The President of the Region of Great Britain and Ireland, Mike Clift, welcomed all members to the 1981 Annual Conference at Wye College. He especially welcomed those from mainland Europe, Sweden, Denmark, Germany, Belgium, and France, and also those from the British Isles who were attending the Conference for the first time.

For this Conference the Vice President, Margaret Scott, provided us with an excellent programme with the theme, 'Gateway to the Future.' Mike Clift congratulated Margaret not only for compiling such as interesting programme but for all the detailed work in coping with accommodation, catering, and all the myriad problems of the conference organizer

He reminded members that last year comment sheets were handed out for the first time. Among the comments received was a request for younger chairmen. It gave him great pleasure to hand the activities our to a definitely younger chairman — David Gilchrist — to start the 1981 conference.

1981 ROSEBOWL AWARD

The President of the G.B. & I Region, Mike Clift, outlined the history of the Rosebowl Award and listed the recipients since it was first awarded.

The Rosebowl is awarded to a member who has made a significant contribution, either to plant propagation or alternatively to the I.P.P.S. in this Region. In presenting the Rosebowl to Brian Humphrey, the President commented that Brian had qualified on both counts. He has a considerable knowledge and experience in all types of plant propagation and has a special interest in some of the newer techniques. He has presented papers of significance to this Region and to the Eastern IPPS Region; he has contributed regularly in discussions in conferences and local meetings. Brian was our first President and, if it wasn't for his drive and enthusiasm in 1968 in inaugurating this region, the I.P.P.S. here might have taken many more years to get established.

WORK FLOW AND COSTING IN PROPAGATION

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"Costings" is a term frequently used by propagators, growers and company directors to express the calculations and procedures necessary to find out one of the most basic questions in nursery production, i.e. "How much does this plant cost me to produce — Could I buy it in cheaper?" The idea of buying in may not be attractive unless the source of material

is safe and the producer is reliable. If these two factors are assured then it may, indeed, make good sense to buy in from a specialist propagator and follow the trend that has been seen in glasshouse, field, vegetable, and fruit production during the past ten years.

Such an enormous decision cannot be made without facts — and realistic, factual costs of propagation are extremely difficult to come by from other people and even more challenging to work out one's own. It was to this end that we have tried to produce a logical, systematic schedule for the calculation of the cost of producing a cutting by conventional means. The actual document is shown in Appendix 1. and the purpose of this paper is to try to explain some the reasoning behind it.

A survey carried out along similar lines with ten growers in Oregon, U.S.A. by their local State University Extension Service showed some interesting results as shown in Tables 1 and 2.

Table 1. Cost breakdown of propagation of *Photinia* × *fraseri* by cuttings in Oregon in 1979

	Percentage of total cutting cost
Cost of cuttings before insertion	23 6
Cost of rooting and growing	59 7
Overhead cost	10 8
Working capital interest	5 9
	100 0
Of this total, the employer and employee input is	63 0

Table 2. Cost breakdown of propagation of *Juniperus sabina* 'Tamariscifolia' by cuttings in Oregon in 1979

	Percentage of total cutting cost
Cost of cuttings before insertion	19 9
Cost of rooting and growing	65 9
Overhead cost	9 0
Working capital interest	5 2
	100.0
Of this total, the employer and employee labour input is	55 0

From these figures it was interesting to note that labour costs amount to 63% and 55% of total costs, and means of reducing these figures are considered later.

From the Oregon survey one grower found that he was, in fact, selling *Photinia* × *fraseri* plants at one U.S. cent less per cutting than the calculated cost of producing it!

What goes in a costing? Firstly it must be said that views on this subject are very different and, in the past, many organizations and advisory people have recorded only the so-called variable costs of materials and direct labor, saying that to calculate and allocate fixed and overhead costs was too laborious and imprecise. Other industries have gone to great lengths to obtain complex formulae to be able to allocate for example, a portion of the cost of running the managing director's car to each washing machine or rivet produced, and this "cost accounting" can mean computors, large amounts of paper, and dubious results.

