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THE EFFECTS OF WEED COMPETITION ON TREE ESTABLISHMENT

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Summary

Weeds reduce the survival and growth of newly planted trees. The nature of this competition and some weeding methods are discussed.

Introduction

1. Arborists ignorant of the damage caused by weeds to trees will not be motivated to control weeds; those ignorant of how weeds damage trees may use inappropriate control methods. This note considers how weeds compete with trees and reviews weeding methods.

2. Many sites are grassed before tree planting to improve their appearance. All plants compete to some extent but grasses and clover are particularly competitive.

Competition for light

3. Tall weeds may compete for light, physically damage the tree when they fall, and harbour bark-gnawing rodents. Conversely, tall weeds may protect the tree from desiccation. However, the roots of weeds close to the tree also compete for moisture and nutrients and on grassy sites this is more important that competition for light. Mowing or cutting these weeds (optimistically termed handweeding) reduces light competition, but not root competition. Mowing often increases the sward's transpiration, and thus the moisture stress suffered by the tree.

Competition for soil moisture

4. Relatively little moisture evaporates from bare soil before a layer of dry soil forms reducing further evaporational losses; vegetation transpires moisture faster and for longer before soil moisture availability limits further transpiration. Therefore soil moisture deficits are greater under weeds than bare soil. Weed induced moisture stress kills trees or reduces their growth.

Competition for nutrients

5. Moisture and nutrient competition are interrelated: weeds may compete directly for nutrients or by drying the soil render them unavailable to the tree. Trees suffering competition often appear nutrient deficient, whereas weed-free trees have larger greener leaves with higher nutrient concentrations. But fertilising alone rarely relieves competition; it often invigorates weeds and the tree suffers.

Competition reduces the survival and growth of newly planted trees

6. The results of an experiment planted with sycamore, hawthorn and Italian alder transplants on the grassed verges of a newly constructed trunk road at Ripley, Derbyshire, illustrate that assertion. The treatments where no weed control and 54, 76 and 106cm diameter areas around the trees sprayed with paraquat once each summer for three years. The figure (page2) shows survival growth after 3 years. The annual paraquat applications gave incomplete weed control; better control would probably have produced greater responses. The shapes of the graphs suggest that spots larger that 106cm diameter might have given greater responses. Many weeding experiments using broadleaved species on grassy sites over the length and breadth of England have produced similar survival and growth responses.

Area of weed control

7. Tree growth is related to the area weeded around the tree. A one metre diameter herbicide spot size is often appropriate for transplants, although larger areas usually give more growth. Larger planting stock should receive larger weed-free spots.

8. Hoeing with care to minimise damage to tree roots can be very effective. However, it is labour intensive and therefore expensive but may be appropriate for small planting schemes in parks and gardens. Hoeing stimulates weed seed germination, so unless there is drought six or seven hoeings a year may be needed. It is more useful in a Mediterranean climate where few weeds germinate in summer.

9. Chemical weed control is usually more cost-effective than hoeing as it is less labour-intensive and requires fewer repetitions to achieve the same degree of control.

10. The effect of a contact herbicide such as paraquat may be short lived, weeds regenerating from their unaffected roots. Translocated herbicides such as glyphosate kill the roots also. Residual herbicides must be selective because weed and tree roots occupy the same soil; propyzamide only kills grasses, and only kills germinating seeds. An effective herbicide application is often followed by a change of weed species requiring a different chemical to be used for the next application. (For details of herbicides see Arboriculture Research Note 27/88/SILS).

11. Mulches control weeds and reduce evaporation from the soil surface. They may also improve nutrient uptake by keeping the surface soil moist; this is where most of the plant-available nutrients are found. Many materials, organic or inorganic, granular or sheet, can be used (for details of mulch materials see Arboriculture Research Notes 71/87/ARB and 72/87/ARB). Supplementary control with hoe or herbicide is required when weeds grow through or germinate in a granular mulch. Sheet mulches such as ultra-violet stabilised black polythene are generally more weed resistant. On waterlogged sites mulches exacerbate anaerobic soil conditions, killing trees; these sites require drainage before planting.

12. Cutting grass dominated swards above ground level by tractor-mounted swipe, mowing machine, clearing saw or sickle is more likely to enhance than reduce competition for moisture and nutrients. With other weed types it may reduce but will not prevent root competition.

Timing of weed control

13. Competition is usually more detrimental in April, May and June. Over most of England summer soil moisture deficits start in April. Transpiration from any weeds remaining after this date results in larger deficits for the whole growing season. Thus one week's weed growth in April may reduce soil moisture availability from April through to October. Weed control must therefore begin early in the year. Given a weed-free start trees make early root growth and withstand some weed reinvasion, although they grow better if kept weed-free through the growing season. Killing the weeds in August may not help the tree: the worst of that year's competition is past, and weeds may recolonise the ground before next April.

14. The first spring and summer is the most critical period for the newly planted tree. In subsequent years trees withstand competition better. Three years weeding should ensure successful tree establishment of the site was well prepared and planted with good plants of suitable species. Thereafter competition still reduces tree growth but weeding may not be cost-effective. Sometimes older trees which have made little growth can be revived by effective weed control.

Conclusions

15. Competition for moisture and nutrients reduces survival and growth of newly planted trees. Effective weed control must free the tree roots from this competition. Cutting weeds above ground level is ineffective and may increase their vigour, thus stressing the tree.

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Further Reading
Experimental support for the statements made in this Note is presented by:-

Davies, R.J. (1985) The importance of weed control and the use of tree shelters for establishing broadleaved trees on grass-dominated sites in England.

Davies, R.J. (1987) *Trees and Weeds-Weed control for successful tree establishment*. Forestry Commission Handbook 2, HMSO London.

Guidance on the control of weeds is given by:-

Davies, R.J. (1987*) Black polythene mulches aid tree establishment*. Arboriculture Research Note 71/87/ARB

Davies, R.J. (1987) *Sheet mulches: suitable materials an how to use them*. Arboriculture Research Note 72/87/ARB

McCavish, W.J. and Insley, H. Revised by D R Williamson (1988). *Herbicides for sward control among broadleaved amenity trees*. Arboriculture Research note 27/88/SILS.

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