Organization Details: Sultan Qaboos University
College of Agricultural & Marine Science

Organization Type (Business/NGO/Gov): Educational
Website http://www.squ.edu.om/
Location /Address: Sultan Qaboos University
College of Agricultural & Marine Science
Alkhod 123, P.O.Box 34
Sultanate of Oman

Award Category No (5) Green Research Award

Project Details:

Project Title: Roof-mounted irrigation by capillary siphoning in Oman (IG/AGR/SWAE/10/05)

Location of Project: SQU Building Roofs

One Line Description of Project:

Different types of crops were cultivated in pots filled with three types of soil (coarse sand, recharge dam silt and soil from the SQU Agricultural Experimental Station plot). The pots were placed in an open area of the roof of SQU buildings. Water was diverted to the pots from containers through siphons made of used T-shirts, which are rolled and filled with soil. Siphoning flow rate, moisture content in the pots, hydrological parameters and the development of the plants were measured and monitored. Feasibility of further greening of roofs of Omani houses and their passive thermal insulation was assessed. Pot modules at the extreme temperature and dryness of Omani climate showed to be efficient thermal insulators of the roof and suitable biomedium for plants. Siphoned pots serve as good buffers for regular regional rainfalls. Irrigation by siphoning for implementation in regional conditions with precautions on secondary salinisation is recommended based on four different green roof modules tested. Along with improving building thermal regimes and flood attenuation the following collateral benefits are: utilization of otherwise idle roof space; as cheap and simple subsidiary farming and direct roof-to-family supply of basic vegetables in urban households; recycling used family cloth and plastics; engaging urban family members in agricultural activities.

Effectiveness

What were your goals?

The main objective of the whole project is to: Test the feasibility and technical applicability of green roofs with a novel capillary siphoning irrigation system in Oman.

The secondary objectives were to:

- Examine the temperature regimes of the roof near siphoned pots and of the soil inside the pots;
- Assess the durability of the siphons as water conduits in harsh Omani conditions, i.e. how sustainable the flow rate throughout the whole cultivation season is;
- Assess the resistance of the plastic counter-evaporation cover of the siphons, containers and the pots themselves to local solar radiation and high temperature;
- Observe the plant development in siphoned pots during one cultivation season;
- Investigate whether the designed siphon-pot coolers are economically efficient at the existing electricity-water prices in Oman;
- Report on laboratory tests with siphoned GR modules as hydrological flood buffers.

How have you measured your success?

1- Green thermal insulation of flat roofs of Omani private houses.
2- Minimal water usage for irrigation.
3- Supplementary fruits and vegetables harvested from otherwise unemployed areas of house roofs.

Innovation & Creativity

How were innovative methods, strategies or ideas applied?

New technology of irrigation was implemented; siphons were constructed and tested. Regular measurements of temperature, moisture content and electrical conductivity of soil, flow rates of siphoning were carried out to prove the agronomical and engineering feasibility of green roof modules

Impact

How has the project/initiative/work motivated others to contribute to a greener Oman

Daily-average temperature of the roof is shown to be reduced by 6-8 degrees (in June) with mid-day temperature peaks reduced by more than 20 degrees.

Several plants (ivy, sunflower, succulents and others) are shown to grow well on the roof when the maximum concrete/gravel temperature of the roof reaches more than 70 degrees

* Development of a novel irrigation system with:
  a) continuous (annually) irrigation without any scheduling.
  b) no additional labor.
  c) meeting optimal crop-water requirements.
  d) no electrical energy is required for this irrigation
  e) huge electricity savings (by reducing air-conditioning) are possible

- Utilization of waste.

- Green landscaping.

- Better harvesting of natural rainfall.

- Engagement of physically and mentally rotten family members in productive work.

Originality and Leadership

How has the nominee demonstrated vision, foresight and persistence?

Green roofs have never been practiced in Oman. Capillary siphoning of green roofs has never been practiced in the world. The combination of the two is unique and novel in arid countries.

Continuity & Sustainability

How sustainable is the initiative carried out?

The capillary siphoning of green roofs has been tried at SQU since 2001. Siphons are mechanically absolutely robust. Water supply to the tanks is as sustainable as the house or building itself. Soil is less sustainable due to secondary salinisation but common leaching can be practiced.

Explain how it will be effective in the long term

This technology (green roofs + capillary siphoning) can be spread all over Oman and other Gulf countries.