

Establishment and Management of Plant Nursery System

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Abstract: The production and sale of healthy nursery stock is essential as production of plant nurseries are the heart of our ornamental, vegetative fruits and forest industries. Most of the seedlings planted by farmers are produced in local small scale plant nurseries which have an important role in the sustaining the development of local community. Very few plants nurseries managers have received professional training and advice on the techniques of nursery management. Thus this paper discusses in details the setting up and running of plant nurseries, with emphasis on the points to look out for in each procedure. Also general principles of plants nurseries growth and management are outlined in non-technical language.

Keywords: Establishment, Management, Plant Nursery.

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I. Introduction

Nursery is a place where plants are grown for the sake of being removed or transported later. It can occupy a field, garden, green house, or other form of growing space. In open field, nursery grows ornamental trees, shrubs and herbaceous perennials, especially plants meant for wholesale trade or for amenity plantings. In the nursery, the young seedlings are tended from sowing to develop in such a way as to be able to endure the hard field conditions. Whether local or introduced plant seedling, nursery seedlings are found to have better survival rate than the seed sown directly in the field or through natural regeneration. Nursery seedlings become the planting material for plantation, whether these plantations are for production, protection or amenity (Garner, et al, 1976). Trees have existed within and colonized tropical farmland for many centuries, because the species are self-replenishing. In spite of this, there are large areas of barren, degraded land in tropic, without enough parent trees to provide seed for natural regeneration or for planting. However, in running a tree nursery which may supplement the loss of tree species one is bound to face a range of problems. Unsatisfactory planting stock is a fragment, and poor growth and failure to survive can occur because a single point has been missed in a well-run nursery.

There are vital roles of vegetation to mankind. They include provision of food, fuel and shelter, medicine, economic utilities, check soil erosion, conservation of water, improvement in soil properties; maintaining ecological balance, check on air pollution, water pollution, noise pollution, beside existing use in landscaping for overall improvement of the environment and beauty (Tyazi, 2012). The aim of this paper is to highlight some methods of nursery establishment and management practices with a view to solving human need for plant materials for food, ornamentation and environmental protection.

II. Classification Of Nurseries

Multipurpose nursery

In this type all kind of plants are propagated and reared for sale, which may include fruit plants, timber trees, shrubs, creeps, bulbous plants, succulent, ferns plants, seed and seedling of vegetation and annuals etc. This type of nursery needs a quite large area not less than 5 acre with substantial infrastructure to make it economically viable. These nurseries are known as commercial nurseries.

Single Purpose Nursery

This type of nursery raises only one group of plants like fruit plant nursery, ornamental plant nursery, vegetable nursery, and nurseries raising seedlings of vegetable and flower, raising seeds of annual and vegetable, bulbs and corms etc.

Specialized Nursery

This nursery is one where a particular kind of plant is raised for instance Mango, Guava or Lemon etc.

Supplementary Nursery

This type of nursery is attached to an institution, school, organization, with a big garden in order to supplement the day to day demand of plants for better maintenance of garden attached to such an institution.

III. Factors Affecting Nursery Establishment

Topography of the land

The topography of land should be plain as far as possible, if undulated it should be leveled and terrain may be divided into terraces as large as possible.

Soil

The land should be cleared of trees, root thoroughly and deeply cultivated to a depth sufficient to achieve this and break any hard pan which may be present. Loam and Sandy loam with humus are best suited soil, so that ball of earth should not break with while transplanting and plant may not die, pH of soil should range between 6.5 - 7.5

Water

Water must be constantly available in adequate quantity to meet the continuous need of the nursery. Source of water and its suitability for plant is paramount importance. Unsuitable water is the main cause of failure of a nursery. Water should contain total soluble salt not in excess of 1,400 ppm (approximately 2 million mhos/cm). It is desirable to get the water tested from some reliable source before selection of site for nursery.

Drainage

Proper drainage is very essential. Water should not be stagnant overnight in any case. Ensure that extra water of nursery area is flushed out immediately and water from surrounding area should not enter the nursery area.

