

Nursery Management for Horticultural Crops, Need and Potentialities for Plant Multiplication

K. Nirosha¹, B. Naveen Kumar², A. Nirmala³, B. Nithya Sri⁴ and MD Sadik Pasha⁵

¹Assistant Professor, Dept. of Vegetable Science, SKLTGHU, Hyderabad

²Assistant Professor & Vice-principal, Horticulture polytechnic, SKLTGHU, Ramagirikhila

³Assistant Professor, Department of Horticulture, College of Agriculture, PJTAU, Hyderabad.

⁴MSc. (Hort.), Dept. Of Vegetable Science, SKLTGHU, Hyderabad

⁵MSc. (Hort.), Dept. Of Vegetable Science, SKLTGHU, Hyderabad

SUMMARY

India is having a great diversity of agro climatic zones suitable for different horticultural crops such as fruits, vegetables, ornamental plants, spices, plantation crops, medicinal and aromatic crops. After green revolution, India has made a tremendous progress in horticultural production and occupies good ranks in vegetables and floriculture production in the world but, the productivity is quite low due to poor planting materials, improper nursery management practices, climate change and traditional cultivation practices. To achieve higher productivity of major share contributing horticultural crops such as vegetables and floriculture sectors, it is very essential to produce healthy seeds and seedlings. Although India has varied agro climatic zones to produce quality and disease free seedlings, however, in off season, it is essential to raise seedlings in protected structure with controlled climate systems.

INTRODUCTION

A nursery is a managed site, designed to produce seedlings grown under favourable conditions until they are ready for planting. All nurseries primarily aim to produce sufficient quantities of high quality seedlings to satisfy the needs of users. Nursery is defined as an area where plants are raised for eventual planting out. It comprises of nursery beds, paths irrigated channels etc. Nursery bed is defined as a prepared area in a nursery where seed is sown or into which seedlings or cuttings are raised.

Need and Potentialities and Role of Nurseries for Plant Multiplication

1. Seedlings and grafts are produced in nursery from which the fruit orchards and ornamental gardens can be established with minimum care, cost and maintenance.
2. The nursery planting materials are available at the beginning of the planting season.
3. This saves the time, money and efforts of the farmers to raise seedlings.
4. There is a wide scope for fruit orchards, ornamental, vegetable, and landscape gardens at public places, highways and co-operative housing societies.
5. It assures the production of genetically improved quality planting material.
6. It provides employment opportunities for technical, skilled, semi-skilled, unskilled labor.
7. They are an important source supplying the seedlings for meeting the fruit, pulp and paper, fuel wood, timber and other demands of the industries.

Types of Plant Propagation Nurseries

It has been estimated that manpower accounts for 70 per cent of the production costs of a horticultural nursery.

I. Types of Nurseries According to Type of Plants Grown

1. Fruit Plant Nurseries: Fruit crops are mainly propagated vegetatively and need special techniques for propagations as well as maintenance. Mango, Guava, Pomegranate, Sapota, Oranges etc. are propagated with vegetative means. Fruit nurseries are essential for production of grafts as well as the mother plants of scions and rootstocks.

2. Vegetable Nurseries: All vegetables except few like potatoes, sweet potato, bulbous vegetables and some other are raised by seedlings. Very few vegetables are perennials like, little gourd, drumsticks, Alocasia etc. Seedlings are to be produced on a large scale in short period.

3. Ornamental Plant Nurseries: Ornamental and floricultural crops are numerous and are propagated vegetatively, like gladiolus, carnation, roses, lilies etc. There is a large group of ornamental plants, which is propagated by seeds and seedling; Asters, Marigolds, Salvias, etc. are some of them.

4. Medicinal and Aromatic Plant Nurseries: There is considerable increase in people adopting ayurvedic medicines with the changing life style. It is also necessary to conserve the fast depleting precious medicinal and aromatic plants. To save and multiply the valuable medicinal and other auspicious plants, nurseries specializing in these plants have begun to flourish. These plants are also demanded by the Ayurvedic medicinal practitioners.

