THE RONNEBY APPROACH FOR GROWING BETTER TREES

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The bulk of nursery trees in Australia are grown in containers that range from tubes to 300mm pots. There are specialist nurseries that provide more advanced trees. There are two methods used for the production of advanced trees, either (one) above the ground in containers, or (two) in the ground.

Both of these methods have disadvantages. Plants grown in containers have problems. Because of the higher aeration levels at the outside of the container, 80% of the roots occur in a sheath near the container wall, with the remainder of the soil acting as ballast.

The size of a container limits growth, the stock must either be sold, be re-potted, or be thrown away when roots become too limited. The third option is rarely taken due to the high cost of production of advanced trees.

The other method of growing advanced trees is in the ground, and this method has been used since man first grew trees.

Even though this method results in a tree with good vigour and root growth, there are several disadvantages. Trees can only be lifted and transplanted for about four months of the year, and there is considerable damage done to root systems Great care has to be taken in lifting, handling, transporting, and planting them to avoid excessive damage to roots.

Most of the fine roots are destroyed during these processes, and there is little root activity until bud swell. This tends to limit trees suitable for this process to those which are strong enough to take a lot of stress and can recover rapidly. Even with care and good techniques the species are limited to deciduous trees or plants which have a dormant period.

Preceding any discussion of solutions to these problems an insight into relevant aspects of plant physiology is necessary. The distribution of carbohydrates within a tree is important, with about 80% going to growing shoots, 15% to the stems, and only about 5% to the root system. It is also of note that any stored carbohydrates will be moved to flowers and fruits rather than to other plant parts (1).

If there is significant root damage and loss during digging, the tree may have sufficient carbohydrates to produce a good flush of new leaves and shoots early in spring, but there may be very little root

growth. Often this new growth cannot be sustained because of insufficient roots, and the new growth may wither. This causes a further lack of carbohydrate production, and a further decline of the tree. In extreme cases the tree may die.

Our nursery, the Ronneby Tree Farm began growing advanced trees a decade ago, when the recognised method was to ball and burlap the root system ready for sale and transport. However, we were not entirely satisfied with the ongoing vigour and performance of trees planted out. Ronneby then looked for an alternative method of producing a tree which had a more vigorous recovery after planting.

On a trip to the USA Ronneby's were introduced to "Root Control Bags" (RCB) by their inventor, Dr. Carl Whitcomb, at a plantation in the sands of Florida. These root control bags combine the advantages of growing a tree in a container with the safety and practicality of field grown trees.

The bags are made of a fabric similar to the filter fabrics used in engineering drainage, and have the appearance of felt. The roots grow outwards and downwards when the plant is initially planted in the container and they come into contact with the wall of the container. The inner surface of the fabric is "bearded", i.e. there are loose fibres on the surface which prevent the roots clinging to it, and this encourages them to grow through the container wall. As the root diameter is very small at this stage there is no restriction of the root.

Because the fabric has tremendous physical strength it resists the expansion of the roots and, as the roots grow out into the surrounding soil and increase in diameter, the fabric constricts or girdles the root.

At some point in the girdling process the so-called "apical dominance" of the root begins to decrease. This "apical dominance" usually prevents lateral root development. As this dominance decreases lateral roots develop, and these laterals will grow out through the container wall, and they themselves will be constricted.

Because the root pruning process is gradual, trees must be left in the container long enough for root restriction and pruning to occur or little benefit will be gained. The larger the diameter of the fabric containers the greater the time required to build an excellent root system, as the roots have to grow further before contacting the fabric.

Water and nutrients are almost exclusively absorbed at the root tips, and these are transported to the stem and leaves through the xylem, which is in the inner part of the root.

Carbohydrates, however, are produced by the leaves and moved down to the root systems via the phloem, which is in the outer part

of the root. These carbohydrates, which are the energy source of the plant for future root growth, are largely prevented from moving out of the container by the fabric. A swelling occurs on the root on the inside of the fabric and a ''nodule'' forms. This ''nodule'' is packed with carbohydrate and is made up of many small cells with thick walls. As a result they are not easily damaged, and are less likely to be affected by dehydration than other root cells.

