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Popular Article

Nursery Management of Citrus in North East India

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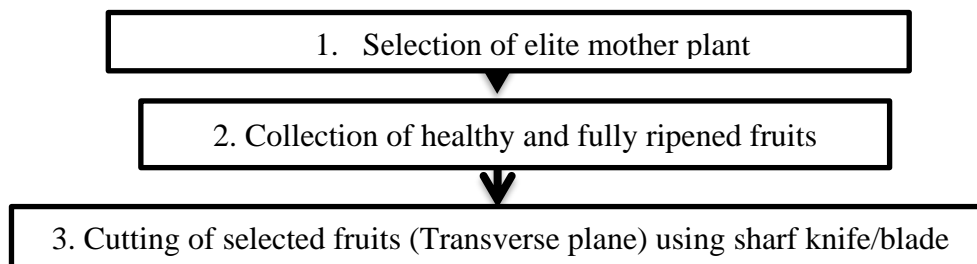
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Citrus trees can be reproduced through both seeds and vegetative methods. The majority of citrus species, such as mandarins, sweet oranges, limes, lemons, grapefruits, tangerines, and tangelos, are polyembryonic, while temple and pummelo are monoembryonic. While nucellar seedlings from polyembryonic citrus species remain true to their type, vegetative propagation is the preferred method to ensure consistent quality, regular fruit production, and early maturity. In some regions like the NEH and Coorg regions of India, seedlings are used for limes and mandarins. Limes and lemons are typically propagated through cuttings or layering. However, in most areas, citrus trees are created by budding a desired scion variety onto a selected seedling rootstock, which provides disease resistance, high yield, and a long tree lifespan.

Site selection for nursery establishment:

- We should choose a sunny area with ample sunlight for our citrus plants.
- Place having deep soil sandy loam.
- Place which is free from soil-borne pathogens and has good drainage to prevent waterlogging.
- To prevent soil problems, we should try to adopt a rotational cropping system.

Collection of planting material Fruit collection and seed extraction



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4. Seed extraction followed by rinsing of seeds



5. Seed cleaning and placing in well-ventilated area



6. Seed sowing should be done on seed bed

2. Collection scion sticks and raising of rootstocks: Scion sticks should be taken from portions of last season's growth with well-developed buds healthy mother trees, during the dormant season, typically in late winter or early spring, pencil-thick and 8-12 inches long. Wrap scion sticks in a damp (not wet) paper towel or place them in a plastic bag to prevent desiccation, moistened cocopeat. In



Fig.1: Collection of Scion

citrus trees, roots stocks can be raised by seed in a proper sterile condition but according to the purpose and species, rootstocks should be about 9-10 months old with diameter of 0.7-0.9 cm (Singh, 2012). Rootstocks attain buddable size at different age but According to a research done at Citrus Experiment Station, Coorg, Rough Lemon attained buddable size at 6-7 months, Cleopatra Mandarin at 10-11 months, Rangpur lime attained at 7-8 months and Trifoliate orange at around 16 months

Preparation of Media and seed bed:

Media preparation: About 10-15 days before sowing, well-rotted farmyard manure (FYM) or pig manure is added at a rate of 2 kg per square meter (m²) of soil. Proper amount of sand, soil and Farm Yard Manure should be mixed together in the ratio 1:1:1 in general to maintain fertility, drainage as well as Ph in the range of 5.8-6.5.

Seed bed preparation: Seed beds are constructed to be about 8-10 cm in height, 1 meter in width, and a convenient length. The prepared seed bed or nursery soils can be sterilized using following methods

- 1. Solarization:** It can be carried out during the time of high temperatures by using Transparent polyethylene sheet (25 um) to heat the soil. Soil should be kept wet during mulching to increase the thermal sensitivity of resting structures and improve conduction of heat. It may be extended up to 6 weeks to control the pathogen at various depths.
- 2. Formaldehyde:** It kills some weed seeds but is not reliable for killing the nematodes or insects. For seedbed treatment formalin (40%) strength of formaldehyde) is used. After application of it the soil should be covered immediately with airtight white polythene sheet and left for 3 days.
- 3. Vapam:** It is soil fumigant which kills weeds, germinating weed seeds, most of the soil fungi and nematodes also. It is applied by sprinkling on the soil surface, through irrigation water. For



seedbed fumigation one litre of liquid formulation of vapam is mixed with 10 litre of water and sprinkled uniformly over 10 sq.m. of area. Three weeks after application, the soil can be used safely for planting.