5. Hi-Tech Nurseries: There is sudden increase in the demand for certain commercial plants. For example Tissue cultured banana, gerbera and carnation etc. It is not possible to fulfil this requirement by ordinary or common nursery practices. There is necessity to have special techniques and methods to meet the demand and only Hi-tech nurseries can satisfy this type of demand. These nurseries grow plants in greenhouse, building of glass or a plastic tunnel, designed to protect young plants from harsh weather, while allowing access to light and ventilation. Modern greenhouses allow automated control of temperature, ventilation, light, watering and feeding. Some also have fold back roofs to allow "hardening-off" of plants without the need for manual transfer of plants to the outdoor beds.

II. Types of Nurseries According to the Type of Sale

1. Retail Nurseries: Retail nurseries raise plants for sale to the general public. These places are small, locally owned nurseries that sell seasonal, annuals, ornamental trees, other landscaping plants and garden decoration to the general public or companies that specialize in a particular type of plant, such as tropical plants, citrus trees, bulbs or roses.

2. Wholesale Nurseries: Wholesale nurseries usually grow plants in bulk for the purpose of selling to large clients. These clients may include florists, garden centers or departmental stores. A wholesale nursery may fill a niche for particular types of plants, such as vegetables or houseplants, or they may grow a general selection of plants to sell such as fruits, vegetables and landscaping plants.

3. Private Nurseries: A private nursery grows plants exclusively for a single client. The private nursery may be owned by the client or it may be under contract for use by the client. Clients for private nurseries include large estates, corporations and institutions. These nurseries are concerned with raising documented historical plants for the historic preservation of the estates.

4. Mail Order: Privately owned, retail and wholesale businesses may all be involved in mail order businesses. As shipping technology improved, it became possible to ship dormant ornamental trees and bedding plants via mail. The internet has largely shifted mail order from catalog to online shopping. Bedding plants may be shipped via postal carrier, but are primarily handled through third-party shipping agents.

III. On the basis of structure used

1. Open field nursery: Such a nursery is established in open areas without any permanent structure. Usually, raised, flat or sunken seedbeds are prepared. These are vulnerable to natural environmental conditions.

2. Hi-tech nursery: Such a nursery is established under protected structures. The protected structures in which the nursery can be successfully raised are as follows. Thatched roof: In this type of nursery, a thatched roof is constructed over the nursery beds, which protects the seedlings from damage caused by extreme wind, rain, heat, etc.

3. Shade-net: Such a nursery is raised under shade-net houses. To give different amount of shade to plants based on their requirements, shade-nets of different colours and mesh sizes are used as covering material.

4. Poly-tunnel: The nursery is covered with a plastic film or sheet to form a tunnel. It is miniature structure, which produces greenhouse-like effect. Besides not being expensive, it is easy to construct and dismantle. The seedlings are protected from cold, wind, storm, rain and frost. Due to modified conditions, there is better germination and plant growth.

5. Greenhouse or poly-house: It is a framed structure covered by poly-film or shade-net so that the plants can grow under partially or completely modified environment. Such structures are ventilated and may have temperature and humidity controlling devices. The seedlings are raised inside the structure on raised beds or in plug-trays, and also for hardening of tissue cultural plants.

Selection of Site

Site is the basic requirement of a nursery. Site is a place upon which one can produce seedlings of plants.

