HCLG Landcare Notes - Note 1

DISCUSSION PAPER

THE RISKS IN USING KINKED OR J-ROOTED EUCALYPTUS TUBE STOCK AS PADDOCK TREES

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Overview

Paddock trees play an important role in farmland. They provide shelter for stock; a home for insects, birds and mammals; as well as providing stepping stones that allow birds, mammals and reptiles to cross the landscape between larger clumps of trees and shrubs.

Planting an individual Eucalyptus tube stock paddock tree within a steel mesh guard, using a weed mat and a plastic guard, is expensive, both in materials and labour. A tree which dies or fails to prosper after several years in the ground is therefore a significant expense and loss.

This discussion paper reports on the risks of using Eucalyptus tube stock trees which, because they have roots which are either J-rooted, circled, kinked or girdled, are likely to be badly stunted in their growth and may eventually die.

The conclusion is drawn that the quality of available tube stock varies very significantly, between those which are simply not worth planting and others which are of high quality and will give good outcomes.

1. Why Some Paddock Trees Fail?

Since the mid-1990s my wife and I have been planting tube stock paddock trees at our Old Graham property, located between Cowra and Boorowa. To our disappointment we noted that some of our early paddock trees either died some years after being planted, or are stunted and haven't prospered and grown well.

This is in marked contrast to our experience with paddock trees planted more recently, including those planted as part of HCLG's NSW Environment Trust-funded linking paddock tree project which I have managed for the past three years. Apart from the usual failures from newly-planted tube stock trees not having enough moisture, and dying as a result, we have had no instances of these trees either not prospering or of them dying some years after planting.

I raised this issue in early-2019 with some experienced tree nursery owners, who said that in their experience eucalypts not prospering or dying some years after planting was because the tube stock trees have tap roots that are either J-rooted, or have circling, kinking or girdling.

2. Australian Standard No. 2303:2018 'Tree Stock for Landscape Use'

'Tree Stock for Landscape Use', a 29-page Australian Standards document, "provides criteria for those who grow, specify or purchase tree stock for landscape use" with the objective of ensuring that a tree is "free of faults that would be likely to cause the tree to fail at some point in the future".

Figure 4.7 on page 15 of the document (see below) shows examples of J-root, kinked, circled and girdled roots which the standard states, "shall not be present in the rootball". When such faults are present then any supply of that tree is in breach of the relevant Australian standard.

3. How to Identify J-Roots, Kinking, Circling and Girdling

Since tube stock trees are planted with the ball of soil intact round the roots it is impossible to see whether or not they are J-rooted or have kinking, circling or girdling. Even after teasing the soil away from the roots such problems are not visible in young tube stock.

Only by washing all of the soil ball from the roots, so that the bare roots are completely visible, can J-rooting and other allied problems be seen. Indeed, it is often necessary to also cut some of the fine fibrous roots away, as only then is the central taproot clearly visible.

