

# Good Agricultural Practices (GAP) in Protected Cultivation

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Protected cultivation or Greenhouse technology is becoming increasingly popular among the farmers in India to grow vegetables, flowers and exotics. As we all know, the cultivation of Agriculture/horticulture crops in open cultivation is dependent on various climatic factors like rain, heavy winds, temperature, humidity, light intensity etc and based on these climatic factors, the farmers get good production sometimes and entire crops is a waste sometimes in bad weather conditions. Thus, cropping in open cultivation is a risky business and efforts were made by various scientists all over the world to find out some suitable measures at least to maintain and cultivate rare high value crops. It was concluded that protected cultivation is the best option to cultivate horticulture crops with the best quality and higher yields of the produce irrespective of outside weather conditions. It is possible to create and maintain desired climate conditions inside protected structures like greenhouses that are required for better growth of crops.

Greenhouse cultivation on commercial basis started in India 35 years ago in 1990-91. Today greenhouse cultivation is very common in India almost in every state and farmers are increasingly showing interest in greenhouse cultivation. At present, more than



30,000 greenhouses exist in India cultivating roses, gerbera, carnations, anthuriums, orchids and vegetables like capsicums, tomatoes, cucumbers, exotic vegetables etc. However, farmers/growers need to study and adopt Good Agriculture Practices in protected cultivation to make it a more successful and profitable business. In India, there is always debate whether greenhouse technology is successful in India or not. Success of any technology depends upon how we adopt it. It is observed that the farmers adopting good agriculture practices are highly successful in protected cultivation, achieving good profits and expanding area under protected cultivation.

For farmers who are beginners in protected cultivation or who want to start protected cultivation, it is very important to understand what good

practices are to adopt for successful business. Adopting Good Agriculture Practices (GAP) assures the following advantages.

1. Good agriculture practices always help farmers to achieve better production in terms of quality and yield of produce.
2. It reduces the cost of production by reducing input costs.
3. Enhance quality production and productivity per unit area resulting in achieving higher profits.
4. Record keeping, analyzing and evaluation help with taking proper decisions in critical situations.
5. Following GAP with certification help in exports of produce and creating brand in domestic and export markets.

Protected cultivation involves various operations/activities right from selection of proper site for greenhouse erection up to marketing of the produce. In each of the activities, certain good practices need to be studied and followed to achieve profits/success.

## A. SELECTION OF SITE FOR GREENHOUSE CONSTRUCTION

Site selection is one of the most important activities as if it is wrong, the entire project may fail. The following are some criteria to consider



*Wrong selection of site*

for selection of the right site.

- Levelled land with good soil (Soil EC & ph)
- The site should be slightly higher elevated than the surrounding land.
- Availability of Irrigation water (Water EC & ph)
- Availability of electricity/backup
- Pollution free site
- Availability of communication facilities, connectivity of good roads.
- Avoid land below high-tension cables
- Shadow free
- Sufficient land should be available considering future expansion

### B. CROP/VARIETY SELECTION

Following criteria/good practices should be adopted for crop/variety selection.

- Based on market demand, location and suitable climate high value crops to be selected
- Flowers/vegetables/fruits/nursery
- Planting material – Healthy, pest/disease resistant. Portrays seedlings should be encouraged to avoid mortality
- Seedling – 35 to 40 days old, 16 to 20 cm height with minimum 4 to 6 leaves
- Should have good rooting system



*Various crops like flowers and vegetables under protected cultivation*

- Other characteristics like fruit color, shape, vigor, production etc

### C. SELECTION OF GREENHOUSE/ AREA/ORIENTATION

Based on crops, location and climate conditions, following criteria/good practice need to be adopted while selecting greenhouse type, area and direction of greenhouse.

- Functional, easy to operate, allows for planting variety of crops
- Design should be as per agroclimatic zones with facility of water harvesting
- Strong enough to withstand extreme climatic conditions (wind, snow, hail, rain)



- Strong enough to support the load of internal service systems and plant foliage
- Minimum shading with maximum longevity
- Easy service, maintain, cover & recover with cladding materials
- Provision of appliances to regulate climatic factors inside the greenhouse
- Economics

### D. SOIL/MEDIA PREPARATION, FYM & BASAL DOSE APPLICATION

The following criteria/good practices should be adopted.

- The soil should have a pH of 5.5 to 6.5 and EC of 0.5 to 0.7 Ms/cm



Media preparation and Fumigation



Mixing of FYM and Bed preparation

- The pH of the irrigation water should be 5.5 to 7.0 and an EC between 0.1 to 0.3 ms/cm.
- Soil should be mixed with optimum quantity of well decomposed FYM
- If required, enough rice husk should be added in soil.
- Soil fumigation/sterilization with available permeable fumigants (with proper and safe procedure of application)
- Wash the soil and bed preparation as per standards
- Basal dose application of fertilizers and mixing of topsoil

### E. SELECTION OF MICRO IRRIGATION SYSTEM

Based on crop and variety, following



Drip Irrigation system for Soil/soilless Cultivation & components

Drip/fogger system

- Fogging/misting system for reducing temperature and increasing relative humidity in the protected structures

### F. WATER AND NUTRIENT MANAGEMENT

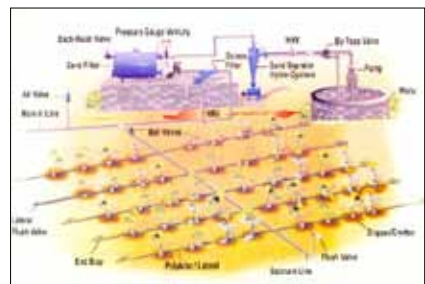
To achieve maximum production and better quality of produce, water and fertilizer management and distribution is very critical and important. The following practices need to be adopted.