Nursery raising through seeds

Primary Nursery: It is a specific area where young plants, often in the form of seeds or seedlings, are initially sown and nurtured before being transplanted to a larger nursery or directly into the field. Key activities in it may include seed sowing, germination, and initial care of seedlings to ensure they develop into healthy and robust plants. It can be developed in raised beds or plastic trays, both filled with sterilized potting mixture. Citrus seeds are sown in it shortly after extraction from the fruits, at a depth of 1.5-2.0 cm and spacing of 10x5 cm. To expedite germination, the seed coats can be removed, or the seeds can be soaked in aerated water for approximately eight hours before soil temperatures, and sufficient moisture for rapid germination and seedling emergence. After sowing, seeds are covered with a fine layer of wood ash or farmyard manure (FYM) mixture and mulched with dry leaves or paddy straw. Regular watering is essential. Mulch is removed approximately 35-40 days after sowing.

Secondary Nursery: It is a stage in the process of raising young plants, such as seedlings, after they have been initially cared for in the primary nursery. Seedlings that have grown and developed in the primary nursery are transplanted to the secondary nursery once they reach a certain size and age. To provide more space and resources for their continued growth and development. In it, the seedlings are given more room to grow and are provided with continued care, including proper nutrition, watering, and protection from diseases and pests. It serves as a place to “harden off” the young plants. Once the seedlings have reached the desired stage of growth and are well-acclimated to outdoor conditions, they are ready to be transplanted into the final field or orchard where they will continue to grow and eventually produce fruit. It is located away from the main citrus orchard to minimize the risk of infection.

Propagation in few citrus crops:

Semi-hard wood cutting of Assam lemon

The cuttings are taken from 4- to 9-month-old shoots of current season woody plants. They are prepared from partially matured, slightly woody shoots. They are succulent and tender in nature and are usually prepared from growing woods of current season’s growth. The length varies from 7 to 20 cm, where 2-3 leaves are retained top of the cuttings. The cuttings are treated with 5000 ppm of IBA. One quarter of the length should be inserted in the soil. Best time for cuttings is summer when new shoots have



Fig.2: Stem cutting



emerged. The cuttings can be inserted into the propagation medium or soil, making sure that the node is below the surface.

Single node leaf cutting in Assam lemon: They are taken from the branch with healthy developed bud as well as having actively growing leaves. It consists of a leaf blade and short piece of stem measuring 2cm. Planted in the medium of leaf mould, soil, sand in 3:2:1 and can be transplanted in two months.



Fig.3: Single node leaf cutting

Cleft grafting in Khasi Mandarin: We select a healthy seedling of rough lemon 1-2 years of pencil size thickness as a rootstock. A healthy scion of khasi mandarin 5-7 buds was selected. The upper portion of the seedling (rootstock) was removed (10-15cm). A V-shape cut was given at the base of the scion. On the cut rootstock a vertical cut was given in the middle with the help of a grafting knife. The V-shape scion was inserted into the cut rootstock adjoining the cambium layers. The grafted portion was wrapped around with paraffin. The grafted plant is ready to be transplanted in two months.



Fig.4: Khasi mandarin grafting

Budding of Khasi Mandarin: Scion/bud wood should be selected from healthy plants and defoliate one week in advance before grafting/budding. It is done in Feb-March or in July-Aug. 'T' shaped cut is made through budding knife in the bark at 15-20 cm above the ground level. The 2 flaps of the bark are loosened with the help of bare blade of budding knife. A shield shaped patch of bark is removed measuring 2.5 cm length containing a bud from the mother plant. The bud is inserted into the 'T' cut on the stock and tied with 400 gauge polythene strip leaving the bud open.



Fig.5: Budding of Khasi

Air layering: The first step in air layering is to remove completely a strip of bark 3 cm in width at a point 15 cm or more below the tip end scraping the exposed surface to ensure complete removal of the phloem and cambium is desirable to retard healing. The cut portion is covered with moss or mud pudding with a mixture of well decomposed cow dung, soil and sand with a ratio of 1: 1: 1, respectively. Then a piece of polythene sheet 15-20 cm wide is wrapped carefully around the



Fig.6: Assam lemon air layering

branch so that the moss and mud is completely covered. Both end of polythene is tied firmly.

Integrated Pest Management under Nursery condition:

1. Citrus leaf Miner (*Phyllocnistis citrella*)

Damage: On young leaves shallow tunnels like structure which are referred as mines are formed by larvae of citrus leafminer. Silvery zigzag lines on the leaves blade are made that lead to results in curl and dry of tender leaves.