When the trees are planted from the containers, the fabric is sliced vertically in 150mm strips and torn downwards, thus removing all the roots which are on the outside of the fabric. There is a tremendous burst of new root growth from the ''nodules'' which have large reserves of stored starch. It is not known whether there are root primordia in the nodules; however, the extremely rapid production of new roots following transplanting suggests this, when compared to the several weeks taken to produce new roots from the end of a cut root on plants which are conventionally open root grown and transplanted. The root control bag produces more rapid root development, and a very different and more responsive root system than the conventional method.

The original root control bags were imported from the USA but, after several trials, inherent faults were found. In particular, some had glued bottoms that simply dropped out. Others were stitched with cotton which decayed and permitted roots to escape, thus defeating the purpose. The major fault was with the fabric itself.

Recognising that the principle was good, Ronnebys have improved the design. The stitching method and thread have been improved by using a non-degradable thread, and a ''burst resistant'' base has been included. Finally a superior fabric has been selected which performs, as required, to the high standard set by Ronnebys. Research is still continuing, however, to improve the root control bag and its performance

With a system that now allowed a tree to be grown with the best of both worlds—in ground and containerised, Ronnebys then turned their attention to the quality of the stock that was placed in the root control bags.

It soon became obvious that the standard method of transplanting evergreen stock from 2 in. tubes or liners into a 6 or 8 in. pot left a lot to be desired, with respect to the formation of the root system.

Potting on of tube stock into a larger sized container is not always done when it is convenient for the plant. This often results in a root-bound plant being placed in a 6 or 8 in. container for sale. Examination of the root system of the plant in the 8 in. container may only reveal new white roots and give an impression of a good healthy root system. If the root ball is further examined it is often found this is not so. In the vast majority of cases, particularly with

shrubs, this does not cause great problems further down the line with time.

However, as the production of some trees may take up to five years, root circling can show up even at this early stage of the plants life. The real problem lies in the ongoing performance, as the roots start to girdle each other. The vigour of the tree declines, and the client may never attribute this decline to the supplier.

Ronneby's felt that their obligation to their clients necessitated the production of the best possible stock and they, therefore, looked at another of Dr. Carl Whitcombe's inventions—the "Root Maker Pot".

For many years it has been known that increased root branching stimulates plant growth. More recently it has been found that if roots branch close to the base of the stem, growth accelerates and health of the plant improved. The key is to force roots to branch close to the base of the stem (2).

The "Root Maker Pot" is 2.5 in. square and 4 in. deep (Figure 1) and these dimensions are ideal for stimulating root formation at the stem base.

When a seed germinates it sends down a strong tap root. If the tip of the tap root is air pruned secondary branching of the root forms, but only a short distance back from the point of pruning. The root maker container stimulates the formation of secondary lateral roots on the main tap root and, in turn, the secondary lateral roots are air-pruned on the sides of the container to accelerate root development at and near the base of the stem. Because of the unique design of the container roots do not wrap or curl.

Using these methods has allowed Ronnebys to produce high quality trouble-free trees. It gives a better product to grow on in their root control bags.

