

MACHINERY

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Several machinery have been developed to mechanise nurseries. They are as follows:

- **Media Siever:**

It is a motorised rotary screen type media siever useful for Farm Yard Manure, Vermicompost, Cocopeat, Sand and soil and remove all the particles larger than 1.5mm in the form of stones, clods, straw, etc. The capacity of machine is 1tonne/ha and is operated by 0.5HP motor.

- **Batch type Media Mixer:**

An electric motor operated batch type media mixer has been provided with peddle type agitators cum conveyors on a shaft rotating at 9 rpm for thorough mixing. The mixer has a capacity varying from 0.2tonnes to 0.5 tonnes/batch and takes 5 minutes for thorough mixing of sand, FYM, Vermicompost, Coco-peat, etc.

- **Protray Filling Machine:**

This is suitable for big nurseries and has a capacity of filling 400 protrays or 39,200 seedlings per hour. The machine mixes media, conveys it to bucket conveyor. The bucket conveyor takes the media to the filling hopper. The empty trays are placed on continuous belt by conveyor. Media is filled into the trays.

- **Protray seeding machine:**

The neutrali filled by tray filling machine are conveyed to the watering pipe fitted with seven nozzles. The machine is suitable for 98 cells.

- **Plate type dibbler:**

This is suitable for small nurseries. It dabbles depression/holes in standard 98 cell neutrali, the capacity is 100 trays per hour. The dimension of the depressions is created by the dibbler with 12mm diameter and 15mm depth. It needs one person to operate it.

- **Plate type vacuum seeder:**

The tray type vacuum seeder to pick up 98 seeds at one time using the suction of 0.5 kg/cm² is created by 1 HP vacuum pump has been developed. The seeds are sown into the cavities by cutting of the vacuum.

The seeding capacity is upto 50 protrays per person per hour.

- **Protray transport system:**

The trolley for transport of media filled neutrali and neutrali with grown up seedlings has been developed. The capacity of the trolley is 80 protrays for media filled neutrali and 16 for grown up seeding neutrali.

- **Tray type depopper:**

A tray type depopper for standard 98 cell.

- **Other equipments:**

The commercially available baby boilers can be used to sterilize the media in filled bags.

The steam sterilization needs only one hour treatment at 80 to 100⁰C for one hour in comparison to one week for chemical sterilisation.

Unit-III
NURSERY MANAGEMENT
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For successful protected cultivation seedling should be raised in high tech nursery only. High-tech nursery can be established as a small- scale industry in major vegetable growing areas especially in peri – urban areas. By this way the vegetable growers can get virus free, healthy and off season seedling as per their requirement generating extra employment to rural youth.

Plug – Tray Nursery raising

Vegetable seedlings or nursery can be raised in a number of containers. Plastic trays are standard ones used worldwide. Generally, plastic trays or portrays having different sizes of cells are used for raising seedlings. Generally, plastic trays or portrays having different sizes of cells are used for raising seedlings. These trays helps in proper germination, provide independent area for each seed to germinate, reduce the mortality rate, maintain uniform and healthy growth of seedlings, are easy in handling and storing, reliable and economical in transportation . These nursery trays may be fixed in thermocol base trays having same number and size of cavities before filling media. If thermocol base is not available only trays placed on floor or firm base may be used. Mostly artificial soilless media is used for raising healthy and vigorous seedlings in plastic portrays. Mainly three ingredients- cocopeat, vermiculite and perlite are used as root medium for raising nursery. These ingredients are mixed in a 3:1:1 ratio before filling in plastic portrays.

Root Medium

Coco peat: It is completely free from infestation of any pest or pathogen. It is commonly used as a medium for raising nurseries of vegetables and ornamental plants.

Perlite: It is light rock material of volcanic origin. it is essentially heat – expended aluminium silicate rock. It improves aeration and drainage. Perlite is neutral in reaction and provides almost no nutrients to the media.

Vermiculite: It is heat expended mica. It is very light in weight and has minerals for enriching the mixture (magnesium and potassium) for enriching the mixture as well as good water holding capacity. Neutral in reaction (pH), it is available in grades according to sizes.

