Root Culturing in Bareroot Nurseries: Undercutting and Wrenching Technique

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Successful seedling establishment mostly depends on the production of planting stock with a large, robust root system and a shoot to root ratio that fits the requirements of the out-planting location. To increase seedling quality at out planting sites, it is essential to comprehend seedling root physiology and how nursery cultural techniques affect total seedling physiology (Duryea 1984). For the purpose of applying fertilizer, cutting roots, wrenching, and scheduling irrigation, it is crucial to understand the seasonality of root activity and growth in seedling beds. In India, container systems with polybag and root trainers are currently widely employed for the production of forest nursery stock. Nursery production in polybags is a common practice in developing countries, primarily in tree nurseries. Although the polythene containers are convenient and cost-effective, they have an inherent problem with root coiling or spiraling, which has a significant impact on the establishment, growth, and survival of the outplanted seedlings. Root trainer stock has far higher out planting survival and, more crucially, long-term survival; yet, recurrent weeding is necessary in forests to prevent the suppression of slow-growing tree species. Undercutting and wrenching are two more techniques that researchers are experimenting with to promote the growth of fine root systems. When planted in the forest, the wrenched and undercut seedling has a more compact and fibrous root system than the untreated seedling.

Polybag System

Polybags, which are made of polyethylene plastic (typically black), are used all over the world because nursery workers are accustomed to using them, they are lightweight, foldable, affordable (depending on size and seller), and less expensive to ship than contemporary nursery containers. There are several sizes of polybags. When given enough time, nutrients, and water, larger bags typically yield larger seedlings than other types of containers (Abugre and Oti-Boateng, 2011). Furthermore, chemically trimming roots with copper-coated polybags which are accessible in some areas can lessen root deformations (Aldrete et al., 2002). Polybags are smooth on the outside. Because of this, when seedling roots come into contact with the polybag wall, they prefer to concentrate in the bottom of the bag and spiral around. There is reduced overall fibrosity and volume as a result of this malformed root development pattern. Untimely out planting of seedlings can worsen spiraling-related root deformation. Reduced development, a worse ability to withstand stress, and early dieback can result from deformed roots. After planting, seedlings with spiraling roots would not be able to sufficiently anchor the plant and might absorb less water and nutrients.

Fig. 1: Spiraling of roots caused by polybags

Container System

Modern containers come in a variety of sizes, shapes, materials, and prices, enabling customization to accommodate a broad range of production variables. They can be purchased as individual cells, free-standing containers, or aggregate blocks. Modern container-grown seedlings grow more uniformly, have more robust roots, and have better root-shoot balance. They can be planted at a much smaller size than seedlings cultivated in polybags. The nursery requires less space, labor, growing media, and other resources because of the smaller size and quicker growth period. Additionally, smaller seedlings are lighter than larger ones, making them simpler to handle, move, and outplant. Modern container-grown seedlings often have higher long-term growth and

survival rates than polybag-grown seedlings after planting (Cedamon et al., 2005). Although modern containerized stock has a much greater rate of long-term survival, regular weeding is still required in forests to keep slow-growing tree species from being suppressed.

Fig. 2: Modern container systems consisting of a tray

Undercutting and Wrenching Technique

About this time last century, undercutting was initially employed to enhance the stock of bare-root seedlings. Undercutting was first used to enhance the quality of bare-root seedlings and boost seedling yield in the 1920s. An early nursery strategy that was somewhat successful was the in-situ modification of roots and the removal of inferior seedlings. The practice of root trimming was not being considered as a potential means of "conditioning" seedlings for out planting until the 1950s in nurseries. The undercutting blade needs to be able to cut in the soil in a position that is completely horizontal and adjustable (up to 8 inches). The blade must be sharp and thin, but also stiff. The blade needs to be sharpened on a regular basis to guarantee a sufficient cutting surface. Root-wrenching and undercutting have been reported to be effective pretreatments for a number of tree species (Rook 1971; Kamis Awang 1973). Cutting roots neatly and rapidly with little to no soil disruption should be the goal. Cutting at a shallower depth raises the possibility of seedling mortality due to drought vulnerability and ground-level stem cutting (Aldhous, 1972). Wrenching manually is similar to undercutting, except after cutting the roots, the handle of the spade is forced down, raising the seedlings 3 or 4 cm above the ground rather than withdrawing it. In a current, when the seedlings are about 20 cm high, the roots of line-sown seedlings are undercut at a depth of 8 cm. A tractor is used to perform the undercutting, and a sharp blade is positioned beneath the seedbeds in most of the developed countries. The soil should be rather damp for this procedure, and caution should be used to avoid uprooting the lateral roots. If the treatment is to be effective, the seedling density should not be any closer than 5 cm apart. A few weeks to a month before the seedlings are needed for planting, undercutting is carried out, however, they can be kept in check for a few months without noticeably losing vigor. The use of bare-rooted seedlings would help to reduce nursery cost and those associated with seedling transportation and planting.

Fig. 3: Bareroot seedlings

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