

# Protected Agriculture in the Sultanate of Oman

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## Abstract

Oman is the third largest Arabian Peninsula country, and has generally warm, sunny winters and very hot, dry summers (although there are several diverse climatic regions). Research in protected agriculture began in 1992 with the screening and evaluation of cucumber, tomato and sweet pepper in plastic houses. Further research concentrated on cucumber, as the other two vegetables were devastated by arthropod pests. Production in single-layer plastic houses was greater than that in double-layer ones. Only one type of greenhouse is in use in the country, however: single-span, 9 × 40 m, double layer of polyethylene sheets, evaporative cooling and a single door. Other constraints to improved production include: cost of structural material; cost of inputs (seed, agro-chemicals); supply of good-quality irrigation water; pests and diseases; toxic residues in crops, and shortage of trained personnel. The following steps are recommended: improving greenhouse structures to improve environmental-control efficiency; making greenhouses pest-proof; research into other potential vegetable crops; integrated pest management research; improved cultural practices (fertigation, water-use efficiency, pruning); soil-sterilization and crop-rotation; determination of safe levels for chemical residues; training of personnel; budget for research; equipment for monitoring greenhouse environments; evaluation of the economics of protected agriculture.

## Introduction

The Sultanate of Oman, situated at the eastern end of the Arabian Peninsula, facing the Arabian Sea and the Gulf of Oman, is the third largest country in the peninsula after Saudi Arabia and Yemen. The Sultanate has 101,346 ha of agricultural land of which 61,530 ha is currently under cultivation (Nadaf et al. 1997). The area under cultivation increased by about 28% from 1980 to 1993 (Nadaf et al. 1997). Total agricultural production increased by 65% during the same period. The total production comprised 66% fodder, 22% fruits, 10% vegetables and 2% cereals.

The climate—which essentially consists of warm, sunny winters and very hot, dry summers—varies from region to region, with the coastal areas more humid than the interior and higher-altitude areas, and the southern region in general more temperate throughout the year. With the exception of Dhofar province in the south, where monsoon rains occur between June and September, rainfall throughout most of the country is low and undependable, and water supply is limited. Groundwater is therefore the main source for irrigation and domestic use. Excessive water-pumping

and prolonged lack of rains has reduced the extent of recharge resulting in ocean-water intrusion that progressively increases salinity in both irrigation water and the soil, and thus limits crop productivity.

## **Status of Research on Protected Agriculture in Oman**

The arid climate and environmental conditions of Oman necessitate and encourage the introduction of protected agriculture, particularly for vegetable-crops research. Research on vegetable crops in plastic houses started at the Agricultural Research Center at Rumais in 1992. Priority was given to cucumber, tomato and sweet pepper, on which screening and evaluation trials were conducted. The performance of cucumber was satisfactory and high yields were obtained. Both tomato and pepper gave good yields during the first season of experimentation; however, during the second season and thereafter both crops were severely infested by pests such as white fly, aphids and spider mites, which devastated the crops. This incidence of pest infestation clearly indicates a structural problem in the greenhouses in use. In fact, only one type of greenhouse is in use at the agricultural research centers in Oman. That is a single-span plastic house (9 × 40 m) covered with a double layer of polyethylene sheet and having a single door.

Further research efforts were concentrated on cucumber. These experiments included various planting dates to extend the availability of cucumber through the year. Fertigation experiments on cucumber were also conducted during the 1996–98 seasons in both single- and double-layer plastic houses. The results revealed significant effects for different levels of nitrogen fertigation and experimental site (i.e. single- or double-layer plastic house). Both yield and dry-matter accumulation were significantly higher in single-layer plastic houses. The data clearly indicated that a simple modification by using one plastic layer instead of two layers was effective in increasing productivity.

### **Constraints**

During our research in protected agriculture we observed several constraints that jeopardized our efforts in this field. These include the following.

The single-span plastic house (9 × 40 m), used in Oman which is covered with a double layer of polyethylene sheets, with evaporative cooling system and a single door that allows for insect infestation, is not an ideal design for the region.

High cost of structural material.

High cost of inputs such as hybrid seeds, pesticides and other chemicals.

Limited sources of good-quality irrigation water.

Lack of integrated pest management.

Build up of soilborne pathogens and soil degradation due to intensive cultivation.  
Excessive residues of toxic chemicals in fruits (cucumber) produced in plastic houses.  
Shortage of qualified personnel and trained technicians.

These constraints could be alleviated by the following actions and activities.

The structure of the greenhouses in use needs to be improved; environmental control and ventilation have to be developed to reduce running (electricity) costs.  
The greenhouses should be constructed in a way that makes them less accessible to various insects; multi-door entrances are recommended.



*Insect-proof netting on side-wall ventilators of greenhouse (UAE)*

Research should be initiated on several vegetables in the improved greenhouses, in addition to cucumber.  
Integrated pest management is strongly advocated and needs to be given priority by relevant scientists.  
Improved cultural and husbandry practices, such as fertigation, water-use efficiency and pruning, should be adopted for vegetables grown in plastic houses.

Soils should be sterilized and crops rotated.  
Safe levels of toxic residues should be defined.  
Personnel involved in protected-agriculture research should be trained.  
Sufficient operational budget should be allocated for research.  
Control and monitoring equipment is needed for research in greenhouses.  
The economics of production under protected agriculture should be thoroughly tested and evaluated.

### **Expected Benefits**

Improvement of protected agriculture will lead to the following benefits.

- Increased productivity and availability of vegetables to consumers.
- Creation of more export opportunities.
- Regular income to the farmers.
- Improved water-use efficiency.

### **Reference**

Nadaf, S.K, S.A. Al Khamisi and M.G. El Hag. 1997. Scope of cultivating fodder beet in salinity affected waste lands of Oman. *In* Soil and Crop Management Under Drip Irrigation in Arid Semi-arid Regions, AOAD and MAF Workshop, Oman, 3–7 May 1997, Muscat, Sultanate of Oman.