small number of identical or similar instruments will be installed at any one site and, therefore, it may be difficult for the grower to transfer less essential equipment. The practical life span of modern instrumentation may be considered shorter, even though generally more reliable, than was experienced a few years ago. As an example, the electronic part of a heating and ventilating control system might have to be changed as a result of one peripheral item being no longer available. However, there is a clear indication that there is an increasing need for good instrumentation, carefully selected and applied, within horticulture. It will not replace good growing but will prove to be a valuable tool in assisting those engaged in a precise and efficient industry.

J. GAGGINI: Is there any instrumentation to measure aeration and compression of composts?

R. RANDALL: Not to my knowledge. I expect there could be developments as a result of work being done on mushrooms.

J. GAGGINI: Do you think it will be possible to design a simple piece of equipment to measure density?

R. RANDALL: Yes. As now, costs are coming down so rapidly it is possible that a system could be evolved at a reasonable cost.

J. CLAYTON, Chairman: Who can one go to for advice on this modern equipment, that becomes obsolete so rapidly, especially to prevent us from spending thousands today only to find that it is obsolete tomorrow?

R. RANDALL: I would suggest you keep in close touch with A.D.A S. and N.I.A.E They are dong a lot of work on computer control and several manufacturers produce control equipment for the glasshouse market. I can also be contacted on anything I have to date.

PROPAGATION OF SHRUBS USING BLOCKING COMPOSTS[1]

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Abstract. The propagation of tree and shrub cuttings in peat blocks made from fertilized peat (Levington Blocking Compost) has been investigated. It was shown that peat blocks can offer a viable alternative rooting method for many

[1] Levington Blocking Compost, Levington Compose Universal, and Levington Container Compost are Trade Marks of Fisons, Ltd

species The use of peat blocks gives a significantly lower density of cuttings in the propagation house However, this early disadvantage may be balanced by the advantages of faster rooting plus a better and higher percentage establishment due to lack of root disturbance or damage Additionally, some subjects when rooted into fertilized peat blocks can be potted directly into one or two litre pots thus saving on potting and handling time The benefits of faster establishment can result in a reduced period from propagation to a saleable product compared with traditional methods

There is a requirement to reduce to a minimum the period between propagation and the production of a saleable plant. Additionally, uniformity in growth pattern and form within batches to ensure the maximum number of top quality plants is necessary.

Care over selection of cutting material and propagation technique is important for the production of well rooted cuttings. However, with the common practice of rooting in trays, if cuttings when rooted are not potted up straight away, starvation, over-crowding and root damage on transplanting can result in uneven and poor establishment.

Recognising the practical significance of the above Dendy (1) investigated the use of peat blocks made from a fertilized peat substrate (Levington Blocking Compost) for the propagation of some 33 types of trees and shrubs. Results of this work indicated that cuttings rooted well in fertilized peat blocks and that subsequent establishment was noticeably better with fewer transplant losses. In the light of these results, the use of fertilized peat blocks for propagating trees and shrubs was investigated covering a wide range of subjects at different sites and under varying conditions.

MATERIALS AND METHODS

Materials. The peat blocks in all experiments were made from Fisons Levington Blocking Compost (LBC). This is a sphagnum peat enriched with a complete fertilizer base. Typical analyses for unfertilized peat and the blocking compost before and after blocking are shown in Table 1.

Table 1. Analyses of unfertilized peat and Levington Blocking Compost before and after blocking

			*mg/l, water soluble salts, fresh compost			
	Spec Cond	pH	NH_4-N	NO_3-N	P	K
Unfertilized peat	92	4 2	6	0	2	12
Fertilized peat (LBC) unused	460	5 4	0	225	45	189
Made-up Blocks (LBC)	487	5 6	0	245	50	184

*Standard (Fisons) analytical method used by Levington Research Station.

It will be noted that the nutrient levels remain constant between the unwet fertilized peat and the wet compressed blocks.

Propagation treatments. The fertilized peat substrate (LBC) was compressed into blocks using either a hand-operated or machine blocker with a compression of around 2:1. Block size varied between 3.5 cm and 4 cm. Environmental conditions and cutting material varied according to site. Individual details are given with the results.

Potting on treatments. Methods and composts are discussed with the results.

