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TECHNICAL NOTE

A METHOD FOR ENHANCING ESTABLISHMENT OF *LEUCAENA LEUCOCEPHALA* (LAM.) DE WIT IN INFERTILE ACID SOILS

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ABSTRACT

The effect of soil cores as a means for enhancing establishment of Leucaena leucocephala *(Lam.) de Wit in an infertile acid soil was examined in a glasshouse trial. Treatments were small cores of black earth soil or peat implanted in a larger pot of podzolic soil. Growth was compared to black earth and podzolic controls. Destructive harvests were made at 2 week intervals over 12 weeks. The black earth core and peat core treatments gave significantly better top and root yields than when seed was sown directly into the podzolic soil. Improved growth was attributed to nodulation which occurred only in the black earth and peat mediums. It was concluded that transplanting leucaena seedlings in cores of medium favouring nodulation will enhance establishment in acid soils.*

INTRODUCTION

Leucaena leucocephala (Lam.) de Wit is a versatile tropical legume that has demonstrated potential as a forage shrub or tree in tropical and sub-tropical Australia. A major factor limiting its widespread use in Australia is its slow growth during establishment in infertile, acid soils (Hutton and Andrew 1978; Lesleighter 1985). This has been related to acid soil factors such as high soil solution aluminium and manganese levels (Hutton and Andrew 1978) which may limit leucaena growth directly or indirectly through deleterious effects on nodulation and nitrogen fixation (Ruaysoongnern *et al.* 1984).

Establishment of leucaena seedlings in pots of limed soil planted in acid soil was suggested by Olvera *et al.* (1982) as a means of enhancing establishment. Surface liming was thought to increase root penetration into acid soils.

This study examines the possible enhancement of growth and nodulation of seedlings grown in small cores of favourable media implanted into an infertile acid soil.

MATERIALS AND METHODS

Environment

The experiment was conducted in an unshaded glasshouse at St. Lucia, Brisbane (Lat. 27°28′) during summer (December 1983–March 1984). The mean weekly maximum and minimum temperature ranges were 34.1–29.3°C and 22.1–19.6°C respectively.

Treatments

Treatments were four different planting mediums, namely:

1. Nodular podzolic soil (Thomson 1958); an infertile, acid and sandy soil from C.S.I.R.O. Beerwah Research Station; initial pH 5.3 (1:5 soil:water).
2. Black earth soil, Ug 5.15 (Northcote 1979); a self-mulching, cracking clay from Gatton; initial pH 6.6.
3. Cylindrical cores of peat (4.5 × 4.5 cm at field capacity, 10 g air dry weight, pH 4.6) implanted into the nodular podzolic soil.
4. Cylindrical cores of black earth soil (3.8 cm diam. × 5.0 cm deep; 30 g of 10 mm sieved air dry soil) implanted into the nodular podzolic soil.

The podzolic soil received a basal application of 80 kg ha^{-1} KCl; 3000 kg ha^{-1} $CaCO_3$, and 200 kg ha^{-1} superphosphate containing 8.8% P, 9.2% S, 18.4% Ca, 0.9% Cu, 0.8% Zn and 0.03% Mo. The black earth did not receive basal fertilizer application.

Experimental Design

A completely randomized, split plot design with 4 replications was used. The plot was split with respect to harvest time and pot size. Six destructive harvests were made at 2 week intervals from planting. Plants harvested at 2 and 4 weeks were grown in pots 180 mm in diameter; at 6 and 8 weeks in pots 220 m in diameter; and those harvested at 10 and 12 weeks were grown in pots 225 mm in diameter.

Establishment

L. leucocephala cv. Cunningham seed was immersed for 5 minutes in water held at 80°C, cooled in running water, soaked in cool water overnight and placed in germination trays held at room temperature. On December 21, 1983, imbibed or germinating seeds were planted at a depth of 30 mm with an average of 5 seeds per pot, or 2 to 3 seeds in each core. In the following week, plants were thinned to 2 plants per pot or 1 plant per core in core treatments. Pots were flooded with 100 ml of a suspension containing 2 ml of NGR8 *Rhizobium* broth. In a previous experiment (Ruaysoongnern *et al.* 1984), the *Rhizobium* strain NGR8 was shown to be more effective than strain CB81 in the nodular podzolic soil from Beerwah.

Measurements

Oven dry weights of roots, tops and nodules were recorded. The pH of mediums were monitored, using 1:5 soil:water or 1:10 peat:water extracts, after vibrating and settling for 24 hours.

RESULTS

Top growth

The black earth treatment yielded significantly more than all other treatments at all weeks except week 2 (Fig. 1a) even though, at weeks 6 and 8, plant height was restricted in the 220 mm pots. The black earth core improved top growth compared to the peat core and podzolic soil in weeks 6 to 10. The peat core treatment yielded more than the podzolic soil from week 8 onwards.

Root growth

The black earth soil yielded significantly more root dry matter than the podzolic soil treatments in all weeks (Fig. 1b). The black earth core improved root growth from week 4, while the peat cores yielded more than the podzolic soil from week 10.

Nodule growth

Nodules were found only in the black earth and peat mediums; in the core treatments, nodules occurred only within the cores (Fig. 1c).

