Protected Farming

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Protected cultivation, which enables some control of wind velocity, moisture, temperature, mineral nutrients, light intensity, and atmospheric composition has contributed and will continue to contribute much to a better understanding of growth factor requirements and inputs for improving crop productivity in open fields. This article discusses little about protected farming structures for growing vegetables and flowers.

Introduction

After the advent of green revolution in India, more emphasis is laid on the quality of the agricultural produce along with the quantity of production to meet the ever-growing food and nutritional requirements. As a profession, agriculture is not attractive for the educated youth, which is partly due to the drudgeries associated with field work. To motivate the educated youth, agriculture has to be developed to be a remunerative and drudgery-less industry as competitive as any other industry using agro-technologies like greenhouse. Then only a sense of pride will be associated with agriculture.

Some of the areas are inaccessible as well as inhospitable where normal cultivation is not possible. To cater the needs of the population in the inaccessible areas greenhouse cultivation could be an answer. There is very good and sustainable demand for fresh vegetables around the cities and towns. The main purpose of protected cultivation is to create a favorable environment for the sustained growth of crop so as to realize its maximum potential even in adverse climatic conditions.

Protected cultivation, which enables some control of wind velocity, moisture, temperature, mineral nutrients, light intensity, and atmospheric composition has contributed and will continue to contribute much to a better understanding of growth factor requirements and inputs for improving crop productivity in open fields. Technologies for protection (windbreaks, irrigation soil mulches) or structures (green house, tunnels, and row-covers) may be used with or without heat. The primary emphasis is on producing high-value horticultural crops (vegetables, fruits, flower, woody ornamental and bedding plants).

Protected cultivation practices can be defined as a cropping technique where in the micro climate surrounding the plant body is controlled partially/ fully as per the requirement of the plant species grown during their period of growth. Our country is self dependent on food grain production but to fulfill the nutritional security, the gap between increasing demand of horticultural produce has to be filled. This gap can not be filled by the traditional horticulture...
which required large area under horticulture to increase the production for the ever growing population.

Among the greatest constraints in horticultural crop production are a lack of sunlight, temperature that are either too hot or too cold, moisture deficiencies in soil nutrients, excessive wind velocity and atmospheric carbon dioxide. Most of these are climate factors or directly related to them. Many of these constraints have been alleviated or lessened by protected cultivation or controlled environments.

**Present Status**
Protected Cultivation technology is a relatively new technology for our country. The total area covered under protected cultivation in our country is approx 30,000 hectares. There has been a very good development in this area during the last five years. The leading states in the area of protected cultivation are Maharashtra, Karnataka, Himachal Pradesh, and North-eastern states, Uttarakhand, Tamilnadu and Punjab. The major crops grown in the protected cultivation are tomato, capsicum, cucumber, melons, rose, gerbera, carnation and chrysanthemum. Nursery grown in the protected cultivation is becoming very popular venture for income and employment generation.

The greenhouse technology is more than 200 years old. The Europeans were considered the pioneers in this field. Later with the advent of plastics during the Second World War a new phase in the green house technology emerged. Now a day, nearly 90% of the new green houses are being constructed by utilizing Ultra Violet (U.V) stabilized polythene sheets as the glazing material. In India, the technology is still in its nascent stage. The area under green house cultivation as reported by 2007-08 was about 500 ha in India. This figure is quite significant when compared with the total area under green house in the world which was 275,000 ha as reported for the year 1999-2000. Thus it can be safely stated that there exists a vast scope for expansion for green house technology in India.

