Rest assured with quality assurance

Quality assurance indicator plots are an inexpensive, reliable way of gauging the quality of plantation establishment and management

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The good, the bad and the dead: the only difference in the radiata pine out-planting system used in the quality assurance plot on the right and the 'standard' practice on the left was in the care taken during the transfer of trees from the nursery to the field. The dramatically better survival and growth in the QA plot led to significant changes in planting practices in New Zealand. *Photo: R. Trewin*

UNLIKE most manufacturing processes, mistakes made during the establishment of tree plantations are not always identified easily and can have a long-term negative effect on the performance of the plantation—with major financial implications. Therefore, a cost-effective system for revealing weaknesses and raising standards would be of considerable value.

Several companies in New Zealand and Australia use quality assurance (QA) indicator plots for this purpose. These are small 'control' plots established in the main plantation using the prescribed out-planting prescription, stock selection, handling and planting. They act as a gauge of efficiency for side-by-side growth comparison with the 'standard' production practices employed throughout the plantation. The regular monitoring of QA plots helps reveal deficiencies in establishment prescriptions and the quality of their implementation in production plantings. They also provide a reliable basis for sampling the quality of plantations through to maturity.

Stocking down, but problems persist

The distortion of root systems in small containers and by poorly trained and supervised planters continues to cause stability problems (leading to wind-damage toppling) in fast-growing plantations. However, research and practical experience over many years in New Zealand have led to considerable improvements in seedling survival rates for *Pinus radiata* (radiata pine). This has allowed substantial reductions in the initial stocking from over 2 000 stems per hectare a few decades ago to 1 000 stems, with 2.5 m x 4 m being a standard spacing. On good land a stocking of 833 stems is common. One large company was so confident of its establishment procedures that it reduced initial stocking to 550 stems per hectare (it recently reverted to 833 stems because the wider spacing encouraged the growth of large branches).

How have these reductions been achieved? The use of improved tree breeds has helped, as has the careful integration of improved nursery and out-planting methods. Because most forest managers resist change, scientists used indicator plots in production plantings to demonstrate the growth improvements possible in such an integrated system. The benefits of the system were clearly demonstrated on a poor site: the survival rate for indicator plots was 98% against only 49% in the adjacent production planting *(see photo)*. Seeing is believing: when presented with this kind of evidence, forest managers quickly adopted the new system. One forester using QA plots reported:

> *"When the actual operational establishment of radiata pine is compared side-by-side with potential (ideal) implementation of our prescription techniques for lifting, dispatch, and planting, it is found that first-year growth of seedlings established on an operational basis falls short of potential. Loss of potential growth amounts to 2.8 mm in diameter (21% of potential), 15 cm in height (16% of potential) and 44% of potential bulk growth. Survival is also down to 92% of potential survivals."*

Improvements in the culling and handling of stocks in the planting season following this assessment raised survival from 92% to 99%, with associated improvements in initial growth.

Survival and growth problems are almost inevitable; in many parts of the world the land available for forestry is

degraded or drought-prone. Even where soils and climate are favourable, pests, disease, high winds and other natural disasters can have devastating effects on young stands. The responsibility for failure generally falls on forest managers, who must be able to show that their establishment prescriptions and implementation were sound. Government agencies or investors faced with failed plantations and financial loss will naturally question competence and, if dissatisfied, may fire the unfortunate manager. By establishing QA plots in all new plantings and monitoring health and growth at regular intervals, forest managers soon become aware of problems and can rectify these in future plantings.

Establishment

The forest manager responsible for establishment should visit supply nurseries regularly to monitor the growth of tree stock. Root development, especially in containers, must be examined carefully by washing away all media to reveal form. Poor root development, common in small containers, can adversely affect field growth and reduce stem anchorage in high winds. At planting, a representative sample of three plants (small, medium and large) should be photographed and filed with comments on quality for future reference in stand records. At regular intervals throughout the planting season the forest manager should visit the nursery and supervise the packaging and dispatch of trees for QA plot plantings. With the nurseryman he should visit the planting site to check that stock has arrived in good order and to supervise the planting of QA plots.

The nurseryman's involvement in the monitoring of planting operations and subsequent visual checks of growth quality will help with the development and integration of the 'nursery-to-field' outplanting system. In New Zealand, plants are packed directly into the box from which they are planted to reduce handling damage.

Planting the QA plots

QA plots must represent, as near as practicable, exact nursery and field prescriptions. If stock quality and/or site preparation are not to specification then this must be noted in stand records and, where possible, supported by photographic evidence. For reliable growth comparisons with production plantings, alternate rows of recently production-planted trees should be carefully removed (these plants can be immediately replanted elsewhere) and replaced with fresh QA stock. These should not be planted in the holes created by the removal or production seedlings but in freshly cultivated spots with root positioning and firming-in to exact specifications. The plots should be clearly marked with poles for ease of location, with positions shown on compartment plans. Production field staff should not be notified of when or where the QA plots will be established so that the quality of their work will not be influenced.

The frequency of the plots will depend on the size and uniformity of planting sites; plots should be established to cover large variations such as soil and elevation. In large-scale plantings (over 100 hectares), one 100-tree plot (10 trees in 10 rows) per 100 hectares is recommended. In plantings of 100 hectares or less, two 50-tree plots (10 x 5 rows) should suffice. An additional five plants should be planted at opposite corners of each QA plot between rows for root growth/form excavation assessments; these will also help identify QA plots should marker pegs be removed.

Monitoring

The health of seedlings and the form of roots in both the QA plots and surrounding production plantings should be visually assessed every three months in the year of planting and six-monthly thereafter—a survey of a 100-tree plot should take no longer than about 30 minutes. A simple assessment sheet with ten columns of ten spaces is used to score 10-tree QA plot lines on a scale of 1 to 5, where 1 = very healthy vigorous plant, 2 = healthy plant, 3 = slightly unhealthy, 4 = very unhealthy and unlikely to survive, and 5 = dead. The assessor should have photos showing 'textbook' examples of seedlings in each of the five categories. The comparative success of the production planting system can be assessed in the same way on adjacent production rows: the lower the score the better the survival and growth. A large disparity in scores or root form between QA plots and the adjacent production plantings indicates a lack of quality control that the forest manager must address.

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Who monitors?

It should be the sole responsibility of the forest manager to check QA plots and to appoint a deputy if he is away. In New Zealand it has been observed that the involvement of senior staff in the establishment of QA plots has a very positive effect on work quality. Scheduled visits for QA plot assessment provide managers with regular opportunities for the detection of growth defects that would otherwise go undetected.