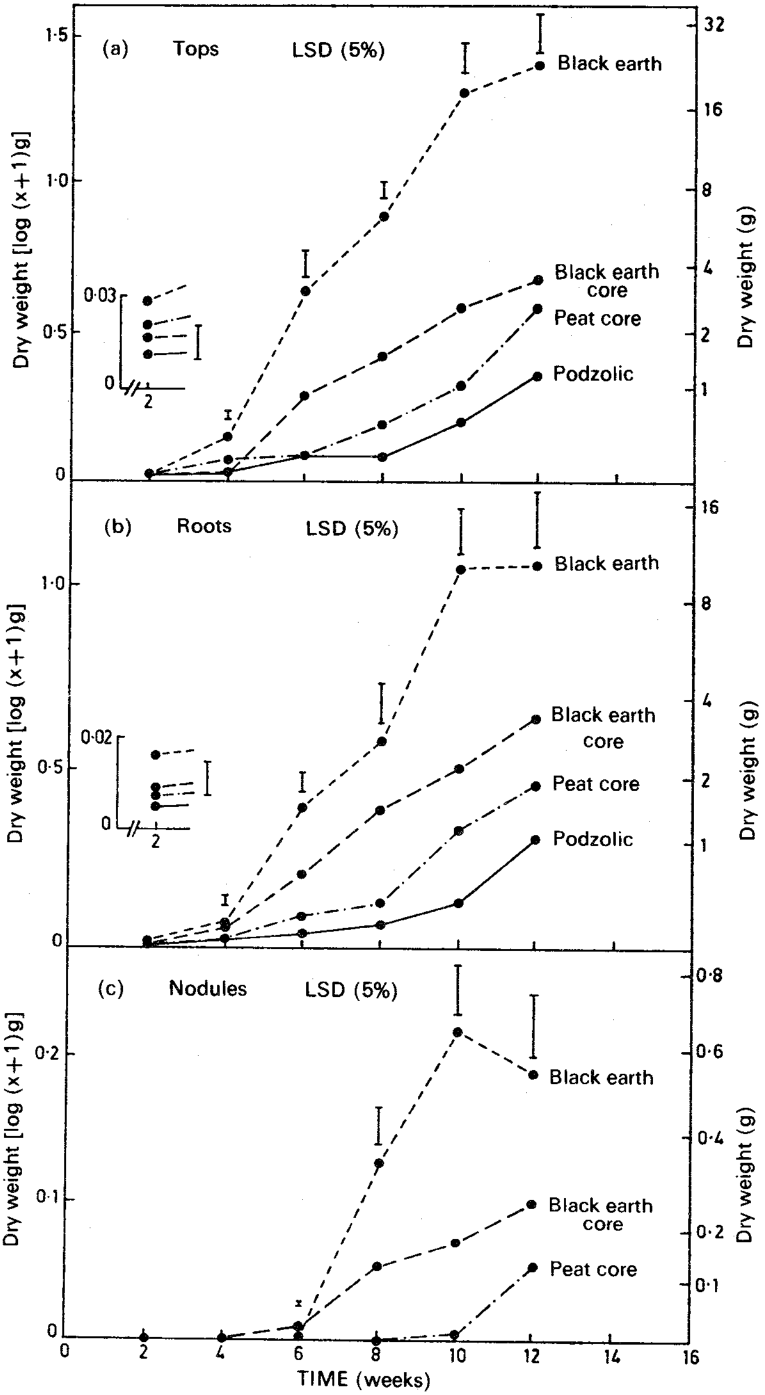

FIGURE 1
Effect of planting medium on the dry weight of (a) tops, (b) roots and (c) nodules of *Leucaena leucocephala*

Medium pH

The pH of the black earth soil remained steady at *c.* 6.6. The pH of the peat core was initially quite acid (pH 4.6) but increased gradually with time to 5.8, whilst in the podzolic soil, pH dropped from 5.3 to 4.7 during the experiment.

DISCUSSION AND CONCLUSION

Plant growth in the infertile, acid podzolic soil from Beerwah was improved when seedlings grew from small cores of black earth or peat moss embedded in the soil. Improved top and root growth was associated with enhanced nodulation. The higher inherent fertility of soil core mediums may have influenced early growth but subsequently was deemed to have had minimal effect as roots were well distributed throughout the implanted pots by week 6.

In the black earth cores, nodulation was detected from week 4 and top growth was greater than for the podzolic soil by week 6. Top and root growth in peat cores did not show an advantage over the podzolic soil until weeks 8 and 10, respectively. This slower response was associated with a delay in nodulation in the peat until week 10.

The lack of nodulation in the podzolic soil may be due to the low pH and associated aluminium toxicity (Hutton and Andrew 1978). By comparison, the pH of black earth cores remained steady at *c.* 6.6, while the pH of the peat cores, which were highly acid initially, increased to a level known not to inhibit nodulation (S. Ruaysoongnern 1984, personal communication).

It is clear that growth of leucaena seedlings in infertile acid soils will be improved by the use of cores of a fertile medium to promote earlier nodulation. Brewbaker and Hutton (1983) noted that the transplanting of seedlings raised in plastic dibble tubes (12.5 × 30 cm) is standard practice for establishing leucaena forests. In Australia, there may be scope for contract planting of large areas using forestry planters. Further work is required to determine the optimum size of cores and age of seedlings for transplanting.

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TECHNICAL NOTE

THE POTENTIAL FOR PERSISTENCE OF SAFARI KENYA WHITE CLOVER BY SEEDLING REGENERATION

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ABSTRACT

Seed set, soil seed reserves, germination and seedling survival of Safari Kenya white clover (Trifolium semipilosum) *were followed in a grazing experiment at Wollongbar in*