Qualities of a good site are

- Nearness of road
- Near a habitat
- Suitable climate
- Neither shady nor exposed area
- Sufficient sunlight
- Good irrigation facilities
- Good soil condition
- Good transport facility

Physical Resources for Nursery

Nursery like any other enterprise requires certain resources. The criteria for selection of products also depend on these resources. These resources thus play a very important role in determining the type of nursery enterprise. These physical resources are enlisted below,

1. Land

Land is the basic and fundamental physical resource for plant nursery. The area available must be considered before planning the nursery and the products. Soil sample testing should be done to avoid problematic and unmanageable soils. Soil should be well drained, porous and light to medium in texture. Soil pH should be 6.5 – 7.5. Heavy, black cotton soil, sandy, ill drained and soils having high pH more than 8 are strictly avoided. Low lying land should not be selected. The soils should be free from salts and other harmful elements. The selected site should be close to railway station or bus station. Wind breaks and shelter belts should be raised prior to planting nursery plants.

2. Irrigation Facilities

Required land with sufficient and assured supply of irrigation is the most important basic resource. Quality of irrigation water should be at prescribed level. Harmful factors can be tested by water testing in laboratory. The pH and electrical conductivity (EC) of irrigation water should be tested.

3. Labour

Labour is another important resource. Degree of mechanization must be considered before estimating the labor requirement. Skilled as well as unskilled man power is necessary for grafting, budding, weeding, irrigation, spraying, dusting, training, pruning, etc. Technically sound gardeners are also necessary. Labour should be available at reasonable rates.

4. Electricity

The availability of power or electricity is also very important and is in accordance with the man power available. Load shedding should be minimum possible. Regular supply of electricity is very essential. Electricity is required for water pumps, spraying, dusting and many other operations.

5. Road and Transport

Once the nursery stock is ready for sale, there should be good roads and transport facilities. These facilities are also required for timely importing of stock and other material for the nursery.

6. Mother Plants

Mother plants are the most important factor for successful nursery. Separate planting of mother plants is necessary. Different varieties of mother plants are planted in different plots. Pests and diseases are controlled regularly by spraying pesticides and fungicides. Mother plants should be authentic and selected from Government nurseries or from Agricultural Universities. Mother plants should be selected very carefully as the sale of the nursery stock depends on the mother plants used for the propagation.

7. Propagation Structures:

Propagation structures are very essential for production of grafts or seedlings. They are useful for multiplication of grafts and seedlings. Hardening of plants is done with the help of propagation structures.

8. Hedges and Compound

Thorny plants like Chilar (thorny creeper), golden duranta (thorny shrub), and agave are used as hedges in nurseries. Barbed wire fencing is also used. Hedges protect the nursery plants from wild and stray animals, theft, etc. They fix the borders of the nursery and are ornamental and decorative.

9. Space for Hardening of Nursery Plants

Small shade net houses are required for hardening of nursery plants. Young, pampered seedlings that were grown either indoors or in a greenhouse will need a period to adjust and acclimatize to outdoor conditions, prior to planting. This transition period is called "hardening off". Hardening off gradually exposes the tender plants to wind, sun and rain and toughens them up by thickening the cuticle on the leaves so that the leaves lose less water. This helps prevent transplant shock in which the seedlings have a stunted growth or they die from sudden changes in temperature. Hardening off time depends on the type of plants grown and the temperature fluctuations.

10. Store and Office

Garden tools, implements, raw materials, insecticides, fungicides, manures, fertilizers, boards, polythene bags etc are stored in store house. An ideal nursery has at least one well managed office for keeping all registers, notebooks, information books and for instructing the team. The record of mother plants, progeny, Stock of plants, etc is preserved in office.

Hi-Tech Nursery Raising Techniques

1. Covering with polythene sheets

In order to ensure early germination, thatching can be swapped with transparent/white polythene sheet (150 micron thickness). After seed sowing, irrigation water is applied in the nursery beds up to field capacity. Then the beds are covered with transparent/white polythene sheet and are made air tight by covering the sheet edges with soil. The polythene sheath is removed after the completion of germination process. Rest of the cultural practices is similar to conventional method of nursery raising.