Fig.7: Leaf miner

Management: Wasps which are the nonstinging like *Cirrospilus*, *Pnigalio* species need to be released. Around pheromone trap @ 5/acre can be established. Mainly during winter season, the affected parts should be pruned and as well as burnt them. Carbofuran 3% CG @ 20000 g/acre, Foliar spray with imidacloprid 17.8% SL @ 50 ml can be used by using sprayer, but volume is depend on size of tree. Foliar spray with phorate 10% CG @ 6000 g/acre are also preferred to mitigate the incidence.

2. Citrus butter fly : *Papilio demoleus*

Damage: Tender leaves of young plants are preferred to feed by early instar larvae where they feed on the lamina of leaves but the matured larvae feeds on all the leaves that create defoliate condition on the entire plants.

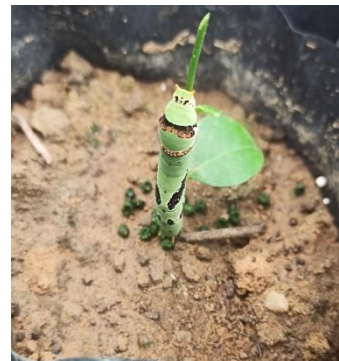


Fig.8: Citrus butter fly (Caterpillar)

Management: The pest in nurseries and new orchards can be collected manually and tried to burn them as much as possible. Parasitoids of it like *Trichogramma evanescens* and *Telenomus sp* on eggs, *Brachymeria sp* on larvae and *Pterolus sp.* on pupae can be preferred to release. Entomogenous bacteria, *Bacillus thuringiensis* @ 1 g / lit. or nematode DD- 136 strain or NSKE 3% also gives high mortality of caterpillar can also be applied. In severe infestation conditions quinalphos 25 EC @ 2-3 lit. or carbaryl 50 WP @ 2 – 3 kgs. in 1500-2000 lit. of water per ha during April and October. or DDVP (Nuvan) @ 1 ml /lit can also be applied by using sprayer.

3. Citrus whitefly: *Dialeurodes citri*

Damage: Nymphs, adults stages suck sap from foliage. Due to development of sooty mold fungus over fruit and foliage that lead to cause further injury.

Management: Affected parts should be pruned timely to avoid whitefly problems. Bio control agents such as predators like Coccinellids viz., *Cryptognatha flavescens*, *Verania cardoni* can be



Fig.9: Whitefly



used to mitigate the percentage of whitefly..

Integrated Disease Management

1. Citrus scab (*Elsinoe fawcettii*)

Symptoms: On the leaves lamina, irregular protuberant corky outgrowths up to 3 mm across can be observed. Cracked on the invaded side of leaf, depression forms on the opposite side can be observed.

Management: Disease free planting materials should be selected to avoid introduction of citrus scab of leaves Inoculum. The disease coincides with the emergence of new flush, prophylactic sprays of captafol, benomyl, methyl thiophenate and Carbendazim at this time provide satisfactory control of the disease.



Fig.10: Greasy Spot

2. **Greasy Spot:** It is caused by *Mycosphaerella* spp. In India, the fungus is identified as *M. horri*.

Symptoms: Appearance of Yellow mottle on the upper side of leaf which produces yellow brown to black Lesions on the lower side of leaf. Sometimes before the development of typical symptoms the infected leaves drop. On upper surface of leaves, the development of necrosis can be observed.

Management: Sanitation and removal of infected leaves from orchard will help in reduction of inoculum. Fungicide spray during the infection time controls the disease significantly. When new flush emergence coincides with highly humid and hot conditions, spray of copper fungicides or benomyl controls the disease significantly.

3. Canker- *Xanthomonas campestris* pv. *Citri*

Symptom: The yellow halo that surrounds lesion can be observed on the leaves. Young lesions are raised or pustular on the lower leaves surface. The pustules later became corky and crateriform, with a raised margin and a sunken centre.

Management: Pruning all the infected foliage before monsoon and burning. Application of neem cake solution on the foliage



Fig.11: Canker

reduced the canker in nursery. Integrated application of pruning of infected foliage is suitable with copper oxychloride (0.1%), Streptomycin (100 ppm) and neem cake.

Conclusion:

To establish the nursery of citrus in sustainable manner under the North East Region of India, there are some basic principles since selection of site till well established nursery structure and management of scion sticks, rootstocks, disease and pest that would help in various fields in terms of research, producing good quality planting materials which will eventually assure in



sustainable production of improved quality fruit.

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