النقب
Ben-Gurion University of the Negev



Israel

BGU's indoor brackish water aquaponics system integrated with anaerobic fish sludge treatment. Left: vertical hydroponic subunit; center: recirculating aquaculture system (RAS) subunit comprising the fish tank and mechanical and biological filtration units; right: Upflow Anaerobic Sludge Blanket (UASB) reactor for fish sludge treatment. The nutrient-rich digestate from the UASB is recirculated back to the vertical hydroponic subunit.



WHAT IS DEMONSTRATED

BGU's indoor brackish water aquaponics system demonstrates the integration of indoor brackish water aquaponics with anaerobic digestion for fish sludge valorization. Fish waste is converted into nutrient-rich digestate in the UASB reactor and recirculated to the hydroponic unit, enhancing nutrient recovery, reducing water discharge, and improving overall system sustainability and productivity.



WHY IT MATTERS?

WEFE NEXUS IMPACT

Water

Reduced freshwater use through recycling

Food

Local, resilient food production

Ecosystem

Lower environmental footprint

WHO BENEFITS?

This small-scale demo is intended as a practical reference for different user groups interested in climate-smart food production:



Farmers / cooperatives

Can see simple options for upgrading to water-saving, intensive production on limited land.



Researchers / students

Can use the setup for experiments, training and data collection on hydroponic performance.



Municipalities / policymakers

Gain a concrete example of how urban and peri-urban agriculture can support WEFE Nexus goals.



SMEs / innovators

May identify business opportunities for greenhouse equipment, services and local food chains.



Local communities

Benefit from increased awareness and potential access to fresh, locally grown vegetables.

WHAT MAKES THIS DEMO UNIQUE?

Designed to improve resource recovery in aquaculture which mostly goes into the environment.

Designed for replication in arid Mediterranean regions

Integrates multiple WEFE dimensions in one system

CURRENT STATUS



Active Demonstration Case

The demo is currently operational and being used for PhD and MSc research to further optimize it

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amgross@bgu.ac.il

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Alma VFarm



Bologna, Italy



TECHNOLOGY TYPE

Hydroponics

LEAD PARTNER



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF
AGRICULTURAL AND FOOD SCIENCES

WHAT IS DEMONSTRATED

This demo showcases a vertical farming system for year-round crop production in controlled environments. Equipped with hydroponic and aeroponic systems with artificial lighting, its main advantage lies in enabling fresh, nutrient-dense food to be locally grown with minimal land, water, and fertilizer use, ensuring consistent yields independent of climate or season.



The experimental vertical farm Alma Vfarm at the University of Bologna

WHY IT MATTERS?

WEFE NEXUS
IMPACT

Water

Reduced freshwater use through recycling and recovery of air humidity

Food

Local, resilient food production

Ecosystem

No pesticide use and no fertilizer losses



WHO BENEFITS?



Farmers /
Cooperatives



Researchers /
Students



Municipalities /
Policymakers



SMEs /
Innovators



Local
Communities

WHAT MAKES THIS DEMO UNIQUE?

Demonstrates an integrated vertical farm addressing multiple WEFE Nexus Impact (water and nutrient use efficiency, food production).

Designed for scaling in space-constrained and arid Mediterranean contexts.

CURRENT STATUS



Active Demonstration Case

The demo is currently operational and used for testing, training, and stakeholder engagement

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vito.cerasola@unibo.it

DISTAL LAB Insect farm



Bologna, Italy

TECHNOLOGY TYPE

Insect Farming

LEAD PARTNER



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF
AGRICULTURAL AND FOOD SCIENCES



WHAT IS DEMONSTRATED

DISTAL LAB-Insect farm is a system for domestic production of insects suitable for animal feed, which avoids any use of water, consumes a minimal amount of energy, and reuses organic waste in the insects' diet.

A domestic insect farm production system

WHY IT

MATTERS?

WEFE NEXUS IMPACT

Water

No water use: all the water needed is absorbed from the diet



Energy

Low-energy consumption



Food

Supports feed or food production



Ecosystem

Low environmental footprint



WHO BENEFITS?



