



Terminal shoot of pepper ideal for collecting cuttings

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3. Planting Material production through Vegetative cuttings

A Pepper vine produces two types of branches; straight upward growing orthotropic branches and laterally growing fruiting or plagiotropic branches. Some of the branches developed from axillary buds of the orthotropic do not produce vigorous clinging roots from the nodes and grow incline. Those are known as hanging shoots or hangers and not suitable for planting material production. Adventitious shoots from the base of the pepper plants develop into vigorous ground runners with prominent aerial root initials during the rainy season or when soil moisture is adequate. Ground runners are most commonly used for commercial pepper plant production. Hangers produce weak pepper vines with very few lateral fruiting branches. Though it is somewhat difficult, if lateral branches are rooted, a bushy pepper plant could be obtained with many laterals and suitable for home gardens in urban areas.

3.1. Plant Production through Terminal shoots

Terminal Orthotropic branches are the most vigorous shoots of a pepper vine with active terminal bud and few lateral shoots. Those terminal shoots are commonly used for pepper plant production in Malaysia, some parts of Indonesia as well as in Brazil. In Indonesia, cuttings are directly planted in the field. In Brazil, mother gardens with promising pepper lines are maintained only for taking cuttings for plant production and replaced in every 2-3 year period. System adopted in Malaysia is more systematic and well established.

3.1.1. Selection of Pepper cuttings

Four to five nodal cuttings with two healthy lateral active shoots from the terminal parts of the pepper vines comply with the criteria of a better mother vine stated above and not older than two years are collected from the field. Generally, those cuttings are directly planted in the field during the wet season. However, when the weather is not conducive for immediate field planting, a simple structure is erected in the farm for rooting of the cuttings prior transplanting to the field. First step is to identify the lower-most node to be severed when preparing a five node cutting. After the position of a cutting has been determined, the plagiotropic branches at the lower three nodes are removed. The fresh younger shoot of the top most orthotropic branch is also pruned off (above 6th node).



Fig 01. a). A potential five-node lateral branch

b). Prune off the lateral branch at the 1st node

c). Prune off the cutting at the 2nd node

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Fig 02. a). Emergence of axillary Buds

b). Five-node cutting is being severed

c). Cuttings placed on clean surface

The node earmarked is the first (lower most) node of a five-node cutting and there should be four other nodes above that with healthy plagiotropic branches arising from the top two nodes. If any one of these top two nodes is without plagiotropic branches, one or two more nodes can be included to ensure that cutting has a plagiotropic branch at the top two nodes.

After 10-14 days, axillary bud emergence could be observed at the fifth (top-most) and the fourth node (Fig 02 a.). The cutting can be collected by making a clean cut at about 1-2 cm below the first (lower-most) node using a disinfected pruning knife or secateurs. After careful detachment of the adventitious roots from the support, harvested cuttings are placed in a clean polythene or poly sack surface preventing contact with soil. Sooner the possible, those cuttings are directly field planted during the rainy season or planted in sand beds for rooting.

3.1.2. Rooting of cuttings

As per the practice in Malaysia, pepper cutting are rooted readily in a rooting bed made up of river sand, before transplanted in the field. Disinfected river sand is placed to a width of 1.0m and convenient length. Furrows are made parallel to the rooting bed at intervals of about 30cm to a depth of 10cm. Pepper cuttings treated with a suitable fungicide are placed in the furrows, 20 to 30 cm apart and at an angle of 45° to 60°. Placing three lower nodes into the rooting medium and the fourth node at the surface level of the rooting medium, cutting is cover with sand. No organic fertilizer is applied. Watering daily, manually or by a sprinkler, is necessary. Within four to five weeks, pepper cuttings will be rooted and ready for transplanting to the field. Those rooted cuttings are kept under shade with cool and moist conditions until planting in the field.

3.1.3. Transport of cuttings

Collected cuttings from the field are rested on sterilized peat and wrap with used newspaper and add water to moist it. Those cuttings are wrapped further with clean polythene sheet and tight together from the lower portion. In 3-5 days, axillary bud emergence and root

development can be observed. Those plants can be established in the field in 10 days after transporting to the desired place.

If rooted cuttings on sand bed need to be transported to a shorter distance, those cuttings placed on peat are wrapped with a clean polythene sheet or else with used newspapers (Fig 03). Those material needs to be established in the field on the same day, hence fields should be ready before transporting.



Fig.03. a). Wrapping with peat, b). Covered with a sheet, c). Rooted cuttings after 10days

Use of terminal shoots produce a pepper plant with more lateral branches from the base and form a conical shape pepper bush and also will come to bearing in two years. The quantity of material can be collected at a time is limited for large scale plant production but suitable for self-plant production by small to medium scale growers. Proper planning for field planting with the beginning of the rainy season reported to yield over 95% field establishment of the planted cuttings and subsequent fast growth. Close monitoring of the established plants for viral and fungal diseases is important to eliminate them at the early stage and prevent further spread.