2 Poly tunnels for normal weather

The nursery beds are covered with pre fabricated tunnels of size 3m long, 1.5m wide and central height of 1.0m. The semi circular structure is clad with UV-polythene sheath (200 micron) with 75 per cent transmittance. Once the seed sowing, covering and irrigation to field capacity is over, the bed can be covered with the tunnels. Both the openings can be closed if nursery is grown in winters.

3. Sunken nursery for weather extremes

- Prepare a trench of any length, 1.2m wide and 50cm deep.
- Prepare a raised bed of 5-10 cm height at the bottom of the trench. The soil should not be imported from outside the trench. Albeit, FYM (25kg) and inorganic fertilizer mixture (100g) may be added as recommended earlier. Precautions must be observed in applying FYM. It may be treated with fungicide/Trichoderma (1kg/100kg dung) at least 15 days prior to bed preparation.
- Seed treated with Captan/bavistin may be sown in lines at 5cm width and cover the seed with the same soil.
- Drench the beds with water to the field capacity of the soil.
- Cover the trench with white, transparent polythene sheath, providing taper to both sides.
- Make the sheath air tight from all sides.
- Start observing the emergence of the seed through the poly sheath from tenth day onwards.
- Once the emergence is over, irrigation may be regulated, as required till the 4 leaf stage is achieved.
- Polythene cover may be removed in sunny days or converted into a roof in rainy days.

4 Naturally ventilated polyhouse

For commercial nursery production, naturally ventilated polyhouses can be used. In a polyhouse of 100 m² area, 40,000 seedlings can be raised in one batch and we can have a total of five such batches per year.

(i) Poly bags for cucurbits

Most of the cucurbits are seed propagated and in situ sowing is practiced. In some cases where early crop is desired, seeds can be sown in alkathene bags and germinated under protected cover from low temperature. The seedlings are transplanted from the bags at 2-true-leaf stage. This practice is prevalent in Punjab, especially in the case of muskmelon and it can be done in the hills to get early crop in July. Normally, the cucurbits do not stand transplantation beyond this stage due to injury to tap root. There is considerable saving in seed quantity, nearly 50 to 60 per cent as compared to in situ sowing

(ii) Plug tray technique

Plastic trays or pro-trays having different sizes of cells are commonly used for raising vegetable seedlings. Mainly two kinds of plastic pro-trays are used for raising the seedlings in several European countries and Israel. In case cucumber, muskmelon, tomato and brinjal require plastic trays of 187 cells of 3.75 cm (1.5") size, whereas lettuce, cabbage, cauliflower and capsicum require trays having 345 cells of 2.5 cm (1.0") size. These trays help in proper germination, provide independent area for each seed to germinate, reduce the mortality rate, maintain uniform and healthy growth of seedlings easy to handle and store, reliable and economical in transportation.

- The seedling tray (pro-tray) is filled with the growing medium (coco peat, perlite and vermiculite).
- A small depression (0.5 cm) is made with fingertip in the center of the cell of the pro tray/ plug tray for sowing.
- One seed per cell is sown and covered with medium.
- Coco peat with 300 to 400 per cent moisture is used and hence no immediate irrigation is required until germination.
- After sowing 10 trays are kept one over other for 3 to 6 days, depending on the crops.
- The entire stack will be covered using polyethylene sheet to ensure conservation of moisture until germination. The stacked trays are spread once the germination commences to avoid etiolation.
- The trays are shifted to net house on germination of seedlings and spread over the beds.
- The trays are irrigated lightly every day depending upon the prevailing weather conditions by using a fine sprinkling rose can or with hose pipe fitted with rose.
- Drenching the trays with fungicides as a precautionary measure against seedling mortality is also being done.
- Spraying of 0.3 per cent (3g/litre) water soluble fertilizer using poly feed (19 all with trace elements) twice (12 and 20 days after sowing) is practiced to enhance the growth of the seedlings.
- The trays are provided with protective cover from rain by covering with polyethylene sheets in the form of low tunnel whenever it rains.
- The seedlings at right stage of planting are hardened by withholding irrigation and reducing the shade before transplanting or selling to the growers.
- Systemic insecticides are sprayed 7-10 days after germination and before transplanting for managing the insect vectors.