Application for the green house technology for commercial purpose is however in its infancy in India. The green houses which existed in 1960s were used for commercial purposes but the impetus and the much required thrust came only in the mid 1980’s with the emergence of the industries manufacturing U.V. stabilized Low Density Poly Ethelene (L.D.P.E.) and the development of the indigenous technology for low cost green houses. Indian Petro Chemicals Limited (I.P.C.L) was one of the foremost industries operating in collaboration with the agricultural scientists in this field. In 1985, Indian Agricultural Research Institute (I.A.R.I) designed and set up green house at Leh (J&K). Today there are more than 1840 small and medium sized greenhouses at Leh. The Defence Research and Development Organisation (DRDO) has provided adequate support and technological help in this project. Nowadays the much needed vegetables are being grown throughout the year in these hostile climates. Production of brinjal, capsicum, tomato and other cucurbits is taken in the summer months on a large scale, whereas the green leafy vegetables are being grown in the long frozen winter months when the average temperature reaches -30.2°C. Underground greenhouses and soil trenches are also being used on a large scale in these remote areas.
Farmers are also utilizing low and medium cost greenhouses for raising potted plants and seedlings in the nursery. In the Northern Gangetic plains especially in Punjab, Haryana and Uttar Pradesh, the farmers are using this technology to raise healthy seedlings of high yielding crop varieties so that they can be transplanted early in the fields during the onset of the spring season so as to capture the early markets and thus reap higher returns. In the North Eastern states, especially in Assam, efforts are on to raise vegetable crops in the greenhouse-cum-Rain Shelter Structures during the long south west monsoon periods. In these regions stress is being given for the development of low cost greenhouses using bamboo frame structures as these construction materials are readily available in these regions. The results obtained in this regard from the concerned agricultural universities are encouraging.

The State Seed Corporation of India is utilizing at present the medium and the high cost greenhouse technology in their seed production units so as to maintain higher degree of purity of parental lineage and genotype. A large number of private companies are utilizing at present the high cost multispan greenhouse technology which has provisions for microprocessor controlled environment control system like operation of motorized shading system, on line drip irrigation system, supplementary heating and lighting system and the likes for vegetative propagation of chrysanthemums, roses, carnations, gladiolus etc.

Development of indigenous evaporative cooling system has taken place in recent times to control greenhouse air temperature during the long summer months. Exhaust fans of upto 60 cm diameter and some specialized equipment are being widely manufactured nowadays in the country. At the same time great strides have been made to develop advanced cellulose and polyfab nylon cooling pads for usage in these cooling systems. The thermostats, thermocouples, high pressure mist and fogging system etc. and other environmental control equipment are being manufactured now a day in the country itself. Similarly, various brands of glazing material which include the U.V. stabilized polythene sheets, the fibre glass reinforced plastics, the twin wall polycarbonate sheets, etc. are also available in the local market now-a- days. Micro irrigation system and application procedures for applying the chemical and bio-fertilizers in the liquefied form are available for ready usage in the greenhouse.

**Protected Structures for Growing Vegetables and Flowers**

Vegetable and flower production is significantly influenced by the seasonality and weather conditions. The extent of their production cause considerable fluctuations in the prices and quality of vegetables. Striking a balance between all-season availability of vegetables and flowers with minimum environmental impact, and still to remain competitive, is a major challenge for the implementation of modern technology of crop production.

The crop productivity is influenced by the genetic characteristics of the cultivar, growing environment and management practices. The plant's environment can be specified by five basic factors, namely, light, temperature, relative humidity, carbon dioxide and nutrients. The main purpose of protected cultivation is to create a favourable environment for the sustained growth of plant so as to realize its maximum potential even in adverse climatic conditions. Greenhouses, rain shelters, plastic tunnels, mulches, insect-proof net houses, shade nets etc. are used as
protective structures and means depending on the requirements and cost-effectiveness. Besides modifying the plant’s environment, these protective structures provide protection against wind, rain and insects.

Protected cultivation is relevant to growers in India who have marginal and small land holdings, which helps them to produce more crops each year from their land, particularly during off-season when prices are higher. However, growing vegetables and flowers under protected conditions requires comparatively high input cost and good management practices, which have direct bearing on the economic viability of the production system. Even if the protective structures are cost effective, proper planning, management and attention to details are needed to achieve maximum benefits.

Benefits of Protected Cultivation
The benefits which can be derived from the protected cultivation are as follows:
- Environment control allows raising plants anywhere in the world at any time of the year i.e. crops could be grown under the inclement climatic conditions when it would not be otherwise possible to grow crops under the open field conditions.
- The crop yields are at the maximum level per unit area, per unit volume and per unit input basis.
- The control of the microcosm allows the production of higher quality products which are free from insect attack, pathogens and chemical residue.
- High value and high quality crops could be grown for export markets.
- Income from the small and the marginal land holdings maintained by the farmer can be increased by producing crops meant for the export markets.
- It can be used to generate self employment for the educated rural youth in the farm sector.

