



## Arboriculture Research Note

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#### DO SOIL AMELIORANTS HELP TREE ESTABLISHMENT?

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#### Summary

Two experiments, one on sandy and one on clay soil, tested a range of soil ameliorants, mixed into cultivated planting-pits. Seventy-five per cent of the Corsican pine planted into cultivated pits survived, compared with only 31 per cent uncultivated soil; but the addition of ameliorants had no effect on survival or growth.

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#### Introduction

1. Traditionally trees were planted into pits containing a mixture of the soil dug from them and compost. May other soil ameliorants are now available often they are said to work by:
  - increasing soil moisture and nutrient retention;
  - releasing nutrients at a controlled rate;
  - improving soil structure and aeration.
2. This note reports two experiments planted in March 1985 to test a range of soil ameliorants.

#### Experimental methods

3. Two contrasting sites were used. The first, at Arborfield Garrison, Berkshire, had been built up with London Clay containing some builders' rubble. The second was in Thetford Forest, Norfolk where 0.5m of sandy soil lies over the chalk. Two species were used at each site; Large-leaved lime (*Tilia platyphyllos*) and ash (*Fraxinus excelsior*) transplants at Arborfield; sycamore (*Acer pseudoplatanus*) transplants and Corsican pine (*pinus nigra* var. *maritime*) seedlings raised in small Japanese paperpots at Thetford. Contact herbicides were used to provide some weed control around all of the trees.
4. The ameliorants were mixed into 21 litre planting-pits at Arborfield, and 15 litre pits at Thetford. These pits were cultivated with a powdered auger. Some trees were planted into identical pits containing no ameliorants. At Thetford, trees planted into uncultivated soil acted as an additional control. Ten of the following treatments were used at Arborfield (A) and then at Thetford (T):

- |   |  |   |
|---|--|---|
| - | <u>Control</u>                         | uncultivated soil. (T)  |
| - | <u>Control</u>                         | Pit-planted. (A&T)  |
| - | <u>Alginate</u>                        | derived from seaweed; 1.5g per litre of pit volume (rate recommended by Alginate Products Ltd). (A&T)                                 |
| - | <u>Agriigel</u>                        | a polyacrylamide that absorbs large quantities of water; 5g per litre (rate recommended by Vinamul, Vinyl Products Ltd). (A&T)        |
| - | <u>Broadleaf P4</u>                    | a polyacrylamide said to hold up to 400 times its own weight of water; 1g per litre (recommended by Agricultural Polymers Ltd). (A&T) |
| - | <u>Fisons Sedge Peat</u>               | 200 ml per litre (A&T)  |
| - | <u>Broadleaf P4+ Fisons Sedge peat</u> | at 1g and 200 ml per litre respectively; (mixture and rate recommended by Agricultural Polymers Ltd). (T)                             |

- ICI Forest Bark 200ml per litre. (A)
  - Pulverised pine bark from Thetford Forest; 200 ml per litre (T)
  - Farm-yard manure: at Thetford it came from a cattle farm and contained straw; at Arborfield it was from a pig farm and was straw free; 200ml per litre (A&T)
  - Ficote 70: a controlled fertiliser; 30g of the 14:14:14: (N:P:K) formulation was mixed in each pit at planting; 40g of the 16:16:10 formulation was inserted into tow slits in each pit in April 1986. (A&T)
  - Perlite: coarse grade; expanded volcanic ash to improve drainage and aeration; 200 ml per litre. (A)
  - Turface: expanded clay granules to improve drainage and aeration; 150ml per litre. (A)
5. Both experiments used randomised block designs with four replications of ten treatments. There were 12 trees per plot (48 of each species in each treatment) at Arborfield, and 16 per plot (64 of each species in each treatment) at Thetford.
  6. The height and diameter of each tree was measured at planting, and survival, height and diameter at the end of the first and second growing seasons. Foliage samples collected in 1985 were analysed for nutrient concentrations.

## Results

7. After two seasons the average survival was

Lime 88%, ash 100%, sycamore 98% and pine 71%

The various treatments had no significant effect on lime, ash and sycamore survival ( $p < 0.05$ ). There were significant differences with the pine ( $p < 0.02$ ): only 31% of the trees planted into uncultivated soil survived, whereas 75% in cultivated pits survived. But it made little difference which, if any, ameliorant was added to the pit. Indeed, survival of pine in pits with no ameliorant (80%) was better than in most of the other treatments.

8. No significant differences in height and diameter growth were detected ( $p < 0.05$ ).
9. Differences in foliar concentrations of N,P,K, or MG, or more than one of these elements, were detected for each species ( $p < 0.01$ ). but these differences were small, and since even the lowest concentrations were adequate for healthy tree growth it is not surprising that Ficote did not improve their growth.

## Discussion

10. One might expect any benefits of the water-retaining ameliorants to be greatest in dry weather. It is a pity that no drought occurred in 1985 or 1986. But both experiments are on fairly low rainfall sites, and rainfall in 1985 and 1986 summers of those years was near average. (Summer 1985 was a little wetter than average in Thetford, because over 130mm fell in June).

Rainfall (mm) for recording stations within 3km of the experiment site

	Arborfield			Thetford		
	Average	1985	1986	Average	1985	1986
12 months	640	597	670	654	623	642
April-September	312	328	300	332	372	298

11. The soil at Arborfield had poor structure and drainage. Such soils are common on landscaped sites. A major hindrance to tree establishment is that these soils are waterlogged for long periods, and in consequence they are poorly aerated. Even if an ameliorant improved the soil structure within the pit, excess water would not drain from it, and so the pit would still be waterlogged and anaerobic. To improve conditions in the root zone, excess water must be able to drain from it.
12. Both experiments were well replicated. So any worthwhile benefits from any of the treatments would have been detected. But the ameliorants tested had no significant effects on tree survival or growth. This is in marked contrast to recent arboricultural weeding experiments, many of which were less well replicated but all of which showed large increases in tree survival or growth, or both, through effective weeding.

13. The only statistically significant result- pit cultivation increasing pine survival at Thetford- may have been caused by the effect of the treatment on the weeds. Pit cultivation provided some initial weed control around the base of the trees. Rather than risk herbicide damage to the pine seedlings in the uncultivated soil, small lumps of weeds were left around them.

#### Conclusion

14. Under the conditions of these two experiments none of the ameliorants tested were of any help to tree establishment.

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