Market

It includes buying and selling both. One must ensure an outlet before starting a nursery and the produce in the nearby areas. Marketing at faraway distance will snatch away profit due to high transportation cost involved beside damage to the plants and other losses in transit.

Skills

In fact nursery profession is scientific and skillful; it requires green finger craftsman ship skill. It is necessary to apply judicious mind while deciding the labour for the nursery operation.

IV. Nursery Protective Measures

Having chosen a nursery site with regard to soil conditions, drainage, water supply, readily access to labour, the main consideration is to provide protection for plants. This may adequately be provided by forest or mature plantation trees, otherwise well supported eight to ten foot (2.5 to 3.0 m) fence of reed or split bamboo held in line by horizontal places of rough timber, should be erected whilst some quick-growing hedging is being established.

V. Pot And Container Types For Raising Seedlings

Plants in containers are more under the control of the nursery operator than those planted out in the field and are therefore dependant on his skills, care and management. Different containers are widely used for propagating seedlings as well as vegetatively raised materials (Garner, et al, 1976).

There are two main classes of containers:

1. **Durable Containers:** clay pots are in generally use throughout the world, they may be used repeatedly unfit accidentally broken. It has been found possible to achieve both a reduction of salinity and disinfection of a pot in 140°f to 180°f (60°C to 82°C) for 24 hours. This destroys algae and mosses, as well as diseases organisms.
2. **Non-Durable Containers:**
 - **Polyethylene bag:** is used in film form for plant container, replacing many of the traditional materials, it is waterproof, tough and flexible, light in weight, readily stored until required, relatively in expensive and readily obtainable. Bags of all size often called poly bags, are obtainable in various thicknesses. The bags have narrow holes in their base particularly in large size, additional holes in their side up to half their height for drainage of excess water.
 - **Basket:** is one of the earliest non-durable plant containers, the basket loosely woven from coarse grasses or split bamboo grown in the locality.

VI. Propagation Methods In Nursery

Where seeds have to be kept moist between harvesting and sowing, or where dry seeds are given a pre-sowing treatment under cool conditions, they are placed in moist material, often under cool condition, they are placed in moist material often in layer and these treatments are known as stratification.

a). Propagation by Seed

Propagation by seed is the primary method of plant multiplication and remains the principal way of raising the majority of tropical fruits. Collecting seeds from suitable sources can do much to minimize seedling variation. Seed source may well be established in isolated areas by planting only selected seedlings. Seedlings arising from such source tend to reproduce characteristics observed in the parents (Nelson, 1985).

b). Vegetative propagation

Plants are vegetative propagated in two main ways; by division or by cutting. Under the term division comes all those processes by which a part of the plant usually the stem is induced to grow roots and shoots before separation from the parents' for example layering in Guava.

Propagation by cutting consists of comparatively small pieces of a plants and setting them in situation where they are able to develop to wholeness.

Source of cutting

Cuttings are part of plants which are separated from parent and treated to encourage the production of complete plant. Having selected the plant required to be multiplied, it should be adequate in quantity for high regenerative capacity. A simple practical way to produce good supplies of regenerative shoot cutting is to harden established plants. It is often convenient to prune isolated established plants for cuttings, and also to reduce the risk of admixture during collection. The best cutting is obtained from young newly-established plants up to two or three years of age. The stem of the plants should not be red beyond a level necessary to ensure survival of the plant to obtain a high shoot ratio (Garner, 1988).

Treatment of cutting

In perception that adequate water supply in the cutting must be maintained, great care should be taken to reduce water loss in the cutting material from the moment it is taken from the source plant. To ensure that, it is widely recommended that cutting should be collected in the early morning when they are fully turgid. Herbaceous leafy cuttings lose water very quickly, while leafless stem cutting along comparatively slowly, but even these may be seriously damaged by drying. Moist-living container should be used to hold the cutting as they are collected. Such containers should exclude direct sun heat and air movement. Polyethylene bags are excellent provided they are not exposed to the sun. Wood container lined, wet cloth or newspapers are excellent materials for maintaining moisture (Garner, 1976).

