Cultural Perspectives

The Target Seedling

Introduction

Nursery management and reforestation in North America have come a long way since the first large scale nurseries were established in the early 1900's. In the past, the entire process was very simple - nurseries produced the seedlings which were then shipped for outplanting. Seedling users took what they got and there wasn't much choice. Tree planting was a mechanical process of getting the seedlings in the ground in the quickest and least expensive manner. Not much thought was given to seedling quality or the possibility of using different stock types.

In the last 25 years, however, more science has been infused into the process. New research into seedling physiology and better-educated customers have revolutionized traditional concepts of reforestation. We now understand much more about how seedlings function-both in the nursery and after outplanting. In particular, the advent of the container seedling showed the importance of nursery cultural practices and vividly demonstrated important concepts like hardiness and dormancy. Today's seedling customers are very well educated, they know what they want, and they have many choices.

My objective in this paper is not to dictate what type of seedling to use but show how some basic concepts can be used to define the best seedling for any outplanting project - the "target seedling".

The Target Seedling Concept

The target seedling is a relatively new concept but the basic idea can be traced back to the late 1970's and early 1980's when new insights into seedling physiology were radically changing nursery management. A literature search of the Forest Nursery Notes database found nothing published on target seedlings before 1990. In that year, however, the Western Forest Nursery Association conducted a symposium to discuss all aspects of the target seedling, and the resultant proceedings are still a major source of information on the subject.

One of the basic tenets of the target seedling concept is that seedling quality is determined by outplanting performance. Although they might be the same species, forest and conservation seedlings are very different from ornamental nursery stock. For example, a Douglas-fir seedling outplanted in the relatively harsh forest environment will have different requirements from one that is outplanted in a city park. These differences are pivotal to the target seedling concept because seedling quality depends on the how the seedlings will be used—"fitness for purpose". This means that seedling quality cannot be merely described at the nursery, it can only be proven on the outplanting site. There is no such thing as an "all-purpose" tree seedling. A nice looking seedling at the nursery will not survive and grow well on all sites.

Defining the Target Seedling

Therefore, a target seedling is a plant that has been grown to survive and grow on a specific outplanting site. "One size fits all" does not apply to reforestation.

A target seedling can be defined in five sequential steps (Figure 1):

1. Objectives of Outplanting Project - The reason why seedlings are being planted will have a critical influence on the characteristics of the target seedling. In traditional reforestation, commercially valuable tree species that have been genetically-improved for fast growth are outplanted with the ultimate objective of producing saw logs or pulp. The target seedling for a restoration project will be radically different. A watershed protection project would require riparian trees, shrubs and wetland plants that will not be harvested for any commercial product. Conservation planting projects can have still different objectives. For example, to establish windbreaks in low rainfall areas with no native trees, exotic species may be required.

2. Proper seed source or vegetative plant material - All nursery managers and reforestation specialists are familiar with the idea of seed source. They know that plant species vary throughout their geographic range because they are adapted to local site conditions.

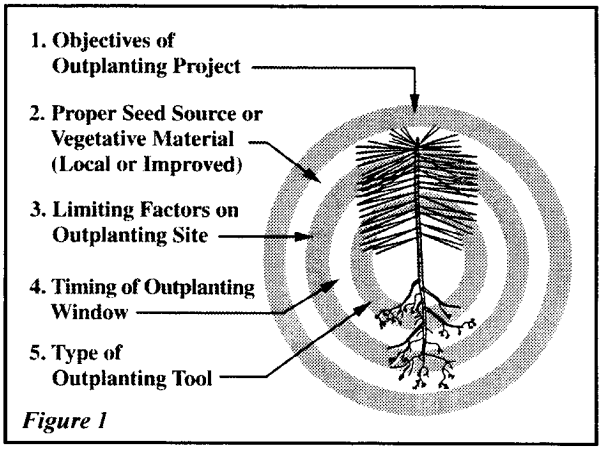

Figure 1

Using a local seed source and collecting from enough individuals to maintain genetic diversity are basic tenets of restoration ecology. The same principals apply to plants that must be propagated vegetatively. Cuttings must be collected from near the outplanting site to make sure that they are properly adapted. Proper seed source can be guaranteed through the use of seed zones, and so the location and elevation of seed is always recorded and included in the seed source identification code.

3. Site conditions - The next step is to identify the limiting factors on the outplanting site. The ecological "principle of limiting factors" can also be applied to reforestation. The specifications of the target seedling should be developed by identifying which environmental factors will be most limiting to survival and growth on that particular site. For example, a fire restoration site in Mexico might have shallow soils and competition for moisture and nutrients from grasses. On the Kenai peninsula in Alaska, however, cold soil temperatures are the limiting factor. Temperature measurements in the shallow rooting zone do not exceed SO °F (10 °C) during the summer and research has shown that root growth almost stops completely below this temperature threshold. After the seedling customer supplies this information, the nursery manager can produce a seedling that will survive and grow under these specific site conditions.

