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TREE STAKING, by D Patch, revised by S Hodge

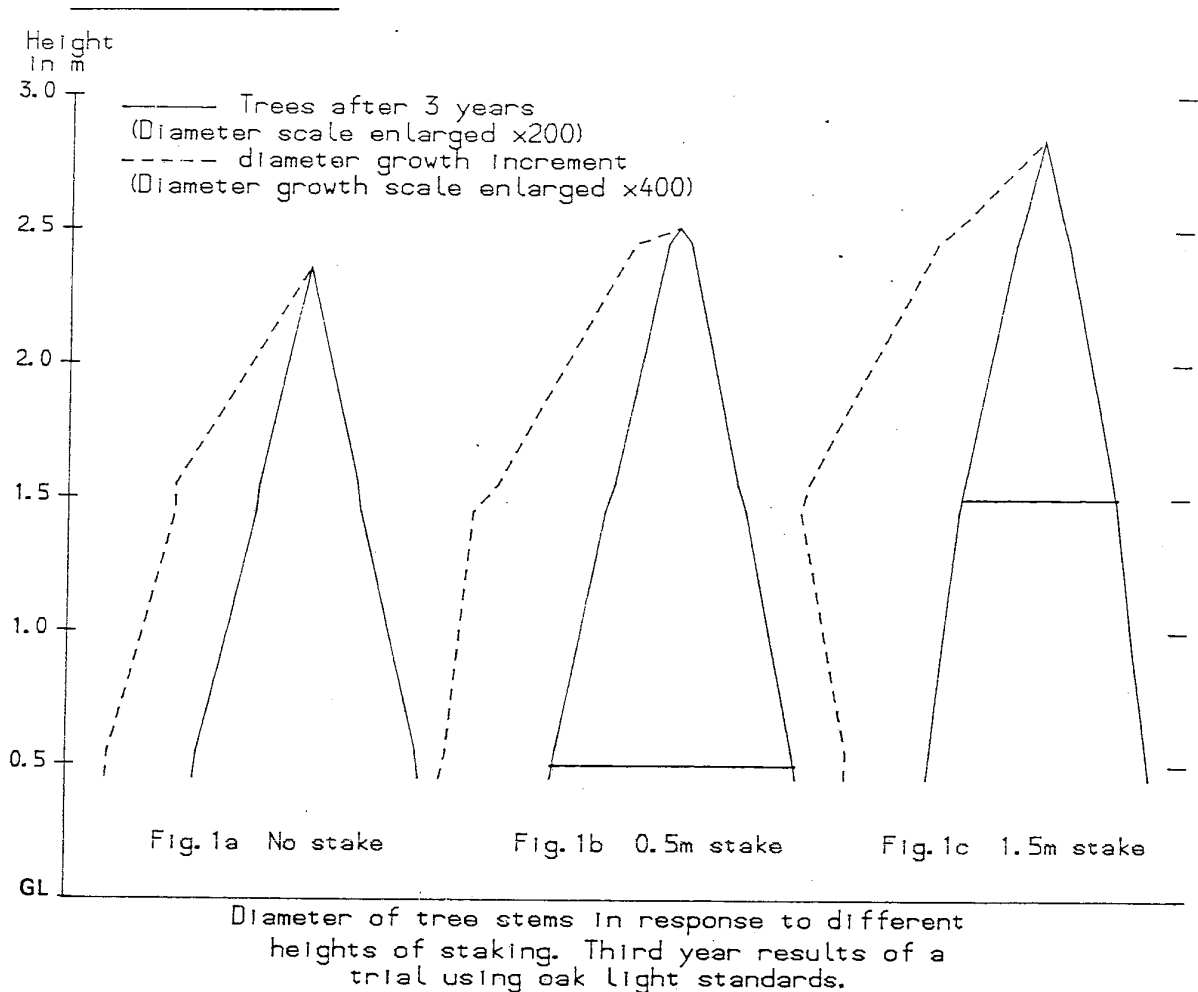
Summary

There is a belief that physical damage and vandalism to newly planted trees can be reduced by providing artificial support for the stem high into the crown of the tree. Research results suggest the practice of staking increases the ease with which a stem can be broken compared with an unsupported stem and, if the support is retained too long, the stem is weakened. Some modifications to staking practices are suggested.

