المـركـز الوطنـي لأبحـاث وتطوير الزراعة المستدامة
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Evaluation of three levels of Greenhouse Technology at ESTIDAMAH Research Center

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Background

Farmers and investors need to know what level of technology they should apply in order to have a feasible production facility. At Estidamah, three levels of technology are present and have been studied. A pad and fan tunnel greenhouse with an advanced water and nutrient supply system is considered as the standard technology, implemented at most of the farms in KSA. A multi span greenhouse with a glass covering is considered as Mid Tech technology. The most advanced system is the closed greenhouse, where the air is conditioned by chillers.
All three levels of technology have been evaluated in terms of resources usage.

Results

The table below shows most important aspects of the three different levels of technology. In terms of operational costs, a Mid Tech greenhouse is most economical. The initial investment in a tunnel greenhouse is lower. The high-tech greenhouse is only feasible in regions where the outside humidity is high so evaporative cooling cannot be applied, hence coastal regions. Based on this information a farmer or investor can decide on what level of technology he wants to invest. The production levels indicated can only be reached by a proper management of the technology and a proper crop management.

Methods

	Tunnel greenhouse	Multi span greenhouse	Closed greenhouse
			
Technology	•Plastic cover •Automated fertigation system	•Glass cover •Frequency controlled ventilation •High placement of fans •Reuse of drain water	•Air conditioning •CO_2 enrichment •Dehumidification system
Benefits	•Low investment costs •Proven technology	•Labour efficient •High light transmissivity •Durable	•Independent of outside conditions •High water use efficiency
Disadvantages	•Moderate production •High water use for cooling	•Water use for cooling	•High operational costs •High investment costs •Complex technology
Annual production (tomato)	70 kg/m²	80 kg/m²	90 kg/m²
Commercial Investment costs	260 SAR/m²	400-600 SAR/m²	1200-1600 SAR/m²
Labour (13 SAR/h)	3.5 h/m² (45 SAR/m²)	2.5 h/m² (30 SAR/m²)	2.5 h/m² (30 SAR/m²)
Fertilizer (including CO_2)	15 SAR/m²	15 SAR/m²	50 SAR/m²
Pesticides	15 SAR/m²	15 SAR/m²	12 SAR/m²
Planting material	4 SAR/m²	4 SAR/m²	4 SAR/m²
Annual water use (4 SAR/m³)	5.7 m³/m² (1.6 m³ irrigation 4.1 m³ cooling) 23 SAR/m²	3.5 m³/m² (1.2 irrigation, 2.3 m³ cooling) 14 SAR/m²	0.2 m³/m² (1.4 irrigation, -1.2 m³ collecting) 1 SAR/m²
Annual electricity use (0.21 SAR/kWh)	35 kWh (7 SAR/m²)	30 kWh (6 SAR/m²)	600 kWh (126 SAR/m²)
Annual operational costs	109 SAR/m²	84 SAR/m²	223 SAR/m²
Operational costs per kg	1.56 SAR/kg	1.05 SAR/kg	2.48 SAR/kg

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