RESULTS

Use of Fertilized Peat Blocks (LBC) for the Propagation of Shrub Cuttings, using Heat Bench. Dendy (1), using soft tip cuttings, successfully rooted 33 different subjects. Only *Erica spp* failed. Speed of rooting was similar to the traditional method using trays Thurlow (3), using soft wood cuttings, obtained variable results from 15 subjects. No comparison is available with equivalent batches of cuttings rooted by traditional methods. Of the species used, two failed completely. The first, *Cytisus sp.*, was thought to be due to the blocks being kept too wet under mist.

The second, *Elaeagnus* × *ebbingei* is inexplicable as Ward (2) reported 73% success under similar conditions, although in this case unfertilized peat blocks were used. Failure does not appear to be associated with nutrient levels since in the same experiment with Jiffy 7s, containing fertilized peat, cuttings were successfully rooted.

Rooting percentage reported by Thurlow (3) are given in Table 2.

Table 2. Percentage rooting of shrub cuttings in fertilized peat blocks (LBC) Cuttings taken from August to September 1979, Assessment made on October 24, 1979

Species/ Cultivar	Rooting Percentage	Species/ Cultivar	Rooting Percentage
Cotoneaster horizontalis	50	*Kerria japononica* 'Pleniflora'	100
Cytisus sp	0	*Lonicera* 'Baggesons Gold'	85
Elaeagnus × *ebbingei*	0	*Prunus dulcis* 'Rosaplena'	60
Escallonia sp	80	*Salix lanata*	80
Euonymus fortunei var *radicans*	90	*Symphoricarpos albus*	50
Fuchsia 'Mrs Popple'	80	*Vinca major*	80
Genista lydia	25	*Weigela* 'Florida Purple'	100
Hypericum sp			

Using a Time-Controlled Overhead Spray in an Unheated Polythene Tunnel.

At Levington Research Station softwood cuttings of ten subjects were inserted either into fertilized peat blocks (LBC) or trays containing a 70% unfertilized sphagnum peat/30% sharp grit mix. Minimum and maximum air temperatures were recorded and compost temperatures were taken at 9:00 a.m. and 2:00 p.m. daily. These showed that air temperature fluctuated between 26° and 31°C during the day, 13° and 24°C at night. The compost temperatures varied between 18°C night and 24°C day. The overhead spray was applied in one-minute bursts every 30 minutes but frequently had to be reduced due to the peat blocks becoming too wet. Results are given in Table 3.

Table 3. Percentage rooting, comparison of fertilizer peat blocks (LBC) with a peat/grit Mix. Cuttings taken August 1979, Assessment at time of potting.

Species/cultivar	Potted On	Peat Blocks	Peat/Grit
Caryopteris × clandonensis	17 9 79	70	65
Chamaecyparis pisifera 'Boulevard'	6 3 79	85	95
Cistus × hybridus (Syn C corbariensis)	22 10 79	17	5
Deutzia wilsonii	31 7.79	10	19
Escallonia 'Apple Blossom'	18 9 79	67	17
Euonymus fodumei 'Emerald 'n Gold'	27 9 79	94	94
Hebe 'Dorothy Peach'	25 9 79	50	67
Hebe salicifolia	27 11 79	96	88
Ligustrum ovalifolium 'Aureum'	24 9 79	56	7
Weigela florida	8 9 79	23	12

Deutzia wilsonii, which gave poor results, had previously rooted very successfully under mist.

Propagation of conifers in fertilized peat blocks (LBC) using heated mist bench.

Thurlow (3) tried a range of 25 subjects taken on October 25, 1979. No comparison was made with alternative substrates. Percentage rooting varied with species from nil to 100%. *Juniperus spp.* gave generally good results, other than for *J. pygmea,* which failed completed. Both *Picea spp.* failed whilst *Chamaecyparis spp.* generally gave poorer results than those experienced in the experiment discussed in 4.2.2. Increased root development and growth occurred with *Juniperus chinensis* 'Columnaris Glauca' in blocks compared with trays.

Cuttings rooted under a polythene sheet in an unheated polythene tunnel.

At Levington Research Station semi-hardwood cuttings of eight subjects were inserted either in fertilized peat blocks (LBC) or trays contaiing a 70% unfertilized sphagnum peat/30% sharp grit mix during October, 1979. The cuttings were then covered with a clear polythene sheet.