Rootstock

Rootstock refers to a plant, sometimes just a stump which already has established healthy root system and a very vegetative growth on which a cutting or a bud from another plant is grafted. The use of rootstock is commonly associated with fruiting plants and tree, and is useful for mass propagation many other plant types that do not breed true from seed, or are particularly susceptible to disease when grown on their own root (Jancis and Robinson, 2006). Rootstock propagation by means of seeds is far the most common method and has the great advantage over vegetative propagation because it entails rather less work.

Land intended for raising rootstock from seed should be clear of perennial weeds and followed at least one year before sowing, during which it is thoroughly cleared. Deep, rich, friable, and well drained soil are best, as these encourage good rapid development of young rootstock. As the seeds germinate they can be carefully removed from the seedling bed and planted into individual pots. It is important to have rootstock of similar characteristics to ensure uniform plantation.



Figure 1: Rootstock

VII. Types Of Propagation

Grafting

Grafting is a technique widely used in horticulture and forestry for the mass production of selected plants, and is one of the most successful methods for vegetative propagation. The technique involves formation of a union between scions taken from desirable mother tree and rootstock that are normally healthy seedlings established in the nursery (NARD, 2001). The fact that both stock and scion must be alike and biologically active, not only when position but throughout the grafting processes, (Garner, 1976). The upper part of the combined plants is called the Scion while the lower part is called the Rootstock. The success of the joining requires that the vascular tissue grow together and such joining is called Inoculation. For successful grafting to take place, the vascular cambium tissue of the stock and scion plant must be kept alive until the graft has taken, usually a period of a few weeks.

Small cut is made in the stalk and the pointed end of the scion is inserted in the stalk. The most common form of grafting is cleft grafting, a thin scion about 1cm (0.39 In) diameter to a thicker branch or stock. The stock should be split down the middle to form a cleft about 3cm (1.2 In) deep; if it is a branch that is not vertical then the cleft should be cut horizontally. The end of the scion should be cut clearly to a long shallow wedge, preferably with a single cut for each edge surface, and not whittled. A third cut may be made across the end of the wedge to make a straight across. Slide the edge into the cleft so that it is at the edge of the stock and the center of the wedge faces are against the cambium layer between the bark and the wood. Tape around the top of the stock to hold the scion in place and cover with grafting wax or sealing compound. These stop the cambium layer from drying out and also prevent the ingress of water into the cleft (Wikipedia, 2008). From the diagram below, A is the Scion; B is the longer basal cutting while C is the cleft in the side.

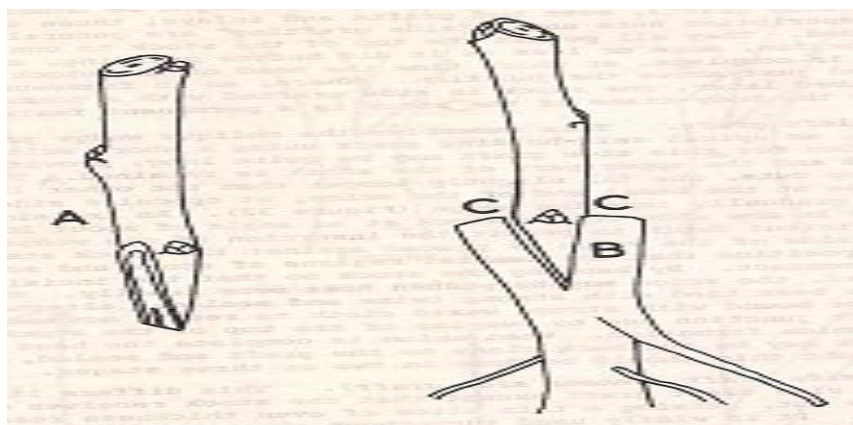


Figure 2: Grafting

Budding

Budding is a grafting technique in which a single bud from the desired scion is used rather than entire scion containing many buds. Most budding is done just before or during growing season. However, some species may be budded during the winter while they are dormant. Budding require the same precaution as grafting that is be sure that the scion and rootstock are compatible, that the scion has mature buds, and that the cambium of the scion and rootstock match. Collection of scion or bud wood should be early in the day while temperature is cool and the plant still fully turgid. The best vegetative buds usually come from the inside canopy of the tree on the current seasons growth (Ranny et al., 2014).