- Irrigation along with nutrition should be done in the morning preferably before 9 am.
- Application of water to be based on water requirement calculations and measured quantity of water to be applied through drip to the root zone of the crop.
- Frequent monitoring of drippers while irrigation
- Soil analysis, water analysis, leaf analysis in suggested period
- Application of WSF based on analysis/crop stage and requirement
- Stress management
- Regular maintenance of micro irrigation system

### G. CULTURAL PRACTICES, USE OF PROPER TOOLS

Timely cultural practices for proper growing of crops and selection of right tools for cultural practices is very important and following practices should be adopted.

- Different crops need different cultural practices for optimum



growth

- As per selected crop, Cultural practices need to be adopted.
- For roses – Pinching, disbudding, bending, removal of wild shoots, removal of blind shoots, development of ground shoots and plant structure, Thinning
- Removal of old and/or infected leaves, removal of weeds
- Development of Two leader/ Four leader structures for raising capsicum crops
- Support system nylon/GI wire for raising crops
- Sickling/raking of soil on top

## H. INTEGRATED PEST MANAGEMENT

Understanding probable pest attack, different pests and their infestation/damage to the crops, probable control measures is a must for farmers and hence following practices need to be adopted and followed.

- Use resistant varieties of crops.
- Use Pest & disease-free planting material
- Quarantine incoming plant material
- Practice good sanitation techniques
- Monitor crop on daily basis
- Scouting (Identification of pest and diseases.)
- Monitor and suppress insect population
- Modify the environment
- Avoid plant stress
- Use pheromone traps, light traps, sticky cards etc
- Keep unauthorized traffic to minimum

## I. HARVESTING AND POST-HARVEST MANAGEMENT

From market point of view, harvesting of produce and post-harvest management adds value to the produce and thus following good practices to be adopted

and followed during harvesting and post-harvest.

- Right stage of harvesting
- Optimum color development, shape and size
- Right time of harvesting
- Selection of proper flowers, fruits for harvesting
- Right kind of tools for harvesting
- Preservatives added in containers/ buckets
- Avoid damaged flowers/fruits during harvesting

## Bunching and packing as per market requirement

### Post-Harvest care of the produce

Proper care of harvested produce is required to keep produce fresh till it reaches to market and consumer. The following are some criteria/practices to adopt.

- Keep the harvested flowers/fruits in a cool place for a few hours
- Precooling chamber
- Cold storage
- Grading according to length of stems, weight and size of fruits
- Sorting according to bud/disc size, color and shape
- Bunching/arrangement of fruits
- Packaging as per standards domestic/international
- Packed Boxes in cold storage before transport

## J. TRANSPORT TO MARKETING DESTINATION

Different types of modes are available for transport of produce to market. The following practices should be learnt and adopted for safe handling of produce till it reaches to market.

- If possible, use cold vans for far distance domestic markets/ international markets and follow cold chain
- For smaller distances, cold chains

are not required.

- During transport, care of boxes must be taken to avoid damage.
- Keep refrigerator on while in transit/stops in between etc
- Maintain temperature, humidity and light intensity in vans during transport as per standards

## K. RECORD KEEPING

Keeping record of all the activities performed at our farm is most essential generally not done by most of the growers. Now a days farmers are more cautious about the produce quality, markets, consumer preference etc and record keeping and the use of the same is done by many progressive farmers. It helps the farmers to make right decisions in problematic situations.

- Record temperature every 2 hours from 8 am to 6 pm daily.
- Record relative humidity every 2 hours from 8 am to 6 pm daily.
- Record minimum and maximum temperatures of the day.
- Record light intensity for every 2 hours from 8 am to 6 pm daily.
- Record EC and ph of soil/media once a week.
- Record EC and ph of water once a week.
- Record EC and ph of drip water once a week and compare with standard.
- Maintain daily records of workers and what work they complete.
- Mark numbers to each bay/beds/ greenhouse for easy understanding of worker movements.
- Maintain a register for regular checks in the irrigation system like daily checks, weekly checks, monthly checks etc
- Maintain a record of maintenance of irrigation systems on a daily, weekly, monthly basis.
- Record timing of foggers/misters running and temperature &



*Media preparation and Fumigation*

humidity before and after fogging for understanding reduction in temperature and increase in humidity as per requirement.

- Record of soil analysis, water analysis, daily fertilizer/nutrients applied in A, B, C tanks (greenhouse/ crop wise)
- Record of cultural practices done in greenhouses (time required,

labor required, tools used, cleaning/ washing of tools etc)

- Scouting/monitoring of crops daily (crop, bed no, bay no, greenhouse no, date)
- Identification of pest disease if any (bed no, bay no, crop, greenhouse no, stage of infection etc)
- Spot application to suppress the pest/disease to avoid spreading (name of chemical/ingredient, concentration, water used, time of application, method of application etc)
- Record result of spot applications (no result, partially killed, completely killed, side effect if any like scorching/burning etc)
- Record of sprays applied in full greenhouse (crop, pest disease name and stage, chemical/biopesticide used, concentration used, total amount of water, time and date of spray, result of spray, method of application)
- Record of TEST sprays on new

chemicals introduced for 1<sup>st</sup> time

- Record of harvest (crop, no of stems/quantity in Kgs etc bay no, greenhouse no, date and time of harvest)
- Record of packaged flowers/fruits (quality and quantity parameters)
- Record of temperatures/humidity/ light in precooling & cold chambers)
- Record of rejected materials (reason for rejection, quantity, source greenhouse no, discard of rejected materials)
- Record of meetings discussions/ suggestions to reduce rejections and improve quality & quantity of standard produce that can be sold on higher rates – Production manager, greenhouse managers/ supervisors etc