Minimum air temperatures dropped below freezing during December, January and February. The lowest temperature recorded in the peat blocks was 3.2°C. Mean air and compost temperatures are given in Figure 1.

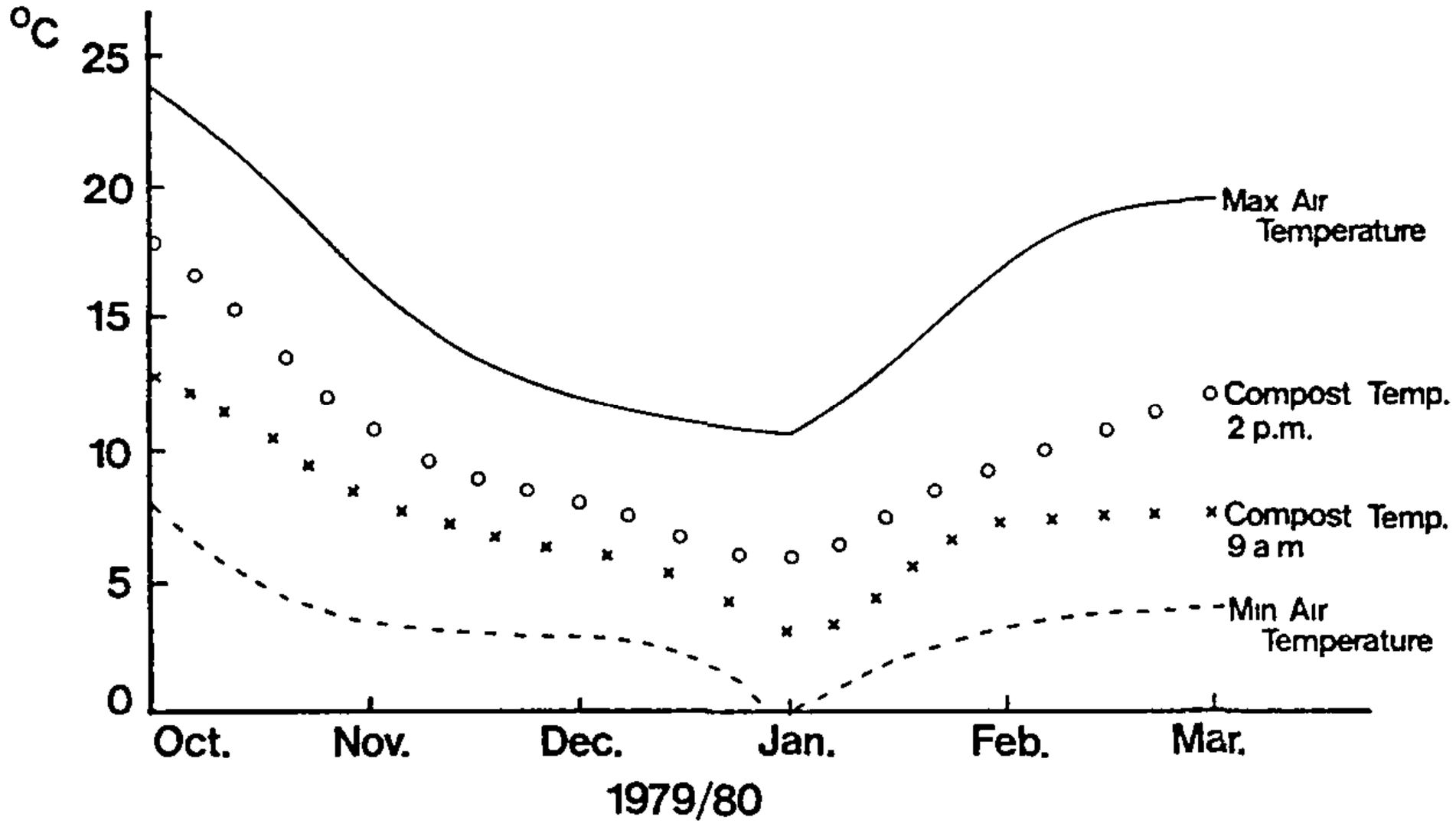

Figure 1. Maximum and minimum air and compost temperatures recorded in unheated polythene tunnel

Percentage rooting varied according to subject in the fertilized peat blocks (LBC). In the peat/grit mix rooting was negligible at the time of assessment. Results for the rooting in fertilized peat blocks are shown in Table 4.