Care and Management of Nursery Plants

Handling of plants: Since plants grown in a nursery are tender, care must be taken in nourishing them in order to ensure their growth and development. Timely and effective preventive measures against pests and diseases must also be taken. The production of quality seedlings depends on how well the following activities have been executed in the nursery.

Shading: Newly grown saplings must be protected from adverse weather conditions. Shade can be provided by using shade-nets or polythene sheets.

Thinning: It is important to maintain plant density in rows so as to ensure adequate light and air to the plants. During this process, weak, diseased or damaged plants are pulled out, allowing the growth of healthy seedlings.

Watering: Nursery beds must be watered carefully with the help of a fine rosé can. After the establishment of plants, watering must be done as per the requirement of individual plants.

Weeding: Weeding refers to the removal of all unwanted plants (weeds) from the nursery. Periodic removal of weeds is beneficial for the growth and development of seedlings as it prevents competition with the main plants for sunlight, water, air and nutrients. It also acts as secondary host for insect-pests and disease-carrying organisms. Thus, the nursery area must be kept free from weeds. Hand weeding and hoeing are the most common practices to remove weeds. To control a large number of weed species, pre-emergence herbicides can also be sprayed just after the sowing of seeds.

Hardening of seedlings: Seedlings must be hardened-off (acclimatized) in partial shade before being planted in the main field so that they can survive the harsh open climatic conditions. Generally, hardening is done before transplanting in the open field by gradually exposing the seedlings from lower to higher temperature. Over-hardening of the seedlings must be avoided.

Staking: Staking is a practice to support plants growing straight and saving them from bending or lodging. This is done at a time when the plants are not too tall. It saves the plants from being blown over due to wind and rain, and also because of the weight of its stems when in bloom. It is useful in potted plants, as well as, grafted and budded plants. Bamboo is the most common plant where staking is used. Other than this, the branches of shrubs and trees, i.e., neem, subabool, phalsa, eucalyptus, etc., can also be used for this purpose.

De-shooting: De-shooting refers to the removal of all side shoots (offshoots, offsets or keikis) emerging from the base of a plant. The main purpose of de-shooting is to divert the energy of the plant towards the development of its shoots or buds.

Disbudding: Disbudding is the removal of floral buds when a large flower on a plant is desired, for example chrysanthemum and dahlia. The energy saved by disbudding is diverted towards the development of the retained bud so that the flowers become large and vigorous. Generally, it is followed in large flower varieties. In carnations, disbudding is practised to obtain long stalks with larger blooms.

Pinching: It refers to the removal of growing tips of vegetative buds to promote bushy growth for more lateral formation and precocious flowering as in case of chrysanthemum. It is the removal of 3–5 cm growing tips when the plants are 8–10 cm tall, i.e., when they are about one-month old. The second pinching takes place about three weeks after the first pinching. Pinching is also a common practice in carnation and marigold.

Pruning: The planned removal of twigs, branches, shoots, limbs or roots in plants is termed as ‘pruning’. Pruning is done to increase the usefulness of the plants.

Advantages of Nursery Management

Seedlings not only reduces the crop span but also increases the uniformity of the crop and thus, harvesting as compared to direct sown crops. Transplanting of seedlings also eliminates the need for thinning and provides good opportunities for virus free vigorous and off-season nursery, if grown under protected conditions.

