

HBKU Thematic Research Grant 2nd Cycle– Project Highlight

Project Title: Design and development of a prototype that harvests water from air for food production



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Executive Summary

Given the increasing population, rising food demand, and limited water resources, it is a matter of national security to explore alternative sources for sustainable food and freshwater production. Agriculture, the largest consumer of freshwater on the planet, is the core of food security aspirations. This is especially important for the State of Qatar, which is striving towards food security and is challenged with access to freshwater and a harsh external climate. Water scarcity is prevalent in Qatar and is subjected to high temperatures and low rainfall. Currently, Qatar relies on the unsustainable utilization of groundwater resources to drive its national food security agenda. As such, for this proposal, we introduce the potential of atmospheric water harvesting as an alternative water source for sustainable agriculture. It has been considered an attractive alternative source of water, despite the obstacles that exist in its collection and seasonality factors related to temperature and humidity throughout the year. The main objectives of this proposal are to develop a novel doped metal-organic framework (MOF) for atmospheric water adsorption and to integrate this material in an agricultural greenhouse. We expect that the main output of this research will form the basis for the future of agriculture in Qatar in designing self-sustaining greenhouses, and exploiting the structure and operation of the greenhouses to collect atmospheric water.

Expected Outcome

The project has the following expected outcomes :

- An operating greenhouse prototype integrated with AWH (MOF) material.
- A set of data containing temperature, relative and absolute humidity, the amount of water produced, the plants' growth indicators, AWH performance indicators, and ambient environmental conditions.
- Possible statistical correlations and insights between various variables of the data.
- A technical framework providing guidelines to integrate AWH material with greenhouses for vegetable production in arid climates.
- Comprehensive thermodynamics model of greenhouses for vegetable production in EES, Python, etc.

Collaborating HBKU entities: Dr. Khaled A. Mahmoud (Qatar Energy Environment Research Institute)

Photos:

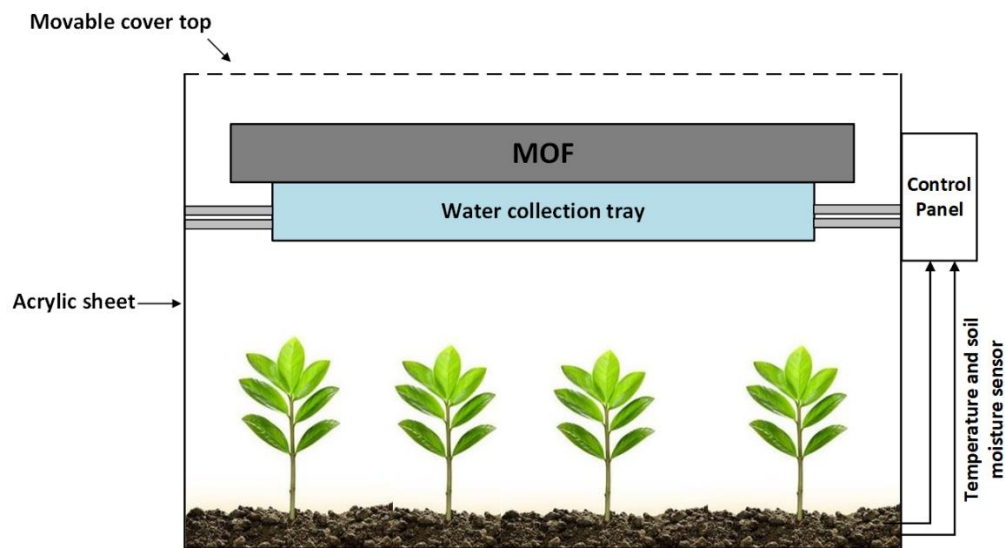


Figure 1: Greenhouse prototype integrated with AWH material.