Table 4. Percentage rooting of conifer cuttings in fertilized peat blocks (LBC) Cuttings taken October, 1979 Assessment April, 1980

Cultivar	Rooting Percentage	Cultivar	Rooting Percentage
Chamaecyparis lawsonii 'Columnaris Glauca'	84	*Chamaecyparis lawsonii* 'Erecta Viridis'	84
Chamaecyparis lawsonii 'Ellwoodii'	96	*Chamaecyparis lawsonii* 'Lanei Aurea'	34
Chamaecyparis lawsonii 'Ellwood's Gold'	97	*Chamaecyparis lawsonii* 'Pottenii'	97
		Cryptomeria japonica 'Elegans'	40
		Thuja plicata	44

Establishment at potting up; cuttings rooted in fertilized peat blocks (LBC).

Dendy (1) reported that rooted cuttings in fertilized peat blocks gave a noticeably higher percentage establishment with better early growth. The overall result was the production of saleable plants in less time than by traditional methods. Thurlow (3) potted up 16 subjects, either rooted in fertilized peat blocks (LBC) or trays, into one litre pots of a fertilized peat/sand mix

(Levington Compost Universal). Early establishment and growth were significantly better for cuttings propagated in fertilized peat blocks, as is illustrated in Figure 2.

Figure 2. Comparison of establishment for cuttings rooted in fertilized peat blocks (LBC) or trays. *Kerria japonica* 'Pleniflora' cuttings taken August 9, 1979, potted October 21, 1979, photo April 14, 1980. Appearance of plants 23 weeks after potting-up. *Left:* Rooted in fertilized peat blocks (LBC). *Right:* Rooted in trays.

Potting-on of cuttings rooted in fertilized peat blocks (LBC).

Optimum pot size (compost volume) for potting up cuttings rooted in fertilized peat blocks (LBC) were investigated at Levington Research Station. Six subjects rooted in 3.8 cm peat blocks were potted into 0.3, 1.0 or 2.0 litre pots containing a fertilized peat mix (Levington Container Compost). Those potted into the two smaller pot sizes were transferred to two litre pots as growth demanded.

Viburnum tinus, *Prunus laurocerasus* 'Rotundifolia', *Pyracantha* 'Mohave' and *Cotoneaster* 'Red Flare' showed no adverse affects from being potted directly into 2 litre pots. *Prunus laurocerasus* 'Otto Luyken' and *Berberis julianiae* established better in the 0.3 litre pots. This may have been due to these two species being weaker rooted and the lack of a weaning period between the propagation tunnel and being stood outside.

Use of fertilized peat blocks (LBC) for growing-on rooted cuttings.

At. G. Jones Ltd., rooted cuttings of three subjects were either transplanted into fertilized peat blocks (LBC) (125 c.c.) or traditional pots of compost (150 c.c.). Establishment in the fertilized peat blocks (LBC) was excellent and despite the smaller volume of compost the cuttings in these blocks had noticeably increased vigour compared to the traditional method.

CONCLUSIONS

Fertilized peat blocks can be used for the successful propagation of some tree and shrub species but environmental control needs to be investigated to obtain the best results.

The lack of root disturbance and damage with plants raised in fertilized peat blocks (LBC) improves establishment and early growth at potting on.

The disadvantages of the lower density of cuttings in the propagating house may be balanced by fewer potting stages and a shorter period to produce a saleable plant.

The use of fertilized peat blocks (LBC) for growing on of rooted cuttings offers better early growth and the saving of at least one pot stage, resulting in economy of compost used.

Acknowledgements. The help and interest of the following people and establishments is acknowledged Without such co-operation this paper could not have been written G W Dendy, W Crowder & Sons Ltd , G Jones Ltd , and E F G. Nurseries Ltd

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B. MACDONALD: Have you done any work with hardwood cuttings in blocks?

D. ATTENBURROW: No. Most of the cuttings used have either been soft or semi-hard. Up to now, we have had more success with the semi-hard than soft.

CURRENT ASPECTS OF COMMERCIAL MICROPROPAGATION

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The Location of Micropropagation Laboratories. Commercial micropropagation units that have arisen during the last ten years have developed either in association with or in close proximity to sites of academic research in the plant tissue culture