Sowing and after care:

Seeds true to type and of good quality should be purchased fresh for each growing season. Seeds are usually planted in shallow depth after pressing the media with finger in a gentle way into the potting plugs or cells which filled with media. After sowing of seed, a thick layer of vermiculite is given to cover for better germination as this media has water holding capacity. These portrays are kept in germination room at optimum temperature for early and better

germination. Water is applied after sowing of seeds in each tray. Hundred percent humidity is maintained and when level comes down irrigation is applied. For raising good and healthy seedlings, optimum EC of irrigation water should be 1.6 to 1.7 with pH of 6.6 to 6.7. Nutrients are applied in form of water soluble N:P:K (1:1:1) @ 140 ppm once a week through the fine sprinkler to maintain the uniformity .

Hardening of vegetable seedlings before transplanting in the main field is very essential for reducing transplanting shock and also to have better crop stand. Plants should be gradually hardened or toughened by acclimatizing them to anticipated growing conditions of fields, at least a week before planting them in main field. This is done by slowing their rate of growth to prepare them to withstand such as chilling, drying winds, shortage of water or high temperature. Generally, seedlings of all vegetables become ready for transplanting 28-30 days after sowing in plug tray.

Advantages of high tech nursery raising:

- Seedling can be raised under adverse climatic conditions where, it is not possible otherwise.
- Healthy seedlings can be raised.
- There is no chance of soil-borne fungus or virus infection to seedling as the nursery is grown in soilless sterilized media.
- Drastic reduction in mortality in transplanting of seedlings as compared to traditional nursery raising.
- Early / offseason planting is accomplished by raising such nursery.
- Easy transportation
- Weed free
- Better root development
- Approximate cost of nursery raising in a year is 3 to 4 lakhs and net profit of 4 to 6 lakh / 1000 m²
- In this technology seed rate can be reduced to the 30-40% as compared to open field.
- Saving the fertilizer and water of use of plug tray nursery.

GRAFTING

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Wedge grafting

- Wedge grafting is a relatively easy method of propagation.
- Success percentage is higher than that of budding.
- The plants grafted with wedge method takes less time (9-12 days) for sprouting and plant gets ready for sale within five months from day of grafting operation.
- The grafted plants showed very high field establishment on account of undisturbed tap root system.
- The major advantage of this technique is that, plants get higher success rate with the help of polythene cap even at low temperature (during winter season).

- After grafting, if scion dies for any reason, the split portion is beheaded and rootstock can be used for further grafting.

Steps:

- Prepare the rootstock seedlings by removing side shoots frequently. Newly emerged stock shoots of 1 year old rootstock, seedlings having bronze coloured leaves are selected for wedge grafting.
- Select 5-7 months old seedlings having straight growth and thickness of 0.8 to 1.25m in diameter.
- For high success temperatures of 30-32°C are ideal.
- Scion wood to be used is defoliated 7- 10 days prior to grafting.
- In winter season defoliation can be done on the same day of detaching.
- Leaf blades are removed leaving the petioles from the scion sticks, wrap them in polythene and store in cool place preferably at 5-6°C.
- Dip the scion sticks in 0.1% Bavistin solution before storing.
- Thickness of stock shoot and scion stick should be the same.
- After the grafting process is over, it is secured firmly using 1.5 cm wide, 4.5 cm long and 200 gauge polyethylene strip without leaving any air pocket.
- This can be performed in open field or containers.
- With use of poly and net house, grafting operation can be continued almost year round.
- Sterilize the budding knife and other tools in 1-2% sodium hypochlorite sol.
- After 5 months the plants are shifted in open for few days before these are ready for sale.

Criteria for selection of mother plants:

- Mother plants of the variety should be genetically true to type.
- The plants should be healthy and free from any diseases, pest infestations and physiological disorders.
- The plants should have known pedigree records regarding bearing potential, fruit quality and problems, if any.
- The plants should be precocious and prolific bearer.

Criteria for selection of rootstock:

- Dwarfing /semi-dwarfing in nature
- Compatibility with the known commercial varieties
- Resistance/tolerance to biotic and abiotic stresses.
- Rootstocks should have well developed root system.
- Easy to propagate by vegetative means

Sanitation for better success:

- For all propagation work, it is necessary to use clean growing medium, sterile containers, a sanitized bench, and pathogen- free plant materials.
- Soil pathogens may contaminate the soil mixture. Small outbreaks of diseases can be controlled by using appropriate fungicides.

