



Arboriculture Research Note

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IMPROVING THE GROWTH OF ESTABLISHED AMENITY TREES: FERTILIZER AND WEED CONTROL

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Summary

Slow growing urban trees in poor condition are a common feature of most cities. Poorly targeted remedial treatments are often worthless. On compacted or waterlogged soils fertilizer application will be ineffective, but where soil physical conditions are not limiting, nitrogen availability appear to have most influence on tree growth. For trees less than 20 years old, weed control is the most effective means of improving growth. For trees over 20 years old and trees not suffering weed competition, high N fertilizer is most likely to be effective. The first year results of two experiments have shown no significant benefit from nutrient injection into the tree.

Introduction

1. This note gives an overview of Forestry Commission (DoE funded) and other research on the performance of established amenity trees in relation to soil conditions, weed control and fertilizer application. The importance of soil physical properties is discussed in Arboriculture Research Note 102/91/ARB.

Foliar nutrient concentrations and growth of established trees

2. The functions and importance of the major plant nutrients are described by Patch *et al* (in press).
3. For trees in an intensive study (Colderick and Hodge 1991), foliar N showed the strongest relationship with shoot extension; there were significant positive correlations against shoot extension of London plane (*Platanus x hispanica*) (fig 1.) and lime (*Tilia* spp). When data were standardised and analysed over all species foliar N concentration was the only factor significantly correlated with shoot extension.
4. Significant positive correlations were found between foliar Mg and shoot extension of lime and Norway maple (*Acer platanoides*), Mg levels being low though not deficient. Low levels of Mg uptake are usually associated with compaction or waterlogging where Mg may be present in the soil but roots are unable to take it up.
5. High levels of foliar Cl (chloride) were negatively correlated with shoot extension of false acacia (*Robinia pseudoacacia*); the source of Cl being road de-icing salt washed into the planting pit (Dobson, 1991).

Fertilizers and growth of established trees

6. Reviewed literature showed a wide range of response from established broadleaved trees to fertilizer. In Forestry Commission (DoE funded) research a positive response to broadcast fertilizer application was more common than no response, and application of high N fertilizer appeared to yield a response most frequently. Response time varied from one to three years after treatment and growth improvements were generally sustained for two or three years. A positive growth response to fertilizer alone tended to be more commonplace in experiments involving trees over 20 years old. An increase in foliar N concentration generally preceded a growth response, in the same season or season after application, and was sustained for

one or two seasons. High foliar N concentration tends to improve leaf colour and hence the appearance of amenity trees.

7. Foliar concentrations of P and K generally showed little response to fertilizer addition, indicating that these nutrients were not in limited supply.
8. Two experiments evaluate “Mauget” injection of “Stemix” fertilizer as a means of improving the growth and condition of established trees; one experiment on 60 year old Red oak (*Quercus rubra*) in grass strips between pavement and road in Norwich, the other on 50 year old birch (*Betula Pendula*) in Bromley. Mean shoot extension, leaf size, leaf colour, crown density and foliar macro-nutrient concentrations were assessed but trees in both experiments showed no significant response to nutrient injection after one growing season. Monitoring continues.

Weed competition and growth of established trees

9. Weeds, particularly grasses, are aggressive competitors for moisture and nutrients. The use of herbicides reduces this competition and increases moisture and nutrient availability to the tree. Quast (1982) studied the interaction between weed control and fertilizer application in plum (*Prunus* spp.) and pear (*Pyrus* spp.) orchards. He concluded that growing fruit trees in weeded strips resulted in considerable economy in nitrogen fertilizers. Both Bould *et al* (1972) and Davies (1987) reported that when nitrogen fertilizer was applied to young but established trees in grass sward the nitrogen was utilized by the sward with no benefit to the trees (fig.2).
10. Weed control using herbicides for three seasons gave a significant positive response in 11 out of 12 Forestry Commission experiments on established broadleaved trees, with six experiments showing a strong growth response which was sustained for several years after cessation of the treatment. Seven of the experiments showed a significant positive response to a combination of fertilizer and weed control greater than the effect of either treatment individually. In three experiments, weed control alone significantly increased foliar nitrogen concentrations, but this was more generally the case when weed control was accompanied by fertilizer application.

Ground cover type

11. 43% of trees in a survey of 3600 street trees (Hodge, 1991) were growing in grass 32% in pavements, 21% in shrub beds and 4% in herbaceous beds. Overall, trees planted in shrub and herbaceous beds had better shoot extension than those in grass or paved areas. (fig3).
12. Competition for moisture is intense when planting is into grass sward (Davies, 1987). The competitive effect of most shrubs (or other trees) is less intense and for trees growing in herbaceous beds still less. Trees in paved areas, although not subject to competition from other vegetation, do often suffer from poor soil physical conditions.

Putting the theory into practice

13. The complex and variable relationship between tree, site and other vegetation leads to apparently inconsistent research results. However, prescriptions can be made which, although not always successful, will generally improve tree growth in many situations. Where soil physical conditions are unacceptable, nutrients may be present in the soil but are not available to the tree. Under these circumstances the addition of fertilizers is unlikely to improve tree growth.
14. Of all factors assessed in the intensive study of street trees, nitrogen showed the strongest correlation with shoot extension. Nitrogen appears to be the most likely nutrient for enhancing the growth and appearance of established broadleaved amenity trees in situations where soil physical factors are not limiting.
15. The principles for treatment of young established trees (planted less than 20 years) not achieving their growth potential in grass sward are the same as for newly planted trees (Davies, 1987): in most situations weed control alone will result in improved tree condition and growth. On particularly impoverished sites, if foliar analysis indicates the need for fertilizer (Binns *et al*, 1987), this must be accompanied by effective weed control.

16. The survey of 3600 trees confirmed that trees suffer most stress when in competition with grass sward. Trees in shrub beds grew better and sustained less damage than trees in other planting positions.
17. In many experiments semi-mature trees in grass sward did not respond readily to weed control. Older trees exploit a large volume of soil and tend to suppress vegetation growth under their crowns. They are, as a result, often less influenced by the moisture competition effects of grass sward than young trees. Trees planted for over 20 years can respond well to NPK (but particularly N) fertilizer alone. Weed control and fertilizer application together generally gave a greater response in experiments than fertilizer application alone, but the visual effect of weed control over the rooting zone of large trees generally makes this unacceptable.
18. Patch et al (in press) gives details of fertilizers and recommended rates of application.
19. There is generally no benefit from augered fertilizer application over broadcast. However, on sloping ground applying a slow release fertilizer into auger holes is necessary to prevent fertilizer loss in surface water run off.
20. Two experiments have detected no significant response so far to "Mauget" nutrient injection into established amenity trees after one growing.

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