A number of dwarf trials established at Yanco, Gosford and Dareton research centres have yielded promising results with Navel and Valencia oranges and with lemons. In all trials dwarfing budlines were inoculated into trees of known virus status. Dwarfing in other citrus species such as grapefruit and Ellendale mandarin is also to be investigated.

Small demonstration plantings of dwarf citrus on five commercial orchards made in 1973 and 1974 have given further information under different soil conditions.

COMPARISON OF POTTING MIXES FOR MACADAMIA NUT TREES

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Abstract. Nine month old composted macadamia husks were tested with sand, soil and sawdust in a combination of potting mixes.

Sand and husks increased macadamia seedling height by 73% after one year in 10 containers while sand and sawdust depressed growth by 39% compared to soil and sand

Dry weight of leaves, stems, tap roots and fibre roots at the end of the experiment showed high dry matter in the leaves (61%) compared to *Pinus radiata* (49%) The shoot to root ratio was 4.6 compared to 2 1 recorded for avocados

The sand and husks treatment (1 1 v/v) would reduce the time for macadamia seedlings to reach graftable size by 9 months compared to sand and soil (1 1 v/v)

INTRODUCTION

The macadamia industry on the north coast of New South Wales has increased from about 100 ha in 1970 to over 1500 ha in 1980. This rapid expansion has resulted in a heavy demand for nursery trees. The time from the potting of seedlings to planting out of grafted trees is usually about two years. Slow growth of seedlings in soil and sand based potting mixes has forced nurseries to outlay considerable investment in floor space and materials to supply the demand for grafted trees.

Field observations have shown that unthrifty mature trees benefit from heavy mulching with macadamia husks. The husk is the fleshy green carpel enclosing the nut. Chemical analysis of 9-month-old decomposed husks show a larger concentration of most major and minor elements compared with red soil. (Appendix 1). An experiment was initiated at Dunoon via Lismore in July, 1979, and terminated in July, 1980, to examine the growth response of macadamia seedlings to a combination of potting mixes made up of red soil, sand, husks, and sawdust.

MATERIALS AND METHODS

Two month old seedlings of the D4 cultivar *(Macadamia tetraphylla)* from a single mother tree with four fully expanded leaves were planted in 10 l containers in the following potting mixes on a volume to volume basis:

1. Red soil)Wollongbar clay loam]
2. Red soil + sand (½ + ½) CONTROL
3. Red soil + husks (½ + ½)
4. Red soil + sand + husks (⅓ + ⅓ + ⅓)
5. Sand + husks (½ + ½)
6. Sand + sawdust (½ + ½)
7. Red soil + sawdust (½ + ½)
8. Red soil + sand + sawdust (⅓ + ⅓ + ⅓)

Two kg dolomite, 1 kg blood and bone, 100 g KNO_3 and 100 g KSO_4 per cubic metre was added to all combinations and mixed for 3 min in a concrete mixer. In September, 4 g of calcium ammonium nitrate (23 per cent N) and 0.2 g of Ess-Min-El (R) trace elements was added to each pot. In November and February 16 g of 19-2.6-10 (NPK) Osmocote (R) were also applied.

All seedlings were placed under 50% shadecloth for the duration of the experiment and watered by sprinklers at regular intervals. Each treatment was represented randomly twice in a block of 4 × 4 pots. Each block (replicate) was repeated 10 times which made a total of 160 pots.

The seedlings were trained to a single stem and measured for height at approximately four weekly intervals. At the end of the experiment the following measurements were taken from one plant in each block (total 80 plants): stem girth at 10 cm, fresh and dry weight of leaves, stem, tap root, fibre roots and ratios of the above parameters.

RESULTS AND DISCUSSION

The treatments did not affect the growth of seedlings for the first 120 days. From 180 days onwards the treatment responses separate out into three main groups. The accepted industry norm, red soil and red soil and sand, were not significantly different from each other; plants reached a mean height of about 55 cm in one year. Sand and husks, red soil and husks and red soil, sand and husks gave a growth increase of 73, 30 and 12% greater than red soil, respectively. On the other hand, red soil, sand and sawdust, red soil and sawdust, and sawdust and sand depressed growth by 11, 17 and 39%, respectively, compared to red soil.

The substantial growth response to the sand and husks treatment suggest that either the nutrient reserves in the 9 month old husks (Appendix 1) are available for some time to the seedlings, or that a growth promoting agent is released from the husks. This is in marked contrast to the sawdust and sand treatment which showed a growth rate of ⅓ that of sand and husks. The sawdust was from a disused sawmill site and had an age of 8 to 30 years (Appendix 1).

An examination of the effect of treatments on dry weights of leaf, stem, tap root and fibre roots in relation to total dry weight showed sand and husks to have a higher stem weight than all others and amongst the lowest proportion of fibre roots (Table 1).

