

Protected Agriculture in the Kingdom of Saudi Arabia

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Abstract

The adverse climatic conditions and scarcity of irrigation water within Saudi Arabia have encouraged the development of protected agriculture as the main agricultural emphasis. A range of different greenhouses is in use, from semicircular-tunnel plastic houses without cooling to triangular or semicircular glass and fiberglass houses with fully automated (computerized) operation. Current constraints include: lack of experienced technical personnel; soil and water salinity, and the cost of desalination; marketing problems and low produce prices; pests and diseases. Fertigation is practised using sprinklers and drip irrigation; a limited amount of soilless culture is conducted. Pests and diseases have generally been controlled by extensive pesticide application, resulting in increased costs, the emergence of pesticide-resistant pathogens, and pollution (crop and environment residues). Integrated production and protection needs to be introduced.

Introduction

As a result of the diverse climate conditions and the scarcity of irrigation water in some regions of the Kingdom of Saudi Arabia, the Ministry of Agriculture and Water has much experience in protected agriculture (PA). Because of the constraints, agricultural emphasis was on PA which can control the crop-growing climate and, using modern agricultural and irrigation techniques, produce fresh products throughout the year. Development of the PA industry in the Kingdom could not have been achieved without the support and encouragement given by the Ministry of Agriculture and Water and the Agriculture Bank. This support was in the form of distribution of land, extension and technical services, loans and subsidies for all the inputs for protected agriculture.

Types of Greenhouse in Use

Glass and Fiberglass Houses

These greenhouses are triangular or semicircular in cross-section. Each unit covers one hectare, partitioned according to need and crop. They have automated computer systems for cooling, heating, irrigation and fertilization. Trained technical personnel and continuous maintenance are needed to manage these houses. The main vegetable crops grown are tomato and cucumber, although some growers cultivate beans, muskmelon, strawberry, cut flowers and houseplants.

Ordinary Plastic Houses

These greenhouses are made from galvanized pipes bent into semicircles (arches) with a plastic cover; the standard area covered is about 500 m² (9 m × 56.5 m). Most growers use this type of non-cooled greenhouse owing to its simplicity and ease of construction. Tomato, cucumber, squash and hot and sweet pepper are the main crops cultivated in these houses during the cool and mild seasons.

Problems and Constraints

Unavailability of experienced technical personal.

Soil and water salinity and the high cost of water desalination units.

Marketing and low prices of produce.

Spread of pests and diseases as a result of the lack of integrated control programs.

Water Use Efficiency

There is a need for more research in this field to rationalize water use, and reduce fertilizer wastage and operational costs.

Fertigation

This method of fertilization was introduced into Saudi Arabia in the 1970s as a result of the widespread use of modern irrigation techniques. About 850,000 ha currently use center pivot systems (sprinklers) and 2000 ha are drip irrigated. Soilless culture is limited to about 10 ha of vegetable production using soluble fertilizers.

Integrated Pest and Disease Control

The density of plants in the greenhouse provides a favorable climate for the spread of pests and diseases that cause a great loss in crop quality and quantity. The most important diseases are powdery mildew, downy mildew, brown rot, early and late blight, and viral and bacterial diseases. To control these diseases growers use pesticides extensively which lead to various problems such as:

increase in production costs

emergence of new strains of pathogens that are resistant to pesticides

pollution of crops and environment (residues).

Consequently, it has become imperative to apply integrated production and protection control methods to reduce pesticide use. These methods include the following.

Cultural methods

Using sterilized soil in the nurseries.

Exercising precautions at the nursery with attention to tools and their periodic fumigation, to prevent contamination with diseases and pests.

Solarizing the greenhouse soil to reduce soil-borne diseases.

Using healthy seeds and uninfected seedlings.

Growing resistant cultivars—at present there are cultivars that are resistant to some fungal diseases such as wilts caused by *Fusarium* and *Verticillium*.

Removing weeds and other undesirable plants from inside and outside the greenhouses, as they act as a secondary hosts for pests and diseases.

Ventilation: The opening vents of greenhouses must be covered with insect-proofing nets or screens. More attention should be given to ventilation in order to reduce humidity (high humidity promotes diseases such as botrytis and mildew).

Cleaning tools and equipment before use to reduce the risk of disease transfer.

Providing balanced fertilization induces vigorous growth of the plants and consequently improved resistance to diseases. Excess use of nitrogen leads to reduced root systems as well as tender and slack tissues that are susceptible to diseases.

Applying manure and organic fertilizer, which helps improve soil fertility, increase natural enemies, and destroy pathogens during the decomposition process.

Applying green manure: Growing certain crops and mixing them with the soil will increase soil organic-matter content, which will improve the soil properties and increase its water-holding capacity; it will also enrich the soil with nutrients, particularly after decomposition of the green manure.

Removing and burning all dead and infected plants and leaves.

Pruning of lower leaves can increase aeration and reduce humidity build-up.

Crop rotation: It is advisable to use a certain cropping rotation to avoid planting the same crop or a crop of the same family in the same soil in successive seasons, so as to prevent disease or pest build-up over time.

Chemical methods

Chemical spray has been and still is the most common method of controlling pests and diseases because of its quick action and ease of use. Chemicals will still be used, but the following points should be taken into consideration.

Minimize preventive sprays.

Use the proper chemicals at the right time.

Apply the recommended dose and follow all the instructions on the label.

Use a suitable sprayer to ensure good coverage and distribution of chemical.

Diversify pesticides to avoid emergence of new resistant strains of pests and diseases.

Treat infested portion of plants or location within greenhouse specifically, if possible; i.e. do not treat uninfected plants.