Farmers /
Cooperatives



Researchers /
Students



Municipalities /
Policymakers



SMEs /
Innovators



Local
Communities



WHAT MAKES THIS DEMO **UNIQUE?**

CURRENT STATUS



Active Demonstration Case

Designed for replication in
arid Mediterranean regions

Integrates multiple WEFE
dimensions in one system

LEARN MORE



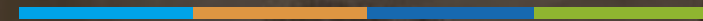
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GET IN TOUCH

vito.cerasola@unibo.it

Hydroponic Shipping Containers **SALUS SPACE**





Bologna, Italy

TECHNOLOGY TYPE

Hydroponics

LEAD PARTNER



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA
DEPARTMENT OF
AGRICULTURAL AND FOOD SCIENCES

WHAT IS DEMONSTRATED

This demonstration showcases hydroponic shipping containers designed for local mushrooms and leafy vegetable production, controlling the environmental conditions, and limiting the water and nutrient use through recirculated nutrient solution.



Hydroponic shipping containers in Salus Space

WHY IT MATTERS?

WEFE NEXUS IMPACT



Water

Reduced freshwater use through recycling

Energy

Partial use of renewable energy

Food

Local, resilient food production

Ecosystem

No pesticide use and no fertilizer losses



WHO BENEFITS?



Farmers /
Cooperatives



Researchers /
Students



Municipalities /
Policymakers



SMEs /
Innovators



Local
Communities

WHAT MAKES THIS DEMO UNIQUE?

Integrates multiple WEFE dimensions in one system

Designed for space-constrained and Mediterranean contexts

CURRENT STATUS



Discontinued

Activities were discontinued due to technical issues that imposed the stop of its use, requiring improvements in some constructive elements, fully documented within the project

