

Horticulture, water and energy use efficiency under protected agriculture conditions in marginal environments

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Objectives

Through our research in ICBA, scientist are trying to develop economical innovative technologies as a low cost system of protected agriculture that will cut on water and energy consumption. In this research works were focusing on assessing the water and energy use efficiency under both net house cooled by mist system and greenhouse cooled by pad-fan system. ICBA works aim also to develop a low cost substrate based on local materials (e.g. sand, compost).

Description of the systems

Structure description

The greenhouse and net house area is 560 m² each with two spans, each span has a width of 8 m, length of 35 m and height of 5 m (See photo 1). the net house is equipped with a mist system consisting of nozzles with an hourly discharge of 32 l/hr. In order to reduce the temperature and evaporation a shade net was installed above the mist system. The used net is an insect proof net with stitch dimensions equal to 1 x 0.5 mm. While the greenhouse is cooled through fan-pad system and equipped by automatic sun screen system. Both greenhouse and net house contain close drainage system where drainage water is recycled.



Greenhouse and net house structures at ICBA

(Figure 1 and 2) Water and energy use efficiency under greenhouse and net house

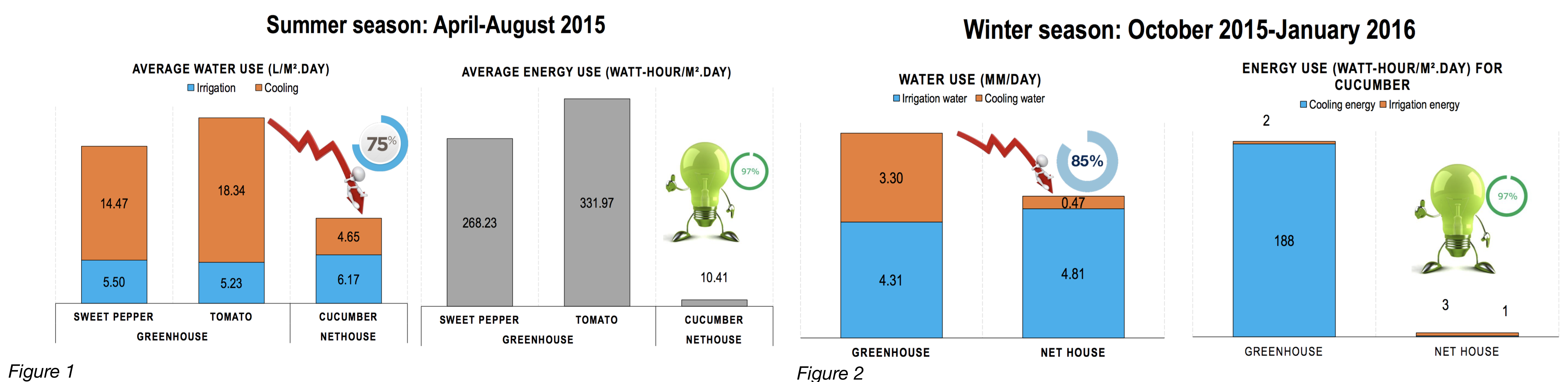


Figure 1

Figure 2

(Figure 3, 4 and 5) Development of local and low cost substrate for hydroponic culture