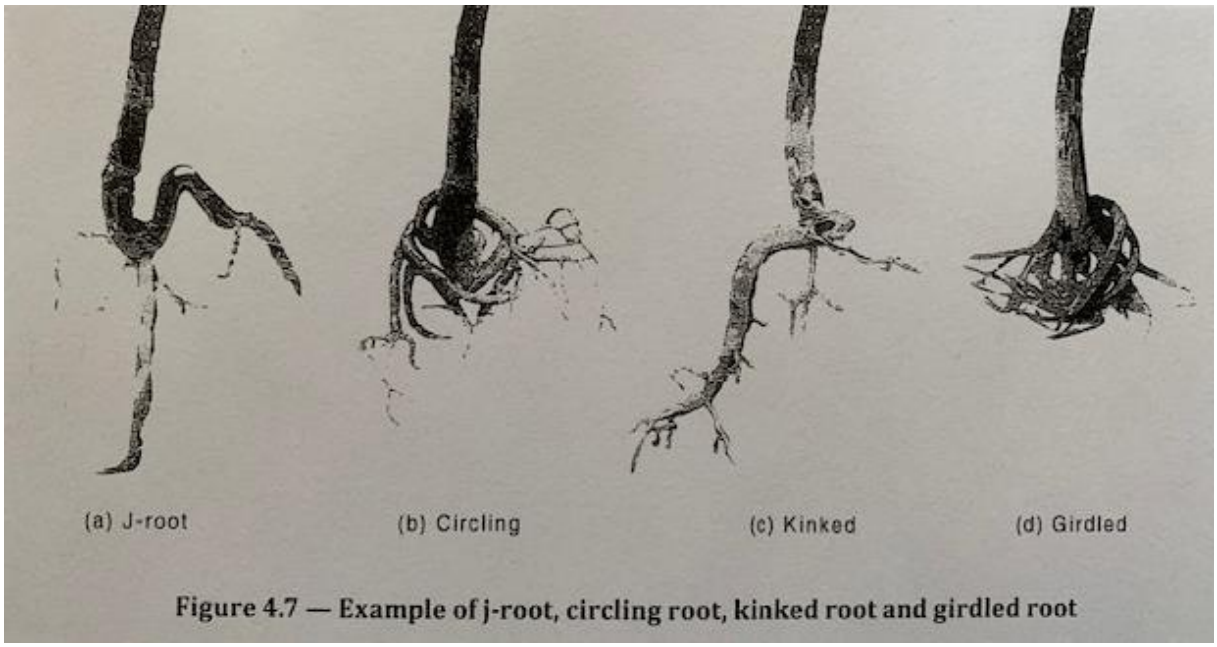

Figure 4.7 — Example of j-root, circling root, kinked root and girdled root

Fig 4.7 from Australian Standard 2303 Showing Various Root problems

4. A Survey of the Incidence of J-Rooting and Related Problems in Sample Sets of Trees

To assess the incidence of J-rooting and related problems in tube stock Eucalyptus trees being used by individual land owners and Landcare groups in the Central West I took a 'mystery shopper' approach and purchased/acquired sets of 6 tube stock Eucalyptus trees from six different sources.

After washing all of the soil from the root ball my wife and I jointly assessed the roots of the 36 young trees. We did this with the identity of the suppliers hidden from us. The results were as follows:

Condition of Roots	Set 1	Set 2	Set 3	Set 4	Set 5	Set 6	Total	%
J-Rooted	5	0	2	2	0	0	9	**25**
Circling	0	.. 0	0	0	0	1	1	**3**
Kinked	0	0	3	3	0	1	7	**19**
Girdled	0	0	0	0	0	0	0	**0**
OK - No Problems	1	6	1	1	6	4	19	**53**
Total	**6**	**6**	**6**	**6**	**6**	**6**	**36**	**100**

These results are frankly very disturbing. Half of the suppliers had only 1 out of 6 trees in their set that met the relevant Australian standard. On the other hand two suppliers had no problems with their trees.

Viewed overall, out of the sample of 36 tube stock trees only just over half of them (53%) are likely to grow into mature trees without problems, while just under half (47%) are likely to either die or have significantly stunted growth as a result of having root characteristics which do not meet the Australian Standard.

The results reported in the table are, based on 'Fisher's Exact Test', judged to be statistically highly significant and valid. The results mean there is a significant disproportion between the sets and the

classifications – in plain English, there is significant variation between the suppliers that is highly unlikely to be a random result.

Set 4 - Showing two J-rooted trees, three J-rooted and kinked, and one straight-rooted tree

5. Sourcing of the Six Sets of Trees

The six sets of tube stock Eucalyptus trees (listed in a different order from Sets 1 to 6 in the table above, so as to de-identify them) were sourced from:

- a specialist native plant nursery in Canberra, Oct 2019
- a general plant nursery in Central West NSW, Sept 2019
- a large nursery specialising in native plants in South East NSW, Oct 2019
- a small general nursery in South East NSW, Oct 2019
- a specialist tree nursery in Central West NSW, Oct 2019
- a landcare group on the South West Slopes, NSW, Oct 2019

6. The Causes of J-Rooting and Allied Root Problems

Most nurseries germinate their tree seedlings in trays of seed raising mix. Seedlings are then pricked out as early as practicable, and even before the first true leaf stage. According to Wrigley and Fagg's classic 'Australian Native Plants', the best method of pricking out and planting seedlings is to partly fill the tube container with potting mix and to then hold the seedling in position while the remaining mix is filled into the container. The plant is then gently firmed down with the fingers. This ensures a straight, natural root system. However, if this step is not done carefully then deformed root systems will result, as per the Australian Standards illustration above.

Unfortunately some growers and nurserymen plant their seedlings into forestry tubes of potting mix by using a dibber, or a piece of wooden rod of a suitable thickness, to make a hole in the mix, with the seedling's roots then being inserted into the hole and the mix being pushed down round it.

The problem with this method, and what causes J-rooting, is that the lower end of the taproot at this stage is like a very fine hair, and when the root is inserted into the hole this hair-like root may not go straight down, but instead may catch on the side of the hole and be bent back upwards. Then as it grows it realises it is pointing upwards and so turns and grows downwards, thus creating the distinctive J-shaped root. Of course, as the tree grows and the root thickens this J-shaped bend in the taproot becomes a significant constriction which not only prevents the free flow of sap between the taproot and the above ground parts of the tree, but also weakens the capacity of the taproot to anchor the tree into the ground.

Set 5 - Showing six straight-rooted trees (though one is slightly kinked)

Unfortunately tube stock trees that are J-rooted, or suffer from kinking etc, often look fine for the first year or more and are indistinguishable from other good tube stock. It is only once they really start to grow after a couple of years that their deficiencies start to become apparent.

7. How to Avoid J-Rooting and Related Root Problems

One nursery avoids J-rooting and allied problems by direct sowing tree seeds into small plastic pots, such as 'Hiko' trays (see photo) which comprise 40 connected small plastic pots, each 40mm diameter x 90mm deep. The seedlings then remain in the one pot (and so are never pricked out) and are then planted into the field from that pot.

