New generation greenhouse to help save water and energy in Gulf countries

Recurring water shortages are a major problem in the Gulf Cooperation Council (GCC) countries. And there are fears that this problem will become more acute in the future.

So the GCC countries are putting more and more efforts into ensuring food and water security in the region. As agriculture uses over 85% of the available freshwater resources, it is the prime target of water-saving efforts. Improving water management and productivity in agricultural systems is a major strategic issue for most GCC countries. And greenhouse production is considered as the most water-saving solution in the agricultural sector. By some estimates, the GCC countries have around 14,000 ha of land allocated for protected agriculture. However, the hot climate means that greenhouses need to be cooled. This, in turn, leads to high energy and water consumption.

Greenhouse energy consumption is the largest component of the system's environmental impact. And this is true especially during the hot season (May to September). For example, the energy consumption for greenhouse cooling is about 240 kWh/ha/day (70,000 kWh/ha/year), which leads to high energy costs. Reductions in fossil fuel energy consumption and possible replacement by renewable and sustainable energy sources are important to greenhouse growers.

This challenge is behind a new research initiative led by a group of scientists from the Food and Agriculture Organization (FAO), the International Center for Biosaline Agriculture (ICBA), the International Center for Agricultural Research in the Dry Areas (ICARDA) in collaboration with the Ministry of Environment and Water (MoEW) of the United Arab Emirates (UAE) and the research group Watergy at Technical University of Berlin (TBU). The international team is carrying out experiments on a new generation of greenhouses at the Agriculture Innovation Centre in Al Dhaid, Sharjah, the UAE. This type of greenhouse can help to save up to 90% of water and significantly reduce energy consumption.

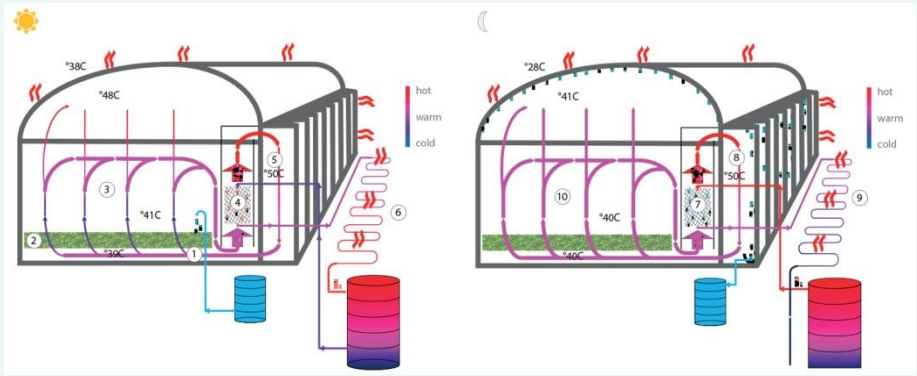
Funded by the MoEW, the research initiative aims to promote key protected agriculture solutions adapted to desert conditions and boost protected agriculture in the UAE and GCC countries.

The significant amount of water savings in this type of greenhouse can have additional advantages such as: productivity is five times higher than that in the open; pest, diseases and weed control is considerably more effective than in the open; and zero pollution of groundwater compared with the open.

The new generation greenhouse will boost water use efficiency under protected agriculture in the GCC countries.

As part of this initiative, researchers and experts from Oman, Bahrain, Kuwait, Qatar, Saudi Arabia, Jordan, Egypt and the UAE met at the ICBA head office in Dubai, the UAE, on September 14-15, 2015, to discuss progress so far and next steps. Participants discussed initial findings on crop productivity and quality; low and medium technological solutions, and put forward policy options for public and private-sector decision-makers.

This research is hoped to improve water and energy use efficiency under protected agriculture. What is more, it will help to develop best practices to improve crop productivity and incomes of farmers involved in greenhouse production while using non-conventional water. However, the ultimate goal is to contribute to the pursuit of ensuring food and water security for sustainable social and economic development in the region and beyond.



Prototype of new generation greenhouse at Al Dhaid, United Arab Emirates

1. Supply of dry air to the greenhouse
2. Evaporative cooling by vegetation
3. Zoning of hot air under roof, heat release through greenhouse cover
4. Humid greenhouse air is dried and further heated by absorption into liquid desiccant within WATERGY Absorber Box
5. Heat release through extended northern wall and return of air with reduced temperature and humidity to the greenhouse
6. Transport of greenhouse thermal energy and greenhouse water by liquid desiccant, additionally heated in a solar-thermal collector to storage container
7. Evaporation of water from liquid desiccant to greenhouse air within the absorber box (regeneration of desiccant for next day) under use of heat from storage
8. Cooling of air and condensation/collection of water on extended northern wall
9. Return of desiccant concentrate to storage, while passing the solar collector for further radiative cooling
10. Further condensation/collection of water on greenhouse cover surface