LEARN MORE

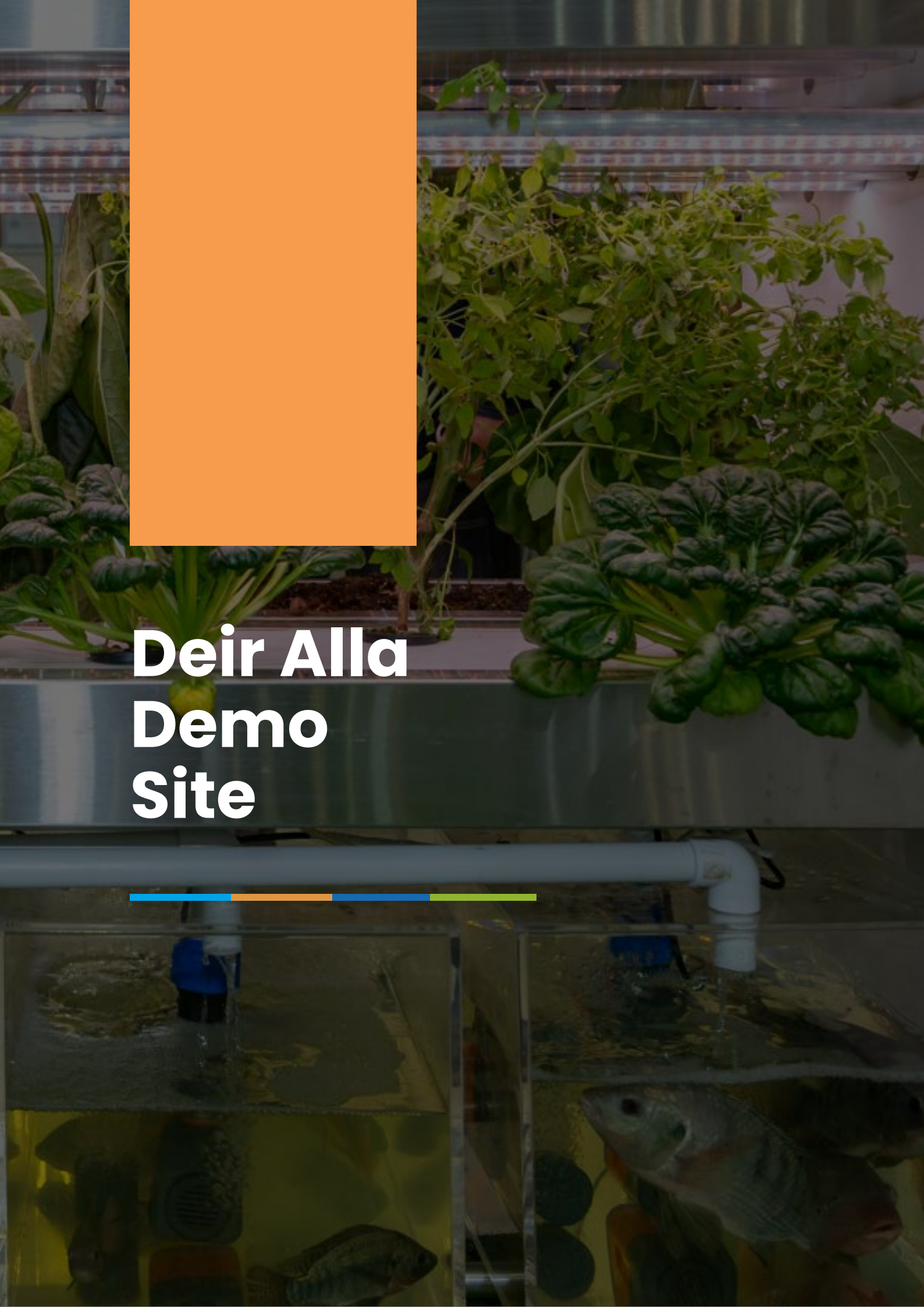


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vito.cerasola@unibo.it



Deir Alla Demo Site

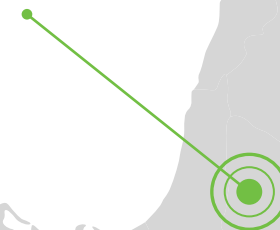
TECHNOLOGY TYPE

Hydroponics
Aquaponics
Insect Farming

LEAD PARTNER



Jordan



WHAT IS DEMONSTRATED

This demonstration showcases an integrated aquaponic and insect farming system combining fish production, soilless crop cultivation, and insect-based biomass conversion. It is designed to test circular, water-efficient food production under arid Mediterranean conditions.



Frontier agriculture in action under arid Mediterranean conditions through aquaponics, insect farming, and sustainable water-smart agriculture.

WHY IT MATTERS?

WEFE NEXUS IMPACT

Water

Reduced freshwater use through recycling



Food

Local, resilient food production

Ecosystem

Lower environmental footprint

WHO BENEFITS?



Farmers /
Cooperatives



Researchers /
Students



Municipalities /
Policymakers



SMEs /
Innovators



Local
Communities

WHAT MAKES THIS DEMO UNIQUE?

Designed for replication in arid
Mediterranean regions

Integrates multiple WEFE dimen-
sions in one system

CURRENT STATUS



Active Demonstration Case

The demo is currently
operational and used
for testing, training, and
stakeholder engagement

LEARN MORE



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GET IN TOUCH

Plant Stress Physiology Lab Agricultural Innovation and Technology Transfer Center

TECHNOLOGY TYPE

Hydroponics
Agrophotovoltaics

LEAD PARTNER

UM6P
University
Mohammed VI
Polytechnic



Benguerir, Morocco



WHAT IS DEMONSTRATED

Located in the heart of Morocco's Rhamna region, the demonstration site features a 20 × 10m greenhouse covering 200m². It combines an integrated hydroponic system with solar panels installed on the greenhouse roof. The panels power six cooling units and two ventilation systems, supporting controlled food production.



Lettuce hydroponic system experiment

WHY IT MATTERS?

WEFE NEXUS IMPACT



Water

Reduced freshwater use through recycling

Energy

Partial use of renewable energy

Food

Local, resilient food production

Ecosystem

No pesticide use and no fertilizer losses

WHO BENEFITS?



Farmers /
Cooperatives



Researchers /
Students



Municipalities /
Policymakers



SMEs /
Innovators



Local
Communities

WHAT MAKES THIS DEMO UNIQUE?

First application in arid Mediterranean regions as Morocco.