Future Potentialities
Research conducted at various locations by the SAUs, PFDCs, ICAR institutions, DRDO and other organizations have confirmed that, there is a vast scope of utilizing the protected cultivation technology for growing many vegetables, flowers and few fruit crops in different parts of the country. The studies conducted by DRDO have proved that even in high altitude areas of Leh and arctic deserts, the green house cultivation can assure fresh supply of vegetables.

A number of opportunities exist for nursery men, commercial crop growers, seed producers and researchers in utilizing greenhouse for their benefit. In temperate and subtropical zones protected farming can easily be used for raising vegetable nursery in late winters which could be transplanted in early spring. This can advance the cropping by one to one and half month and thus, may provide remunerative price to the farmers. In plains green house may be utilized for year round propagation of many tropical and subtropical fruits which could prove a boon for nursery men. There is a demand of quality vegetable nursery in the vegetable growing areas.

Year round cultivation of selected vegetable crops such as tomato, capsicum and cucumber is possible under protected environment with single/ multi crop in a year, which fetches off season higher price with quality produce and also with lower cost of cultivation and longer
duration of crop. There is high demand of colored capsicum, parthenocarpic cucumber and cherry tomato in the hotel industry and export market throughout year at very attractive market price of the produce. India has a vast scope for exporting cut-flowers such as Gerbera, Carnation, Lilium etc grown under protected environment.

**Type of Greenhouse Based on Cost of Installation**

*Low Cost Polyhouse/Greenhouse*

Polythene sheet of 700 gauge thickness is supported on bamboo ropes and nails. Temperature inside greenhouse is 6-10°C higher than outside.

*Medium Cost Greenhouse*

It costs higher than low tech greenhouse. In quonset shaped polyhouses frame, Galvanised Iron (GI) pipes are used. Thickness of single layered Ultra Violet (UV) stabilized polythene is 800 gauges. Exhaust fan are thermostatically controlled. Frames and glazing materials have life span of 20 years and 2 years, respectively.

*High Tech Greenhouse*

Frame is made up of iron or aluminum. Designs are dome shaped or cone shaped. These are highly durable, 5-6 times costlier, growing medium used in these type of greenhouses are Peat, Perlite, Solarite, Vermiculite, Rock wool. In India coco fibres and rice husks are used as growing media as these materials are cheaper. Fertigation and pesticide sprays are done by fogging machine.

*Miniature Forms of Greenhouses*  

*Plastic Low Tunnels*

Plastic low tunnels are miniature form of greenhouses to protect the plants from rains, winds, low temperature, frost and other vagaries of weather. The low tunnels are very simple structures requiring very limited skills to maintain and easy to constructs and offer multiple advantages. For construction of low tunnels, film of 100 micron would be sufficient.

*Net Houses*

Net houses are used for raising vegetable crops in high rainfall regions. Roof of the structure is covered with suitable cladding material. Sides are made of wire mesh of different gauges. Such structures are useful for north-eastern hilly region. Sweet pepper, an economically potential vegetable is generally grown at high altitude (>1000 ft.) but more recently its cultivation is
gaining popularity in Northern Indian plains where its fruit size and productivity is very poor because of fluctuations in temperature and attack of insects-pests (fruit borer, aphid, mite and white fly) under open field conditions. Therefore there is a great scope for protected Sweet pepper cultivation. Likewise, offseason capsicum production under protected cultivation is also becoming popular in Indian plains.

**Conclusion**

The protected cultivation of high value crops has become irreplaceable both from economic and environment points of view. It offers several advantages to grow high value crops with improved quality even under unfavourable and marginal environments. However, due to high training needs of the green house growers and some poor quality produce with pesticide residues has been a matter of great concern. These issues can easily be addressed by integrating various production and protection practices including location specific designing and construction of the polyhouses for efficient input use. Creating awareness among the greenhouse growers for judicious use of pesticides for safe production can be instrumental in providing quality products without polluting the environment.