- It is easy and convenient to manage seedlings under small area.
- Effective and timely plant protection measures are possible with minimal efforts.
- Nursery provide favorable climate to emerging plants for their better growth and development.
- The effective utilization of unfavorable period by preparing nursery under protected conditions.
- Effective input utilization for crop production by reducing initial stage crop infestations and interferences.
- Seed cost of some crops like hybrid vegetables can be economized through nursery.
- Nursery production help in maintaining effective plant stand in shortest possible time through gap fillings.
- More time is available for main field preparation

Points to be considered:

- Use healthy vigorous seeds having better germinability, treat the seeds with recommended pesticides to check disease and pest infestation.
- Do not sow soaked seeds in dry soil.
- Do not soak seeds in hot water for more than recommended temperature and duration.
- Do not store seeds after soaking.
- Use well decomposed organic manures and compost
- Disinfect the beds against soil borne pathogens and pests with recommended chemical/treatment.
- Sow the seeds preferably in 15 cm raised bed instead of flat bed.
- Seed may be sown shallower in the spring when the ground tends to be moist and deeper in summer when the soil is usually dry. In no case the seed should be sown more than 2 cm deep.
- Sow the seeds in line, 5 cm apart thinly to avoid over crowding.
- Cover the sown bed with clean dry grass leaves, paddy straw, polythene sheet or gunny bags till seeds start germination.
- Avoid covering the seed bed with clayey and alkaline soil.
- Irrigate the beds daily once in morning and once in evening with the help of watercane till they are ready for transplanting.
- Always give light irrigation and avoid excessive watering and do not allow the water accumulation/stagnation.
- Remove the covering when seeds have germinated.
- Save the seedlings from sun scorching, chilly winds and heavy rainfall by providing shade whenever necessary.
- In case damping off or wilt diseases spray seedlings with 0.25% Dithane M-45 and 0.05% Bavistin.
- Maintain 25-30 seedlings per meter rows by keeping 3-5 cm plant spacing by removing weak, damaged and diseased plants.
- Never force the plant by heavy fertilization, watering and over crowding.
- After 4-6 weeks, plants become 10-15 cm tall and will be ready for transplanting.
- Stop irrigation or gradually reduce watering for hardening of the seedlings.
- Always raise 20% more seedlings.
- Apply ample water to the nursery bed before pulling out the seedlings in order to reduce root injury.
- Do not place the seedlings in direct sunlight after uprooting.
- Keep the reserve seedlings in shade or moist substrate.
- After uprooting and just before transplanting dip the seedlings in recommended solutions / formulation to avoid pest, disease attack and for proper establishment and growth of seedlings in main field.

- Press the soil in such a way that the roots come in well contact with soil and prevent the air pockets near the roots by pressing the soil around plant gently.
- While transplanting the seedlings maintain natural position of roots in the soil as far as possible. Never remove leaves or any portion of leaves from the seedlings.
- Uproot seedlings as per requirement and complete the transplanting as quickly as possible on the same day of uprooting the seedlings.
- Transplanting should be done during evening hours except in cloudy days.
- Irrigation water must be arranged well before transplanting and must be applied soon after the transplanting. Onion is an exception where water requirement is less in the beginning.
- Gap filling must be followed at the earliest to maintain plant population.
- Attack of insect, pest and diseases may be checked regularly and adopt precautionary and control measures well before they spread throughout field.
- The spray pumps, pesticides, etc. should be arranged well in advance.

CONCLUSION

Raising the healthy nursery is a specialized technology which requires knowledge and skill about various nursery raising techniques and scientific management of nurseries. The advent of different nursery techniques has opened the new vistas for growing healthy vegetable crops in any part of the year and irrespective of any vegetable crop. Such innovative techniques are facilitating the growers in producing off season vegetable crops for getting high yield and fetching remunerative returns. The young and tender plants are well nourished and protected in nursery area which in turn facilitate better seed germination and healthy seedlings production resulting ultimately in reduced seed rate and improved yield and quality.

REFERENCES

R.Radhakrishnan, K. Kalia, J.C. Tewari and M.M. Roy. Plant nursery management Principles and Practices. CAZRI, Rajasthan, 2014.

<http://ecoursesonline.iasri.res.in/course/view.php?id=133>