Another nursery direct sows their seed into trays (see photo) comprising 200-500 small cells that can be as small as 15 x 15 x 30 mm deep, containing plugs of seed raising mix. Another approach shown on YouTube is to sow into small peat pellets (like those given out by Woolworths in late-2019 as a customer incentive program). Once the seedlings have germinated each plug or block is inserted into a suitably-shaped hollow created in the top of the potting mix in a standard black plastic forestry tube 50 x 50 x 220 mm deep. With this approach there is absolutely no transplant shock and no disturbance of the taproot, which at this stage is still well up in the soil plug. This method produces well rooted tube stock trees with no incidence of J-rooting, girdling, kinking or circling or other tap root damage, and is clearly the preferred approach. The technology is widely used in the USA and Europe in hydroponics and vegetable growing, but is also very applicable to tree growing. There are a number of good YouTube videos available which explain the various methods used.

It is important to flag here that even perfectly rooted tube stock trees face problems if they are left in their tubes for too long and their roots are allowed to become pot bound. This is a strong argument for planting out tube stock trees in autumn rather than in spring, in addition to the other benefits of the trees getting their roots established over winter into the surrounding soil so that they are well placed to handle a dry spring or summer (see HCLG YouTube video 'Why We Should Plant Paddock Trees in Early-Autumn' https://youtu.be/-986Pve8aLo).

Forestry tube pot and six Hiko pots cut from a larger Hiko tray of 40 pots

8. Cost Implications of Kinked or J-Rooted Tube Stock Trees

The average sale price for the trees in the survey was $3.00 each. However, based on Hovells Creek Landcare Group's NSW ET-funded paddock tree project, the total materials cost per paddock tree planted, including the tree, was in 2019 around $40 for 1200 high mesh guards in sheep country and $55 for 1650 high mesh guards for use with cattle. Assuming a labour cost of $30/hr and total time inputs of one hr per tree (inclusive of picking up the trees and other materials, cutting up the mesh and fabricating the guards, etc etc), this brings the total cost per tree to about $70 in sheep country and $85 for cattle.

Part of plug tray with wooden dibber used to insert soil plug with seedling into forestry tube pots

Thus the cost of planting the 36 trees in the sample would range between $2,520 and $3,060. Assuming that 47 per cent of the trees have to be replanted then the labour cost would remain at least the same and the cost of new trees, plus consumables of weed mats and some plastics and canes, would bring the replanting cost per tree to around $35, or about $592 for replanting 17 trees (ie 47% of the 36 trees).

This, of course, ignores the lost growing time for trees that have to be replaced. Also replanting some individual paddock trees at a later date, when the surviving trees are becoming well established, may not be convenient and not fit in with a person or a group's other priorities/commitments.

9. J-Rooted and Kinked Rooted Eucalypt Tube Stock and Australian Consumer Law

Australian Consumer Law (Competition and Consumer Act 2010) requires that suppliers guarantee that goods are of an acceptable quality and are 'fit for purpose'. Tube stock eucalyptus trees where a significant proportion are kinked or J-rooted are clearly not of acceptable quality or fit for purpose, the more so since they do not meet the requirements of Australian Standard No. 2303:2018 'Tree Stock for Landscape Use'.

Remedies available to consumers, where kinked or J-rooted tube stock trees have been supplied, are to seek either a refund or compensation for damage or loss. In the case of paddock trees or tree lanes planted at considerable expense the compensation could far exceed the original cost of the tube stock trees themselves.

A more likely outcome is that suppliers of J-rooted or kinked rooted tube stock trees may suffer significant reputational damage as individuals and Landcare groups become more aware of the significant risks of using such tube stock, as word gets around.

10. Tree Lane Plantings as Distinct from Paddock Tree Plantings

Tree lane plantings are very different from paddock trees. Typically they involve the planting of large numbers of trees, often 4-6 rows deep and at 5-8 metre spacings, within a single external fence. Consequently the death of some of the trees is not a big issue – the more so since it is often claimed that tree lanes involve the planting of trees at excessive densities, which very soon require thinning.

By comparison individual paddock trees are typically planted 30-40 metres apart within individual guards and at considerable expense, where the loss of even a few trees can leave significant gaps. Thus the J-root issue is much more serious for paddock trees than for tree lanes.

11. What This All Means for Future Landcare Paddock Tree Plantings

Based on the results of this study it is suggested that individuals and Landcare groups undertaking tree plantings should:

1. be very conscious that not all tube stock trees are equal. Some are simply 'not fit for purpose' and are a waste of time to plant, while others are of high quality and will give good growing outcomes;
2. choose their tree suppliers carefully and make it clear to them that they are expected to meet Australian Standard 2303:2018 and that their trees will be tested against the criteria in Fig 4.7 on page 15 of the standard; and
3. test a sample of the trees supplied to ensure that they meet the requirements of the standard. This current exercise has shown that by using a sample of only six trees it is easy to separate good suppliers from unreliable suppliers.