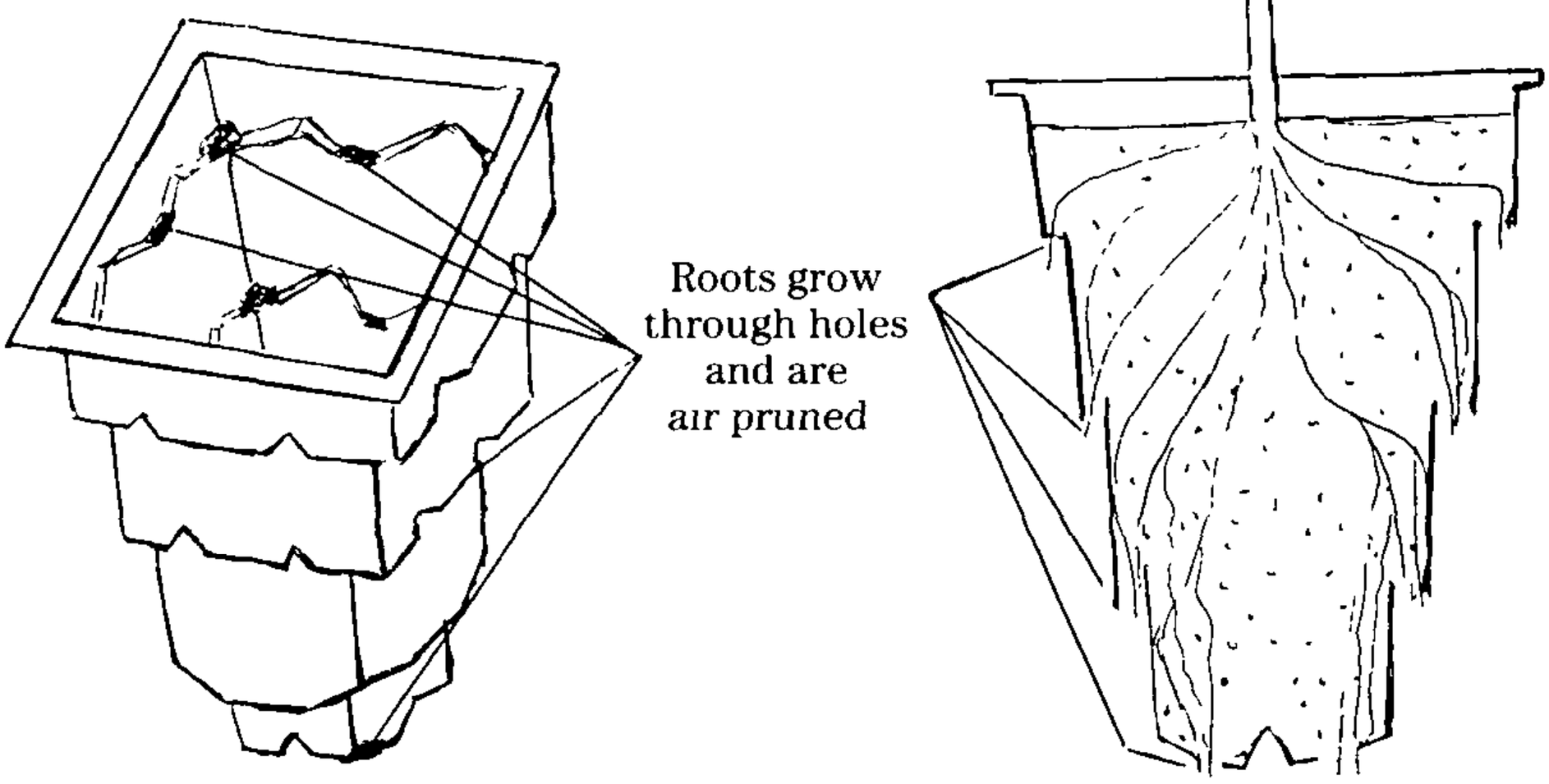

Figure 1. "Root-Maker Pot" Three dimensional (left) and cross-sectional (right)

A new problem arose—how to store the trees once they had been dug from the ground. The conventional method using a 200 litre plastic bag, although good in the short term, creates problems of weight, and stress on the root system if movement is attempted too early. The trees have to be left until the root system has formed sufficiently to withstand movement and handling.

Most of the results accomplished up to this point by Ronnebys would have been undone if the trees were then placed in a smooth sided container where root curl would result This problem led to the development of the "Spring ring."

This consists of an 18 in. (60 litre) container which has 600 hexagonal shaped funnels in the side wall and these are open at the tips. As roots grow outwards they are directed into the funnels and are air-pruned at the openings. Since roots contacting the sidewalls are directed into the funnels, no root curling occurs. This builds a superior root system compared to a conventional container.

After the strong spring flush of growth is complete the trees function as if container-grown. This eliminates the hardening/ acclimatisation process necessary when the trees are dug during the growing season.

This container is especially compatible with the root control bags that build a superior crown, stem, and root system on trees grown in the field. By removing the root control bag and placing the tree in a spring ring, the root ball size can be increased to be more proportionate to the top, and the appearance of tree is improved.

The extensive root system developed from a root-maker pot produces a tree with the capacity to establish quickly in a limited volume of soil. This allows a much larger tree to be harvested and transplanted successfully with a smaller and lighter root ball than is required using conventional methods and techniques. It is not the size of the root ball but rather what is in the root ball that counts. The combination of more roots and more energy to produce new roots sets this system apart from all the others.

In essence the "Ronneby Approach" is to produce trees that are as close to perfect as technology and current methods will permit.

LITERATURE CITED

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