Budding techniques

T-budding or shield is most commonly used for budding of Citrus, Apples, Peaches and Pear. T-budding must be one when the bark will 'slip'. Slipping means that, when cut the bark can easily lifts or peels in one uniform layer from the underlying wood without tearing. Budding knives usually have a curved tip making it easier cut a T-shaped split.

First insert the point of the knife and use a simple motion to cut the top of the T. the without removing the point of the knife, twist it perpendicularly to the horizontal cut and rock the blade horizontally down the stem to make the vertical split of the T. If the bark is slipping properly, a slight twist of the knife at the end of the cut will pop open the flops of the cut and make it easier to insert the bud. While the bud are removed from the bud woods by making cut about ½ Inch between the bud and draw the knife upward just under the bark to a point at least ¼ Inch above the bud. Grasp the petiole from the detached leaf between the thumb and forefinger of the free hand. Make the second cut by rotating the knife blade straight across the horizontal axis of the bud sticks and about ¼ Inch above the desired bud. This cut should be deep enough to remove the bud; it's shielded the bark and thin selves of wood.

Insert the bud into T-flaps of the stock and slide it down to ensure that it make intimate contact with the rootstock. Many tying materials have been used with the success e.g. rubber budding strips are now employed in considerable sealed. If all exposed edge of the cuts is not corrected, the bud will dry out before it can take. When irrigation is available apply water normal rate for the plant budded. Successful budding take place after 3 weeks (Ranny, et al., 2014).

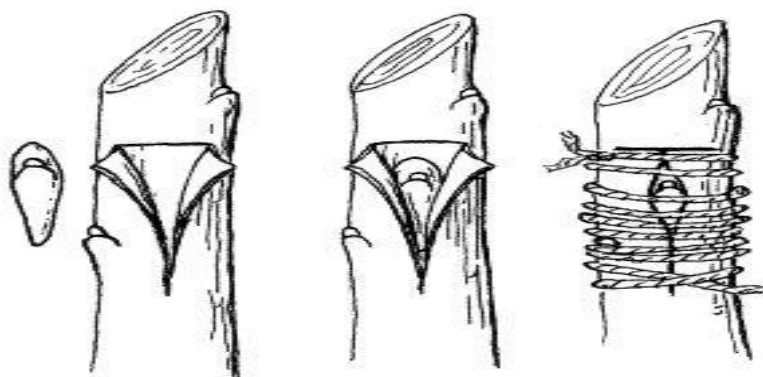


Figure 3: Budding

Layering

The term layering is used to cover processes in which a part of the plant, usually the stem is induced to grow roots and shoot before separation from the plant (Garner, 1988). Layering is more complicated than taking cuttings, but has the advantage that the propagated portion continue to receive water and nutrient from the parent plants that form root slowly, or for propagating large pieces. Layering is used quite frequently in the propagation of guava, grapevine, Peaches etc. it is also used as a technique for both creating new roots and improving existing roots (Kibrain, 2016).

Layering techniques

There are different types or technique in layering, but the most commonest ones are ground layering, and Air layering.

1. Ground layering: Ground layering or mound is the typical propagation techniques were by bending a low growing flexible stem to the ground. Cover part of it with soil, leaving the remaining 6 to 12 Inches above the soil. Bend the tip into a vertical position and stake in place. The sharp bend will often induce rooting,

but wounding the lower side of the bent branch may also help. The side bent branches will root and can be separated while the plant is dormant. Then plant in the field (Blazich, et. al., 1999).