One outplanting site condition deserves special mention - mycorrhizal fungi. Reforestation sites typically have an adequate complement of mycorrhizal fungi that quickly infect outplanted seedlings whereas many restoration sites do not. For example, severe forest fires or mining operations eliminate all soil microorganisms including mycorrhizal fungi. Therefore, seedlings destined for these sites should receive inoculation with the appropriate fungal symbiont before outplanting.

4. Outplanting window - The timing of the outplanting project must also be considered. The outplanting window is the period of time in which environmental conditions on the outplanting site are most favorable for survival and growth. Soil moisture and temperature are the usual constraints. In the Pacific Northwest, seedlings are outplanted during the rains of winter or early spring. However, because winters in Mexico are sunny and dry, seedling outplanting is done early in the summer rainy season (Figure 2).

Soil temperature rather than moisture is the consideration at high elevations or latitudes. In Alaska, the outplanting window is later in the summer when temperatures are at their peak. Using this information

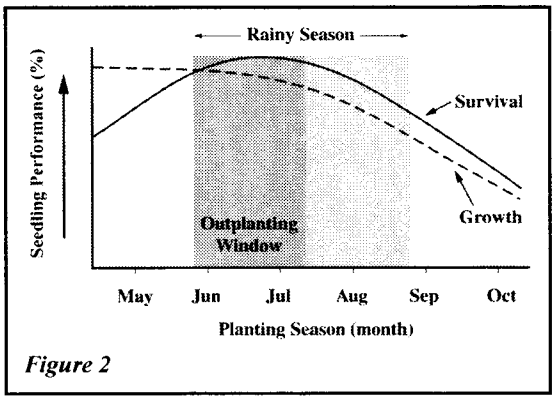

Figure 2

from the seedling customer, a growing schedule for the target seedling can be constructed. Starting at the date of delivery, the nursery manager plans backwards to determine how much time will be required to produce a seedling with the target specifications.

5. Planting Tools - There is an ideal planting tool for each outplanting site. All too often, foresters or other seedling customers will develop a preference for a particular implement because it has worked well in the past. However, no one tool will work under all site conditions. Special planting hoes called hoedads are popular in the steep terrain on the Pacific Northwest but shovels or planting bars are traditionally used in Mexico. The level terrain in the Southern Coastal Plain or on the Kenai peninsula in Alaska allows machine planting. Nursery manager must know the planting tools in advance so that they can grow target seedlings with the appropriate root length and volume.

Improving the Target Seedling

The target seedling is not a static concept but must be continually updated and improved. At the start of the project, the forester and the nursery manager must agree on certain seedling specifications. This prototype target seedling must be verified by outplanting trials in which survival and growth are monitored for up to five years. The first few months are critical because seedlings that die immediately after outplanting indicate a problem with stock quality. Plants that survive initially but gradually lose vigor indicate poor planting or drought conditions. Therefore, plots must be monitored during and at the end of the first year for initial survival. Subsequent checks after 3 or 5 years will give a good indication of seedling growth potential. This performance information is then used to give valuable feedback to the nursery manager who can fine tune the target seedling specifications for the next crop (Figure 3).

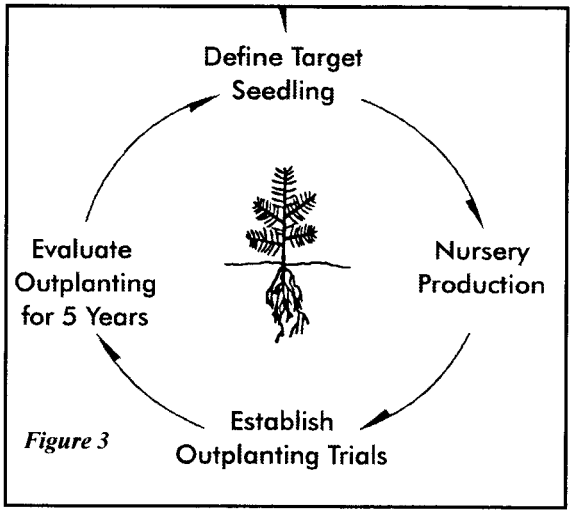

Figure 3

Summary

The target seedling concept emphasizes that successful outplanting projects require good communications between the seedling user and the nursery manager. Instead of the traditional linear process which begins in the nursery, the target seedling concept is viewed as a circular feedback system where information from the outplanting site is used to define and refine the best type of seedling.

Sources

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