



National Center for Research and Development

Al-Safawi Educational Center for Soilless Agriculture & Innovation

Implemented by:

National Center for Research and Development – Water, Food, and Energy Program

Project Location:

Al-Safawi Field Station – Northern Badia, Jordan

Official Inauguration:

Under the gracious patronage of His Royal Highness Prince El Hassan bin Talal

September 2025



The Al-Safawi Educational Center for Soilless Agriculture and Innovation was established as an integrated reference model for smart and sustainable agriculture, in alignment with the royal directives of His Majesty King Abdullah II ibn Al Hussein, which emphasize food security and sustainable development. Its establishment reflects the continuous support and visionary guidance of His Royal Highness Prince El Hassan bin Talal, aimed at revitalizing the Jordanian Badia.

The Center is fully aligned with Jordan's strategic plans, integrating the objectives of the Sustainable Agriculture Plan for resource rationalization, the Green Growth Plan for environmental sustainability, and the Economic Modernization Vision for building a productive, sustainable economy, positioning it as a cornerstone for achieving these national goals.

Supervised by the National Center for Research and Development under the Higher Council for Science and Technology, the Center functions as a living platform for research and education. It employs advanced soilless agriculture (hydroponics) and smart control technologies, systematically addressing the interconnections between water, food, energy, and environment sectors to maximize resource efficiency and sustainability. The Center offers a practical solution to Jordan's critical water scarcity and limited arable land challenges, disseminating hydroponic techniques that reduce water consumption by up to 90% compared to traditional agriculture. This approach enhances water and food security while creating sustainable economic opportunities by empowering farmers and establishing scalable agricultural business models in arid regions.

1. Vision and Mission

Vision: To become a leading educational and research destination locally and regionally, providing sustainable, integrated solutions to challenges in water, climate, and agriculture, leveraging smart technologies.

Mission: To disseminate soilless agriculture techniques through a complete, replicable practical model; support applied scientific research; and empower farmers and researchers with real-time data for informed decision-making and improved agricultural efficiency.

2. Integrated Technological Infrastructure

The center features a fully solar-powered, integrated infrastructure, representing a practical model for the energy-agriculture nexus. Key components include

1. **Specialized Agricultural Weather Station:** Provides precise climate data (solar radiation, air/soil temperature, humidity, wind, CO₂ levels, precipitation, and evaporation), enabling optimal crop management, disease prediction, and resource efficiency.



2. **Rainwater Harvesting System:** Collects, treats, and purifies rainwater from building rooftops to irrigate crops, reducing reliance on conventional water sources and promoting integrated water management.
3. **Comprehensive Agricultural Units:** Two cooled agricultural units (270 m² each) serve as living educational exhibitions, showcasing major hydroponic systems:
 - Nutrient Film Technique (NFT)
 - Deep Water Culture (DWC)
 - Vertical Farming and Green Walls
 - Dutch Bucket Technique
 - Trench Techniques
4. **Smart IoT Control Unit:** A fully automated system managing irrigation, fertilization, and environmental monitoring through sensors:
 - **Automatic Irrigation:** Adjusts water flow based on soil moisture and weather data.
 - **Automatic Fertilization:** Delivers precise nutrient levels per crop stage.
 - **Continuous Monitoring:** Tracks plant health, temperature, humidity, light, and CO₂ levels.

This advanced integration ensures **optimal resource efficiency**, supports crop productivity, and generates rich data for scientific research and continuous improvement in sustainable agriculture.

3. Strategic Objectives and Performance Indicators

The Center's objectives focus on **four pillars** that serve sustainable development in the Badia and empower local communities, especially women:

A. Training, Education, and Community Empowerment

- Conduct practical hydroponics training for farmers, engineers, entrepreneurs, and women.
- Host student visits to raise awareness on sustainable agriculture.

Indicators:

- Annual number of trainees, including rural women's participation.
- Percentage of graduates launching projects within a year.
- Increase in awareness of water conservation in agriculture.

B. Research, Development, and Innovation

- Provide a research environment for testing nutrient solutions and growing media.



- Develop climate-smart, affordable, adoptable agricultural models.

Indicators:

- Number of applied research studies and publications annually.
- Number of innovative models developed and adopted locally.
- Quantified impact on water and nutrient savings.

C. Production and Sustainable Development (Sectoral Nexus)

- Produce fresh, high-quality crops as a practical model for Badia regions.
- Integrate energy-water-food sectors via solar-powered smart systems.

Indicators:

- Water use efficiency (targeting >90% reduction vs. traditional agriculture).
- Economic return per unit area compared to soil-based farming.
- Percentage of energy self-reliance.

D. Partnerships and Community Impact

- Forge partnerships with universities, research centers, the private sector, and civil society.
- Launch community awareness and engagement initiatives.
- Develop governance systems for sustainable Center operations.

Indicators:

- Annual number of partnerships signed.
- Participation rate of women and youth in initiatives.
- Proportion of sustainable financing in the total budget.

4. Expected Outputs

Impact	Main Outputs	Level
Enhanced resource management, women's participation, and modern agricultural practices	Disseminate climate-smart agriculture, prepare skilled cadres, empower farmers and women	Knowledge & Capacity Building
Local economic revitalization, reduced unemployment, and improved rural living	Create sustainable business models, provide alternative income for rural families	Economic & Local Development



Water security, food security, rural self-sufficiency	Adopt water-conserving and climate-resilient systems, and increase local vegetable production	Environmental & Sustainability
Evidence-based policies, effective investments	Provide scientific data for decision-makers, build a knowledge base for future investments	Policy & Decision-Making

5. Summary

The Al-Safawi Educational Center for Soilless Agriculture and Innovation is a strategic national project addressing Jordan's key agricultural challenges: water scarcity and limited arable land. By adopting and disseminating advanced hydroponics techniques, the Center:

- Enhances food security through local production of high-quality crops.
- Improves water security via smart irrigation and resource rationalization.
- Supports Jordan's sustainable development and climate resilience goals through an integrated water-energy-food-environment nexus.

The Center goes beyond training and research to provide an innovative, replicable model for sustainable, productive agriculture in arid regions.