Integrates multiple WEFE dimensions in one system

CURRENT STATUS



Active Demonstration Case

LEARN MORE

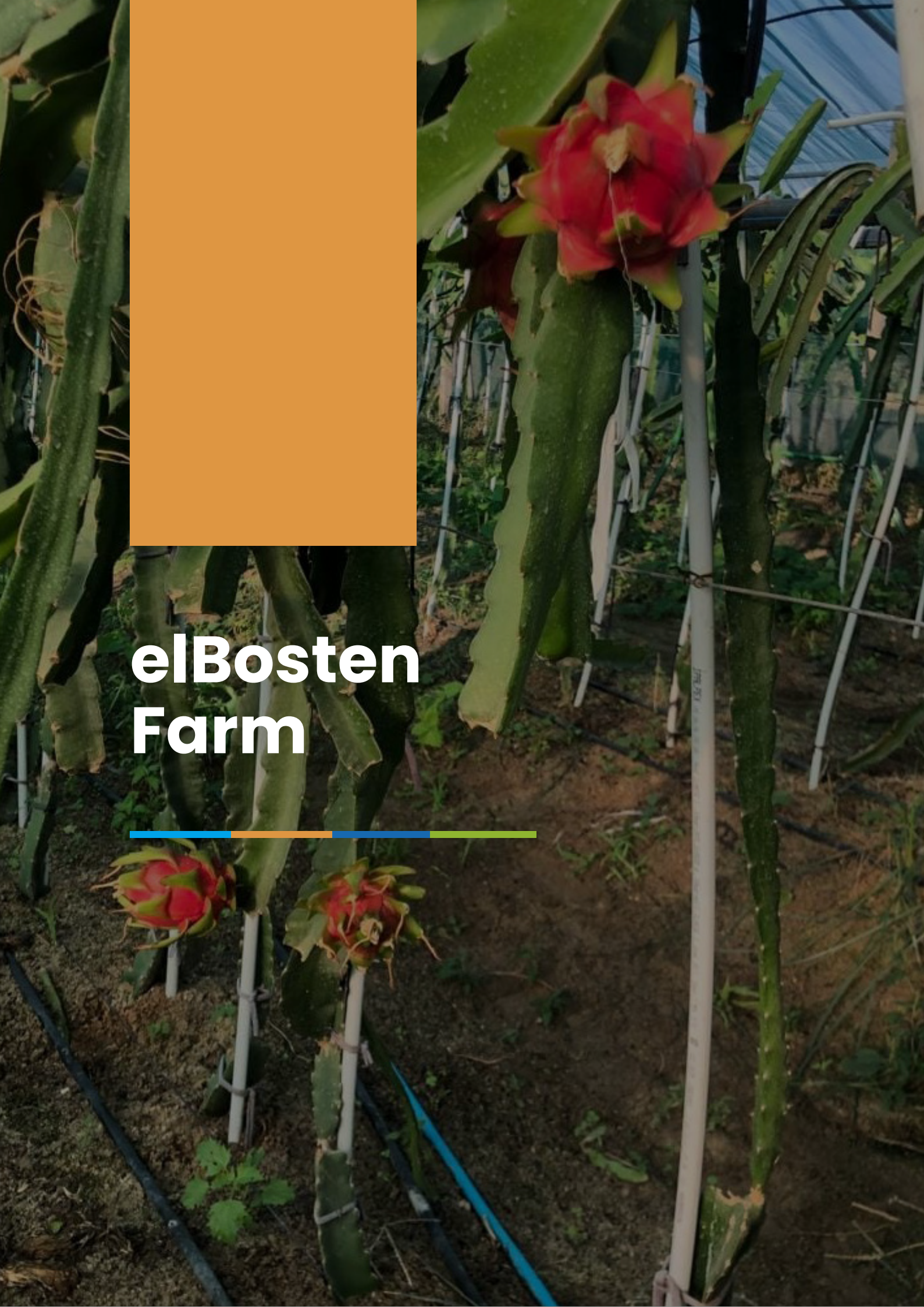


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GET IN TOUCH

abdallah.oukarroum@um6p.ma



elBosten Farm

TECHNOLOGY TYPE

Hydroponics
Aquaponics
Insect Farming
Photovoltaics

LEAD PARTNER



Tunisia
Bir Halima, Zaghouan



Hydroponics, insect farming & dragon fruit cultivation

Exploring innovative and climate-resilient farming systems combining:

- Hydroponic strawberry production
- Insect farming infrastructure
- Dragon fruit cultivation in greenhouses



WHAT IS DEMONSTRATED

Hydroponic Efficiency: Soil vs. Soilless

This trial compares traditional soil-based cultivation against **soilless** hydroponic systems for strawberry production. The goal is to measure differences in:

- **Water Usage:**
Hydroponics can reduce water consumption by up to 90% through recirculation.
- **Yield Density:**
The vertical/elevated racks used in the demonstration allow for more plants per square meter.

