Roots, Shoots and Leaves – Nursery Issues

This Guidance Note is one of a series summarising information presented at a seminar on "Improved Conifer Timber Quality through Plant Selection and Silviculture", held in February 2009 as part of FC Scotland's Timber Development Programme. It outlines a presentation given by Richard Ogilvy, of Christie Elite Nurseries Limited, reviewing nursery practice for the production of commercial conifer plants and highlighting the importance of good forward planning and communication with nurseries to ensure cost effective plant procurement. The presentation itself is available for download through the seminar web page.

Introduction

The aim of this guidance note is to describe the process of modern nursery production for different specifications of conifer plants, emphasising the important influence of plant quality on establishment success. The future of tree nurseries, in the face of an uncertain market, is also considered and procurement practices which will promote the economic interests of both the nursery and the grower are proposed.

Nursery Production

For trees to survive and thrive after planting they need good roots and the craft of nurseries is to produce healthy stock with a high proportion of compact fibrous roots. This is achieved by disturbing the roots in the nursery by undercutting and transplanting.

Other than for vegetative propagation, the process of plant production starts with seed broadcast on sterilised beds, covered with grit, irrigated and protected against birds. The sowing density is varied depending on whether the seedlings are destined to be supplied as undercuts, when they are sown thinly, or to be transplanted, when they are grown densely. They are regularly undercut or "wrenched" to stimulate roots at the expense of shoots.

Undercut Plants

Undercut plants have less root development than a comparable transplant, but with appropriate site preparation and management, especially on new planting of bare land, these are well able to realise their potential. The small plants minimise planting check with high survival, although their size renders them vulnerable to weeds and weevils, requiring higher post planting maintenance. Using undercut plants can reduce plant costs by about £140 per hectare and they are easy to transport and plant. As they are less costly to produce, nurseries are more inclined to invest speculatively in such production.

One method of site preparation that is suitable for the use of undercut plants, on appropriate site types, is the Rotary Spot Cultivator which leaves a level, clear planting site and has been shown to promote good root establishment and early growth.

Vegetative Propagation

The very best Sitka spruce material is produced by vegetative propagation (VP). Stock plants are raised from seed and nurtured for 3 years, after which cuttings are taken by hand in February and 'struck' in modular cells in a misted polytunnel, forming a root system by late July. They are then transplanted into the field for a further growing season and after 5 years the finished stock is ready to lift and grade. Growing significant quantities of VP material means committing to much expense in anticipation of a market which is speculative. It is labour intensive and coupled with losses from rooting failures, poor root form and branch-like habit (plagiotropism), it is a costly business. No sane nurseryman (if there are any) is going to risk having unsold stock, so the most likely result is less VP being grown than the market requires, even although the production capacity exists.

Transplanting

Transplanting, commonly known as lining out, produces a more robust plant with more fibrous and compact roots. The seedlings from the beds, and the rooted cuttings from vegetative propagation, are generally planted out using adapted vegetable growers' machines. We are now also introducing a new system where the seedlings are raised in mini-plugs, instead of a seed bed, and lined out using a mechanical transplanter. Where six staff were previously planting 40,000 a day, this machine can do 200,000 with 4 staff, producing a finished plant in 2 instead of 3 seasons.

Lined-out stock is usually kept in the transplant lines for one growing season, so that a you have variously 1+1, 2+1 or 1½ +1½ referring respectively to the age of seedling and period in the transplant lines. For cuttings which are struck in Spring and lined out the same summer, they are referred to and supplied as ½ +1½ after 2 years in the nursery.

Plant quality

If asked to choose between the two plants shown in Figure 1, most foresters would opt for the larger, sturdier plant with the better root system. The stunted plant on the left is actually of the more highly selected, improved stock and will theoretically produce more green logs than the seed orchard sourced plant on the right. However, genetic quality must be set against post

planting survival and growth. Only after successful establishment can the genetic gains be expressed, so it is important that strong, healthy plants are produced in the nursery.

Figure 1: Stunted plant produced by VP (on left) and sturdier seed orchard plant

Cell grown plants

In what circumstances should cell-grown plants be considered? Apart from perhaps Corsican pine and the silver firs, survival and performance of cell-grown plants is essentially equivalent to that of bare-rooted stock. Cells are particularly useful for planting in the late summer and autumn when the quiescent shoots reduce transpiration losses and active roots allow site colonisation, giving good overwinter survival with a high tolerance of drought in the following spring. The use of cells with side-slits to encourage root pruning throughout the root plug is beneficial to root development.

Cells also allow the use of the mechanised “Bracke” planter which cultivates, plants and fertilises in one operation. Other than in case of the Bracke planter, bare-rooted plants are ideal for winter and spring planting, with cold-storage extending planting to early summer. It is much safer to plant dormant stock from cold-storage in June, than to plant stock that is flushing in March or April (or at any time). With short winters and early springs, this is a major consideration.

Seed Supply

Nurseries are reliant on obtaining adequate supplies of seed. Improved material is largely supplied by the Forestry Commission, although two privately owned seed orchards have been established that will produce seed of a genetic level equivalent to that currently only available from VP.

Supply Chain Issues & Plant Procurement

The market for conifer plants is heavily influenced by forestry grant structures. Any uncertainty when support mechanisms are changed, or under review, makes it hard for nurseries to consider investment in producing planting stock in the face of unknown demand. Nurseries desperately need some clarity if they are to invest in speculative production, especially of the more expensive seed orchard and VP stock.

Trees are a commodity where demand cannot be created by price cutting. If no-one is planting trees cannot be given away, nor can they be put on a shelf to wait for the demand to pick-up. I think the UK forest industry only has a functioning nursery sector because we carry so much invested in growing stock it is very hard to stop. It's a bit like owning an oil pipeline. You can never get your hands on the contents, just keep pumping it in at one end to force it out of the other. And in the case of the nursery it can be anything from 1 to 5 years in the pipe.

In an unstable and unpredictable market, with a large proportion of the supply being costly improved stock, I do not believe that the existing business model is sustainable. Ultimately, our customers have to pay for surpluses as an overhead on stock actually sold or pay over the odds when the market is undersupplied.

We all hear how supply chain management can increase efficiency and reduce costs. I would estimate customers are all paying 30% too much for planting stock, solely for the privilege of being able to treat nurseries as they would a supermarket, wandering in and buying groceries when the need arises.

Even if customers do commit to supply contracts, unless it is for specific projects it merely passes the risk on and the cost of over-production will still be carried within the supply chain. We need to get to the point that working plans are agreed and supply contracts entered into at least two years ahead of planting.

Conclusions

I suggest there are three types of forester:

- The hunter gatherers who go shopping when they have to, may not find the stock they want and pay a higher price. If all foresters remain hunter gatherers you might not have the range of high quality nurseries currently available in the future.
- The tactician, planning one year ahead to allow at least transplanting of seed orchard sourced seedlings for supply the following season. A step forward from the hunter gatherer but not able to take full advantage of the financial savings possible.
- The strategist, using long term forest plans and ordering at least two years in advance to allow specific production of any seed sourced material plus the production of VP from existing stock plants. Able to reduce plant costs by around 30%, a saving of around £150 per hectare.