- Propagating media can easily be pasteurized by steam, chemicals or solar radiation.
- Expensive equipments and training of personnel are necessary for pasteurization or sterilization of propagating media.
- A temperature of about 71 °C for 30 minutes is considered sufficient to kill almost all pests.
- Drenching the medium with certain fungicides, such as Captan, Fytolan or Brassicol (1 g/litre water), is also useful in eliminating pathogens from the medium.
- Besides a clean and sterile medium, disinfection of pots, flats, greenhouse benches, watering cans and other garden tools, general cleanliness is also necessary to avoid recontamination of the medium.
- Pots, flats and propagating benches can be sterilized with steam, boiling water or 2 per cent formaldehyde.

SOIL LESS MEDIA

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Different types of soil less media:

1. **Peat:** Consist of remains of aquatic, marsh bog or swamp vegetation, preserved under water in partially decomposed state. Stable source of organic material that holds a great deal of water and air. It is quite acidic (pH-3.5 to 9.0) and limestone added to adjust the pH.
2. **Perlite:** Grey white siliceous material of volcanic origin mined from lava flow. It is neutral in Ph and negligible cation exchange capacity. Although cost are moderate but it is effective amendement for growing media.
3. **Vermiculite-**It is micaceous mineral, expands markedly when heated. It is hydrated magnesium-aluminium-iron silicate. It is light in weight , neutral in reaction and insoluble in water.
4. **Sphagnum moss-**It is hydrated remains of acid bog plants such as *Sphagnum pappilosum* and *Sphagnum palustre*. It is sterile and light weight with high water holding capacity. It is able to absorb 10 to 20 times weight of water. It contains small amount of minerals.
5. **Leaf mould:** Leaf types, maple, oak, sycamore and elm are suitable for leaf mould. After composting of leaves to 12 to 18 months , leaf mould is ready for use. It may contains nematodes as well as seeds or noxious insects and diseases, so it should be sterile before use.
6. **Bark:** It is partially composted and screened material of plant origin. It is beneficial to obtain bark from local source s to avoid cost of transport.
7. **Rockwool-**Produced by burning a mixture of coke, basalt, limestone and possibly slog from iron production. Composition is 60% basalt, 20% limestone, 20% coke. It is

formulated to prescribe higher density to provide the air and water holding requirements of plants.

8. **Polystyrene Foam:** It helps in bringing improved aeration and light weight to root substrate. Consist of white synthetic product containing numerous closed cells filled in air. It is extremely light, does-not absorb water and has no appreciable CEC.
9. **Sand:** Basic component of soil, particle ranges in diameter 0.05mm-0.25mm. Least among all in organic amendements. The heaviest which may result in prohibitive transportation cost.
10. **Rice hulls:** By products of rice milling industry. Extremely light in weight and very effective in improving drainage.
11. **Calcinated clays:** These are formed by heating montmorillonite clay minerals to approximately 690° C. The pottery like particles formed is six times as heavy as perlite. They have relatively high cation exchange as well as water holding capacity. They are very durable and useful amendment.
12. **Bagasse:** It is a waste by product of sugar industry. It may be shredded and or composted to produce material which can increase the aeration and drainage properties of container media.
13. **Coco-peat:** It is a by product of coconut husk. After grinding the husk, coco peat is ready. It is considered best in providing aeration, drainage and life to media.
14. **Sawdust and shavings:** These are by product of lumber mills. It is close to neutral in pH when thoroughly composted.

Advantages

- Growers who do not have their own field are also able to grow vegetables other crops.
- It has wide adaptability to produce vegetables in greenhouses, kitchen gardens, in the houses and in the areas where suitable soil areas are not present.
- Soil-less culture media is free from pathogens and nematodes.
- It provides good aeration and drainage.
- Nutrient control: complete analysis of soil-less culture media is possible, which economizes the fertilizer use.
- Labour economics: Less handling time, sterilization, weeding, fertilizer application and watering.
- The light weight of soil-less substrates reduces the cost of transportation.