Drought-Resistant Diversification

The cultivation of **Dragon Fruit** (Pitaya) represents a strategic shift toward “future-proof” crops. As a member of the cactus family, it is naturally adapted to arid conditions and requires significantly less water than traditional fruit trees. This test aims to determine:

- **Economic Viability:**
Whether high-value, low-water crops can sustain a farm’s revenue during drought.
- **Microclimate Performance:**
How well these desert-native plants adapt to the specific humidity and light of the greenhouse setup.

Insect Farming: Black Soldier Fly (BSF)

The project is currently in the “mastery” phase of the **Black Soldier Fly** (*Hermetia illucens*) lifecycle. This involves controlling the transition from egg to larva to adult fly.

- **The Goal:**
Mastering this cycle allows for the conversion of organic waste into high-quality protein (larvae) and **frass** (insect excrement).
- **Fertilizer Potential:**
The demo is testing BSF frass as a potent, nutrient-rich organic fertilizer to see if it can replace synthetic inputs in the strawberry or dragon fruit systems.

WHY IT MATTERS?

WEFE NEXUS IMPACT



Water

Reduced freshwater use through recycling

Energy

Renewable / low-energy operation

Food

Local, resilient food production

Ecosystem

Lower environmental footprint

WHO BENEFITS?



Farmers /
Cooperatives



Researchers /
Students



SMEs /
Innovators



Local
Communities

WHAT MAKES THIS DEMO UNIQUE?

Circular Economy Integration: Uniquely combines **Black Soldier Fly** (BSF) bioconversion with fruit production, testing insect “frass” as a sustainable, locally produced fertilizer to close the nutrient loop.

Climate-Adaptive Benchmarking: Simultaneously compares high-tech “**hors-sol**” efficiency against drought-resistant **exotic crops**, creating a blueprint for resilient farming in water-scarce Mediterranean or arid regions.

CURRENT STATUS



Active Demonstration Case

Strawberries (Soilless): Evaluating if the controlled, hors-sol environment yields superior fruit quality compared to traditional soil

Dragon Fruit: Assessing the adaptation of this drought-resistant cactus to the greenhouse microclimate and its potential as a low-water commercial alternative

The primary objective is now the Mastery of the Black Soldier Fly life cycle. This isn't just about breeding; it's about waste-to-wealth conversion

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GET IN TOUCH

Frontier Agriculture Taşarasi Village Project of EUROSOLAR



Türkiye
Havran Taşarasi Village,
Balıkesir Province



TECHNOLOGY TYPE

Hydroponics
Aquaponics
Insect Farming
Agrophotovoltaics
Vermicomposting
Traditional Seed Utilization

LEAD PARTNER

RENEWABLE ENERGY
ASSOCIATION



WHAT IS DEMONSTRATED

Unique Mediterranean WEFE Nexus Demonstration Unit was built together with an Agri-PV System which is ready to be one of the Living Labs of Europe.

The pilot aims to boost efficient land use, produce clean energy alongside crops, provide employment opportunities, and contribute to the region's economic development.



Frontier agriculture in action under arid Mediterranean conditions



WHO BENEFITS?



Farmers /
Cooperatives



Researchers /
Students



Municipalities /
Policymakers



Local
Communities

WHY IT MATTERS?

WEFE NEXUS IMPACT

Water

Reduced freshwater use through recycling



Energy

Renewable / low-energy operation



Food

Local, resilient healthy food production



Ecosystem

Lower environmental footprint



WHAT MAKES THIS DEMO UNIQUE?