Table 1. Effect of potting mixture on dry weight of macadamia leaf, stem, tap root, fibre roots as a proportion of total plant dry weight

	Leaf		Stem		Tap Root		Fibre Roots	
Treatment	Mean	S D	Mean	S D	Mean	S D	Mean	S D
RS	55 0	7 0	21 2	1.32	7 2	0.06	7 8	1.5
RS + S	44 5	6.8	21 5	0.78	6 6	0.06	13 1	2 0
RS + H	54 8	7 0	24 0	1 17	6 1	0 04	9.3	0 9
RS + S + H	58 4	7 1	21 3	1 31	5 0	0 06	10 6	1 1
S + H	51 5	6.7	27 6	1 34	6 3	0.05	7 8	0 4
Sd + S	45 3	6 8	16.8	0 76	8.4	0 06	17.3	1 8
RS + Sd	57 9	7 2	19 9	1 28	7 1	0 06	7 8	0 4
RS + S + Sd	49 4	7 1	17 4	0 96	6 4	0 06	12 3	1 5
S E	±0 18		±1 2		±0 6		±1 5	

The red soil treatments grew as well as neighbouring commercial seedlings and no obvious visual nutrient deficiencies were noticed in any of the treatments.

The incorporation of husks in potting mixes in a macadamia operation avoids hauling husks back to the field for use as a mulch. This haul-back operation is costly as evidenced by the need to develop an in-field macadamia nut husker in Hawaii (1).

Table 2. Fresh (FW— and dry weight (DW) growth parameters for macadamia (means of all treatments)

Parameter	Mean	S.D
Leaves DW/FW	0 51	0 15
Stem DW/FW	0 49	0.32
Tap root DW/FW	0 47	0 05
Fibre roots DW/FW	0 23	0 08
Leaf DW/total DW	0 61	0 06
Stem DW/TDW	0 21	0 05
Tap root DW/TDW	0.07	0 02
Fibre roots DW/TDW	0 11	0 05
Height	60 49 cm	22 13
Girth	7 39 cm	1 89
Height/girth	8 07	1 57
Height/total DW	1.16	0 29

A dry weight shoot/root ratio of 4.6 (Table 2) was more than twice as high as the 2.1 ratio found in seedling avocados by Yusof *et al.* (3) The leaf showed a high dry weight to fresh weight ratio (0.51) and as a percentage of total dry weight (61.0) was higher than that recorded in *Pinus radiata* (49.0%) (2).

The height of macadamia seedlings trained to a single stem can give a satisfactory estimate (ratio 1.16) of its dry weight (Table 2).

Most macadamia seedlings are grafted at a girth of 8 to 10 mm. The sand and husks treatment reached at this level under twelve months (Table 3). Other treatments would take 18 to 24 months before they are ready for grafting so the increased growth rate would shorten the turnabout of seedlings by an average of nine months.

Comparable growth rates are achieved by some nurseries but only with fertilizer inputs. Our system only uses small amounts of fertilizer and mainly waste materials.

Table 3. The effects of treatment on girth of macadamia seedlings at the end of the experiment.

Treatment	Girth (cm) Mean	S E.
RS	6 8	0 42
RS + S	7 9	0 31
RS + H	9.7	0.50
RS + S + H	7 6	0 43
S + H	10 1	0.38
Sd + S	4 9	0 23
RS + Sd	6 3	0 30
RS + S + Sd	6 8	0 44
S E	±0 43	

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Appendix 1. Chemical analysis of soil, sand, sawdust and husks, respectively, used in the experiments

Nitrate nitrogen (ppm N)	16 7	1.0	2 0	19.8
Phosphorus BSES (ppm P)	20	99++	23	99++
Phosphorus bicarb (ppm P)	25	32	35	99+
Potassium (ppm K)	120	23	120	2550
Calcium (ppm Ca)	600	310	4200	2150
Magnesium (ppm Mg)	166	150	620	840
pH (1.5 water)	5 2	5.2	4.6	6.1
Iron (ppm Fe)	205	67	200++	194
Copper (ppm Cu)	1 4	0.2	1 2	1 2
Manganese (ppm Mn)	27	8	62	130
Zinc (ppm Zn)	2.2	0 8	20 8	20++
Sodium (ppm Na)	13	18	44	310
Chloride (ppm Cl)	10	5	60	350
Conductivity (mmho/cm)	0 04	0.13	0.18	0 32
Organic carbon (%C)	3 30	0 25	5.0+	5 0+
Sulphate sulphur (ppm S)	44	99+	46 0	96.0
Soil colour	red brown	yellow brown	—	—
Soil texture	silty loam	sand	sawdust	husks

PEACH UNDERSTOCK FROM CUTTINGS

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It has been the practice to market peach trees during the dormant months of the year. From a retail aspect this practice develops sales resistance as, during this period, the public does not display the same purchasing interest as during the summer period when fruit is available. The reverse attitude applies in the summer when field stock is not available until winter. In addition, field-grown containerised stock is usually large, lacks sales appeal, and is difficult to handle.

Producing rootstocks of 'Okinawa' (100 hours chilling required) and 'Nemaguard' (resistant to certain species of nematodes) from cuttings during spring, summer and autumn, is more economical and reduces the production time to a few months.

Rootstock tip cuttings are taken in the autumn (second week in April), disinfected with 1% sodium hypochlorite for 4 minutes, cut to 10 cm in length and slightly wounded at the base of the cutting by removing a small slither about 1 cm long by 2 mm wide. They are dipped in a hormone powder containing 0.2% IBA and NAA, and inserted into 20% peat-sand mix and placed on bottom heat at 18°C for four weeks. Misting must be reduced or stopped as soon as a reasonable callus is apparent. When rooted, these cuttings must be transferred to liner containers for wintering then, as root development begins in late winter, trans-