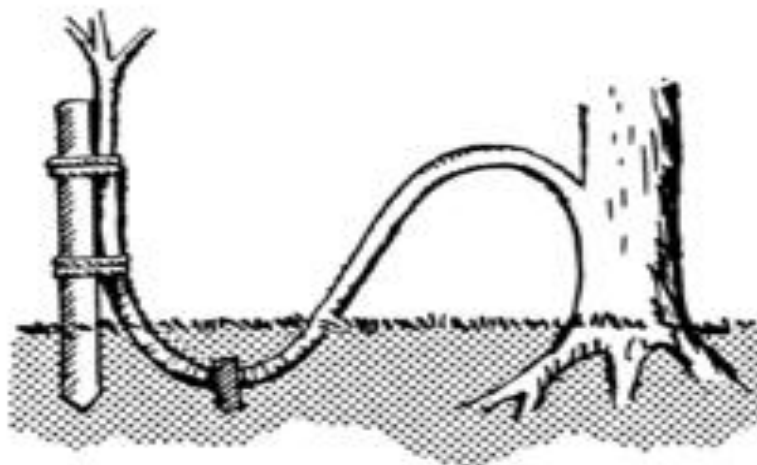


Figure 4: Ground layering

2. **Air layering:** In air layering, the target region is wounded, or strip of bark is removed and then encased in moisture retaining such cloth which is further surrounded in a moisture barrier such as plastic film. Add soil and the litter material, rooting hormones e.g. auxin is often applied to encourage the wounded region to grow root. When sufficient root have grown from the wound stem is removed from the parent plant and planted (Kibrain, 2016).



Figure 5: Air layering

VIII. Tools And Accessories Used For Nursery Work

The use of tools which have been well proved, the work is made easier and quicker, examples of these tools are:

- a. **Knives:** there are six kinds to be considered, the first general grafting knife, the budding knife, the two edged (Mexican) knife, the surgical knife, double blade knife, and the pruning or trimming knife.
- b. **Secateurs:** Secateurs are almost indispensable for the preparation of rootstocks and trees for grafting, particularly for frame working mature trees.
- c. **Disinfection of tools:** The disinfection of grafting tools is sometimes essential to prevent the spread of disease from one plant to another. The choice of chemicals is strictly limited by the susceptibility of cut surface of plants to damage. Domestic sterility based on sodium hydrochloride is safe and satisfactory.
- d. **Wax Matter:** are used to heat the wax for sealing graft and bud junctions. They are usually made by modifying kerosene lantern. When the flame is kept low, the wax is melted without burning can be kept at a suitable temperature.

- e. **Grafting point:** a like mixture used like warm grafting wax to cover wound and prevent drying. It requires heating before use and dries to a mixture proof seal when exposed to air. Unlike conventional points, it does not damage plant use.
- f. **Tying materials:** almost any tying material may serve to hold stock and scion together. Until joined, but of the many materials used some have proven more suitable than others e.g Raffia is probably used more than any other, meanwhile other tying materials include klin film and paraffin.

IX. Conclusion

This paper highlighted some practices that will bring about a high degree of success in various plant nursery operations and losses will be reduced to the barest minimum. It is pertinent to mention here that proper selection of site for nursery, good propagation method, technique of grafting and employment of right caliber of staff that will carry out the necessary operation in the nursery. There will be rapid expansion of the nursery, more revenue and availability of improved varieties of planting stocks and reduced cost for production.

X. Recommendation

For a nursery to run satisfactorily and provide good returns, the following points should be kept in mind:

1. Price should be very reasonable and competitive
2. Propagate and grow the plants keeping in view the demand and supply position in local market.
3. Impart training to your staff to acquaint with the latest technology in the field. The staff may be sent for refresher courses or long term courses.
4. To maintain quality, to grow to rear, propagate and sell only true to the type plants to have a reputed and reliable nursery.
5. Arrange training programme, demonstrate in your nursery for the nearby farmers purchaser and garden lovers.

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