First application of hydroponic technology in Europe

Designed for replication in arid Mediterranean regions

Integrates multiple WEFE dimensions in one system

Will serve as a Living Lab for Agri-PV Nexus Project of İstanbul Gedik University

CURRENT STATUS



Active Demonstration Case

The demo is currently operational and used for testing, training, and stakeholder engagement

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GET IN TOUCH

Prof. Dr. Tanay Sıdkı Uyar

İstanbul Gedik University
Department of Mechanical Engineering

tanay.uyar@gedik.edu.tr

+905333955839

irenec.org/eng/

Bodrum Ortakent Greenhouse Hydroponic Production



Türkiye
Muğla, Bodrum, Ortakent,
Müskebi Çakmaklı Sok.
Greenhouse area: 40m²

TECHNOLOGY TYPE

Hydroponics
Greenhouse Hydroponic
Production

LEAD PARTNER



SYSTEM 1

Sakız squash in pots with cocopeat

(recirculating water)

Squash plants grown in pots filled with cocopeat, connected to a recirculating nutrient solution loop

SYSTEM 2

Horizontal hydroponic lettuce

Lettuce grown in a horizontal hydroponic NFT-type setup



SYSTEM 3

Vertical hydroponic lettuce

Lettuce grown in a multi-layer vertical hydroponic NFT-type system



SYSTEM 4

Yard-long bean (Yard-long bean (börülce)) in pots with cocopeat

(non-recirculating)
Beans grown in standard pots with cocopeat, without recirculation (conventional drip / container system)

WHAT IS DEMONSTRATED

This demo presents a 40m² greenhouse that hosts four different systems: recirculating squash pots, horizontal NFT lettuce, vertical NFT lettuce and non-recirculating bean pots. The setup allows for simple comparison of space-efficient production methods and different nutrient delivery strategies (recirculating vs. non-recirculating).



WHY IT MATTERS?

WEFE NEXUS IMPACT



Water

Reduced freshwater use through recycling. The recirculating hydroponic systems are designed to reduce freshwater use by re-using nutrient solutions instead of continuous discharge.

Food

Local, resilient food production. The demo produces fresh vegetables close to consumers, contributing to more local and potentially more resilient food supply.

Energy

Renewable / low-energy operation. The greenhouse aims to operate with relatively low energy demand by using compact systems and short pumping distances.

Ecosystem

Lower environmental footprint. By limiting fertilizer losses and runoff, the systems can help lower the environmental footprint compared with conventional open-field production.

WHO BENEFITS?

This small-scale demo is intended as a practical reference for different user groups interested in climate-smart food production:



Farmers / cooperatives

Can see simple options for upgrading to water-saving, intensive production on limited land.



Researchers / students

Can use the setup for experiments, training and data collection on hydroponic performance.



Municipalities / policymakers

Gain a concrete example of how urban and peri-urban agriculture can support WEFE Nexus goals.



SMEs / innovators

May identify business opportunities for greenhouse equipment, services and local food chains.



Local communities

Benefit from increased awareness and potential access to fresh, locally grown vegetables.

WHAT MAKES THIS DEMO UNIQUE?

It compares four hydroponic configurations within the same 40 m² greenhouse, making it easy to observe differences between recirculating and non-recirculating systems, and between horizontal and vertical NFT designs.

It brings several WEFE Nexus dimensions together in one place, linking water saving, energy use, food production, and environmental impact in a compact, real-life setting.

CURRENT STATUS



Active Demonstration Case

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GET IN TOUCH

iklim@bodrum.bel.tr

Bahçeyaka Tohum Merkezi



Türkiye
Bahçeyaka, 48440 Bodrum
Muğla

TECHNOLOGY TYPE

Hydroponics

LEAD PARTNER



WHAT IS DEMONSTRATED

Due to technical reasons, the hydroponic system could not be installed at the Bahçeyaka Seed Center. Instead, the project activities have been implemented at the Ortakent greenhouse site.

CURRENT STATUS



Discontinued

During the planning and design phase of the FrontAg Nexus project, Bodrum Municipality initially intended to implement the activities at the “Bahçeyaka Seed Center.” However, because the technical infrastructure was insufficient and the staff profile of the relevant unit did not match the project’s requirements, the implementation setup was revised and the project was transferred to the Parks and Gardens Department

As a result, hydroponic systems were installed in the municipality’s greenhouse in Ortakent neighbourhood, and the project operations and crop production have been carried out at this site

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iklim@bodrum.bel.tr





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