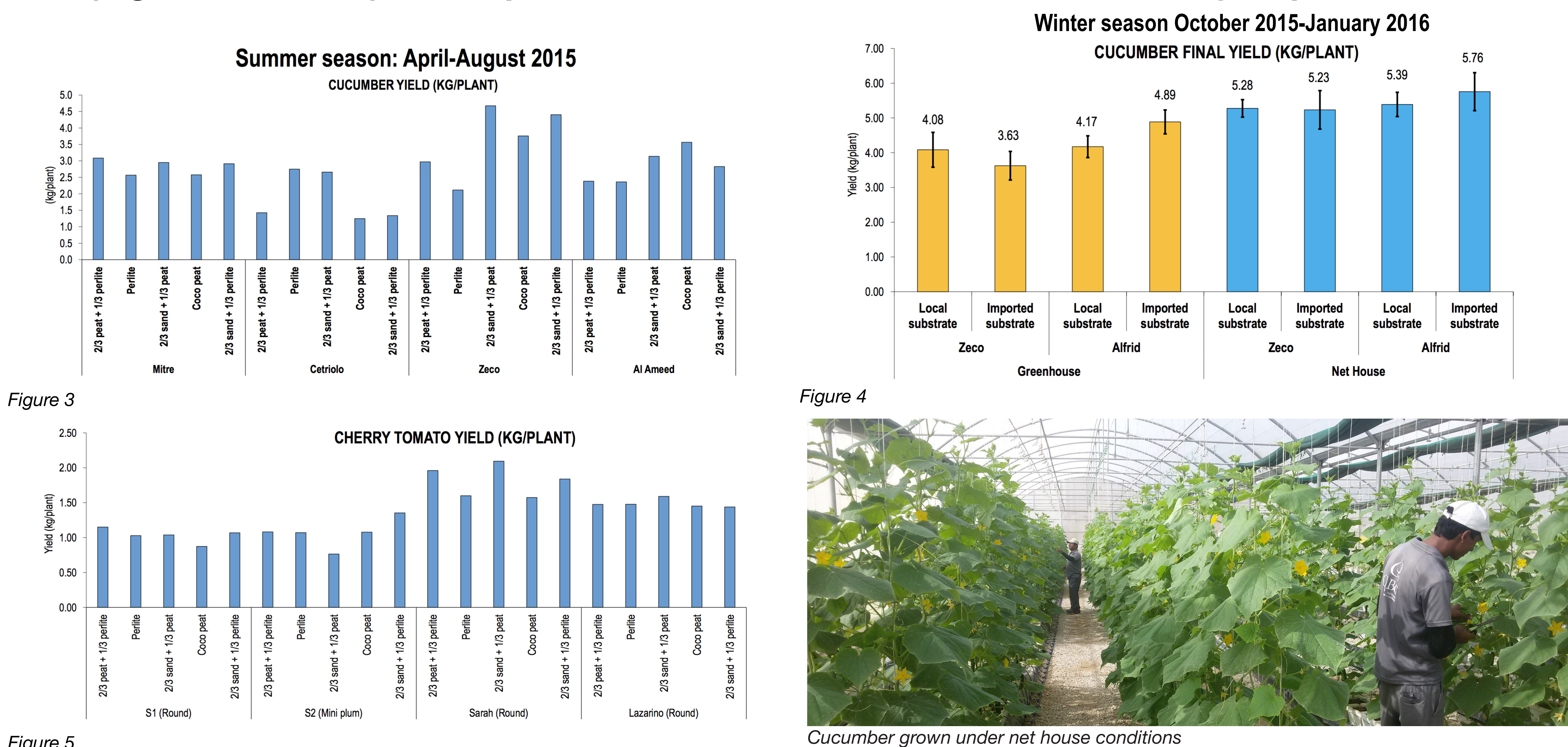


Figure 3

Figure 4

Figure 5



Cucumber grown under net house conditions

Conclusion

In the greenhouse, water consumption needed for cooling was 2.6 and 3.5 times higher than the required irrigation for sweet pepper and cherry tomato respectively. However, the mist and shade material in the net house helped to reduce water consumption: Two fold in comparison to the cooling greenhouse. It was also found that energy consumption in the greenhouse was 32 times higher than in the net house with the mist system.

During the winter season (October 2015-January 2016) greenhouse cooling consumed about 76% of water used in irrigation while the mist system in net house consumed about 9%. Greenhouse was shown to consume 49 time energy and 1.5 time water compared to net house. The scientists also tested several substrates, including imported (coco peat, perlite, peat) and local (sand). The results indicated that local substrates were more productive than imported substrates (perlite and coco peat) and were also economical.