Reasons for staking

1. Vandalism and physical damage to trees are seen as broken stems. In attempts to reduce the incidence of such damage it has been common practice to use either Advanced Nursery Stock (Anon 1975) or long stakes secured high in the crown of the tree.
2. Nursery grown trees, whether grown in open ground or in containers, have a restricted root spread. When planted in cultivated soil the root system is not extensive enough to prevent the tree being toppled by wind or vandals. A stake and ties are justified, therefore, to secure the larger sizes of tree (i.e. 1.5m and taller) until the root system has developed to provide a natural anchorage.
3. Maximum stem diameter growth tends to be at about the lowest group of branches (whilst stem taper is most rapid in the crown) but it is also influenced by stem movement. With an unsupported tree having branches retained on the lower stem these two factors cause maximum diameter growth close to ground level (Fig 1a). In this situation diameter growth of the roots near the root collar will also be at a maximum (Fayle 1968).
4. Holding the stem of a tree firm at the base of the crown or higher prevents the stem from swaying over the lower part of its length. Furthermore, the nurseryman's practice of clean pruning the stem of standard (anon 1980) and larger trees (anon 1975) raises the base of the crown, and hence the point of maximum stem diameter growth. In consequence, there will be less diameter growth of the lower stem of a staked tree compared with that above the point of tying. Eventually the stem can become thicker above the tie than below it.
5. Fig 1 shows that the height growth of half standard oaks staked to 1.5m was significantly greater than in trees staked at 0.5m or not staked at all. This accentuates instability caused by reduced diameter growth at the base of the stem of a tree staked to the crown.
6. The ease with which a physical force, whether due to vandalism or as a result of wind, can break a tree's stem depends upon the length of stem over which the force can be distributed. If a stem is conical and able to flex over its whole length in response to a force there is a reduced likelihood of fracture. In contrast, the same force applied over a short length of the upper stem is more likely to cause fracture, the top tie acting as a pivot for the force. This agrees with mathematical modelling undertaken by Leiser and Kemper (1968).

Figure 1 Effects of staking



7. When support is eventually removed from a tree, or it ceases to be effective because the tie breaks or the stake rots off at ground level, the crown and lower stem are likely to be out of balance. As a result the weight of the crown will cause the weakened stem to bend.
8. If the stem rubs on the stake, the resultant wound may persist as a physical weakness in the stem. The stem may become colonised by pathogens, which could extend the wound and may cause dieback of the crown. A tie that is too tight produces internal morphological changes in the stem structure before causing constriction of the stem (Brown 1987). As a result the stem is weakened and may fail more easily than that of an undamaged tree.
9. The use of a stake and tie is justified, therefore, only as a means of holding steady the root collar of a newly planted tree until a natural root anchorage has developed.

Minimising the need for staking

10. Are standard trees essential? Whips less than 1.5m tall, which will establish more easily than larger trees, are generally suitable for rural roadside verges and large traffic islands. Standard trees may be unavoidable for many urban streets; then it should be possible to hold steady the root collar of a newly planted tree with a stake reaching about a quarter of the way up the stem and secured by a single tie at the top. The point of maximum stem diameter growth will then be lower than in a tree staked to the crown (Fig 1b). Any force applied to the tree is dissipated over a greater length of the stem reducing the potential for breakage or unacceptable distortion.

11. Provided the soil conditions are favourable for root growth, adequate anchorage to support the tree against uprooting should have developed by the end of the growing season after planting. Removal of support at the start of the second growing season after planting should provide an opportunity for trees to regain a balanced form before the onset of winter gales.
12. Stem diameter growth can be maximised by planting trees with their stem feathers intact or shortened instead of the commonly produced clean pruned stems. The feathers may be removed selectively or by progressive shortening over a number of years during the routine after-care programme of the tree.

Treatment of previously staked trees

13. Where a tree has been secured to a stake for a number of years an imbalance in the stem and crown will have developed. Sudden removal of the support can result in stem fracture in strong winds or a tree with a permanent lean. It is essential, therefore, to wean the tree from its support.
14. An assessment of the need for support must be made for each individual tree. If, when a tree is freed from its stake, manual shaking of the stem does not create a permanent displacement of the crown from the upright position it should be safe to leave the stem unsupported. Where a tree is unable to remain upright the stem should be re-secured to the stake with a single tie at a height so that the stem just remains erect. The excess stake above the tie must then be removed to prevent abrasion of the tree against the stake. At the onset of each subsequent growing season the tie should be released and the exercise repeated until the stem is able to support the crown.
15. Where, after a number of years of being staked, a tree has failed to develop a natural anchorage in the soil, it is unlikely that it will ever become stable. This is because soil conditions are unsuitable for extensive root growth. Such trees may require staking throughout their lives.

Conclusions

16. Traditional methods of supporting newly planted amenity trees are potentially damaging. It is recommended that the tree size prescribed for each planting scheme should be critically examined, and where standard or larger tree cannot be avoided a short stake and a single tie should be used. These should be removed at the onset of the second growing season after planting. A tree staked for two or more years will need to be weaned from the artificial support over a period of years.

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