4. Maintain a Mother Plant Stock Garden for Terminal shoot production

Collection of upright branches from pepper fields is limited and only 2-3 cutting, at a time, can be collected from a single vine. Collecting cutting from the field may indirectly responsible for the transmission of many diseases. Therefore, maintain a source for planting material is required to maintain crop health and vigor. As described in Sri Lanka, specific field as showing in figure 07 to 15 is recommended for collection of upright cuttings.

4.1. Field establishment of a mother Plant Garden

In this method, trenches with 45cm wide, 45cm deep are prepared at 1m apart for a convenient length, approximately for a 5m. The trenches are filled using equal parts of coir dust, cow dung and top soil. Support sticks of *Gliricidia sepium* or timber, about 2m in length, are established in 60cm apart. They are established at one side of the trenches and single upright cutting is planted to each support. Shade with frond of palm or suitable material should be provided at the initial stage until plant is established and also an additional shade using appropriate net is more suitable (Figure 05).

After the plants are established shades can be removed but watering as required and maintaining a mulch is essential (Figure 06). When plants reach to the top of the support within 4-5 months period and they are ready for collecting stem cuttings (figure 07). By the

time, well fixed adventitious root system to the support and lateral branches from each node can be observed as in Figure 08. Pepper mother plants need to be provided with adequate nutrients for the healthy growth. Application of 500ml of solution made by mixing 1kg Urea, 0.75kg Conc. superphosphate, 0.5kg Muriate of Potash and 0.25kg of Kieserite in 250 litre of water, per plant in every four weeks enhance the growth and vigour of the mother vines. Maintaining mulch with green manure or compost throughout the growth is recommended for moisture conservation and improves the soil condition for a healthy growth. Close attention to avoid any pest or disease incidence on mother plants is essential throughout this period.



Figure 04 – Preparation of trenches



Figure 05 – Providing suitable shade at initial stage



Figure 06. Mulch during early stages



Figure 07. Plants ready for collecting cuttings



Figure 08. Adventitious roots and lateral branches at each node

4.2. Collection of Terminal shoots for Plant production

Terminal shoot with two to three immature nodes are removed in each branch for activation of axillary buds. Within 2-3 weeks, axillary buds will emerge and five nodal cuttings with two lateral branches at uppermost nodes are collected (Figure 09) and planted in bags of 20.0 x 12.5cm filled with the potting mixture made with equal parts of compost or animal dung, river sand, coir dust and top soil. At the first stage, only one cutting can be collected but with subsequent growth, 4-6 cuttings from each mother vine can be collected. Pepper cuttings should be planted leaving upper three nodes above the soil level and balance two nodes into the media. Potted plants are watered well and kept in a humid chamber for 3- 4 weeks and another eight to ten weeks under a nursery shed. Plants at the age of 3 months are ready for field planting. Hardening of the plants for 3-4 weeks before field planting will support for better field establishment.



Figure 09. Five nodal upright cutting.



Figure 10. Bags planted with upright cuttings



Figure 11. Three month old Plant.



Figure 12. Conical shape canopy growth

4.3. Advantages of the use of Terminal shoot for plant production.

Use of terminal shoots for production of Pepper plants have several advantages compared to the plants produced from ground runners.

- The cuttings collecting from the mother plants already having active axillary buds and roots, help to increase establishment rate in the nursery.
- Cuttings are bigger in size, then contain more food reserves, thus facilitate higher establishment rate in the nursery and enhanced growth at field level.
- Pepper plants originated from terminal shoots produce lateral branches from the base itself which leads to develop a conical shape canopy at the initial stage (Figure 15) and later to uniform, cylindrical canopy with more number of laterals which help to increase the important yield parameters; number of lateral branches and spikes per plant.
- Gestation period is short and mostly they start bearing from the second year of planting.
- Disease free plants can be obtained as the mother plants is monitored frequently. Helps to arrest the spread of viral diseases.
- The plants reside with higher growth rate; hence the pepper plant can develop to a bigger canopy within a short period as compared to the other techniques.

However, the main disadvantage is the difficulty of finding large number of terminal shoots from pepper fields in compared to the ground runners. Therefore, it is necessary to maintain a source of planting material as explained above. First set of stem cutting can be harvested 5 months after planting and the second harvest commence within next 3-4 months period. At the first harvest only one terminal stem cuttings can be collected from one plant but the second time onwards, it will increase up to 4-6 cuttings per plant. Therefore, if 100 sticks are maintained, over 500 stem cuttings per harvest may be collected.