We have aimed for something in between, so Sections 2, 3, and 4 of the formula in Appendix 1. are reasonably straight forward in that they record the more obvious costs of direct labour and actual materials used

Labour Hours. We often fail to appreciate that, although a propagator may be paid, say, £90 for a 44 hr week (including overtime) the cost per week to employ him or her will be nearer to £110 (or more) when such costs as Employers National Insurance contributions, holiday pay, sick pay, and training days are included, not to mention other possibles such as accommodation and use of a vehicle. Furthermore out of 365 days in a year, the average person is unlikely to work more than 240, if you allow for weekends, holidays, sickness, and training; this then puts up the price of labour per hour even higher.

e.g. 365 days × 9 hours =3285 hours/year
if the wage is £5000, then hourly cost is £1.52
but at 240 days × 9 hours =2160 hour/year
then if employment cost is £6500, then hourly costs rises to £3.00

It is this second type of hourly cost which should be used in costings.

Stockground. Section 1 deals with the cost of a stockground or, if absent, the cost of travelling out to collect cutting material. This is usually overlooked especially when it comes to consideration of stockground maintenance and the "*opportunity cost*" in terms of rental value of the site occupied by the stock plants. If they were not there what could be done with the land? At worst it could be rented out to a farmer or grower and, at best, used for extra production or even a crop of houses! The rent is suggested at 5% because in this country horticultural rents are notoriously low in relation to land values.

Indirect Costs. These are costs which, although incurred and often substantial, are not easy to allocate specifically to

one crop or batch, even though they are a cost of being in the propagation business (compared to overheads in Section 7 which are a cost of being in business in general). Points to note here are:—

1 Structures such as glass or polytunnels and equipment, such as environmental control gear, are usually depreciated (for tax purposes) from the original cost and in days of inflation this can be extremely misleading. A polytunnel in 1985 will cost two or three times the cost of its predecessor erected in 1975 and the purpose of depreciation is to build a fund for replacement Thus a polytunnel of £1000 depreciated over seven years should create £1000 to buy a new one — the only problem being that a new one by that time costs £2000. the idea of using current replacement cost is not new, other industries use it in pricing calculations all the time. In fact, to be more realistic the cost of future replacement should be included as it is now for car hire, machinery hire, etc. although the problem with this in our business is knowing what technological advances are going to do to future glass or polytunnel replacement costs.

2. "Amortized" is a word used to describe the method of calculating the annual repayments of capital plus interest (equivalent to depreciation plus interest) by a pre-worked table available from most banks, A D.A.S., or the Farm Management Pocketbook (Wye College). The percentage referred to is the likely borrowing rate for the period of years over which the item is being written off.

Services. Unless oil, gas, electricity, and water are metered the calculation is very difficult and not necessarily accurate. The methods of allocating are either by labour or output.

Labour refers to the nurseries where labour hours are well recorded and services costs are allocated in proportion to the amount of labour hours each nursery department uses.

For example, if conifer propagation uses 13% of all labour hours on the nursery it is allocated 13% of service costs in Section 6. Output refers to the fact that the output of propagation is measured in relation to total nursery output and this proportion forms the basis of service cost allocation.

For example, if ericaceous propagation produces 10% by value of all the nursery output then it is allocated 10% of the service costs.

Neither of these methods are particularly accurate but some representation of service costs must be shown if the costing is to be complete. With careful use of fuel and insulation this section is not likely to be more than a low percentage of the cost of propagation.

Overheads. These are general business costs. Section 7.1 comes from work in the U.S.A. which has shown that the cost in terms of management time for the planning and overseeing of the propagation unit can be equal to another 15% of the propagation unit labour cost.

7.2 is included because when a batch of cuttings is sitting there it is tying up money in terms of materials, labour, and services, which is usually borrowed on an overdraft. In this case we have allowed a crop to be *in situ* for 4 months, hence the annual costs are divided by 3.

7.4 can be allocated in a similar way to services (above).

Standing Charge. A very telling, if depressing, calculation is to total sections 1.1, 1.2, 5 and 7 to get the overall costs of propagation *before* plants are involved. If this is expressed on a square metre of bed area it can give the "standing charge" that each square metre has to be able to return from cuttings produced after the cost of labour and materials have been deducted in order to make a profit out of propagation.

For example, if the labour, service, and material costs come to £925 for a tunnel, and the standing is £15/m^2 per year; a tunnel with bed space of 32m^2 will have a standing charge of £480 per annum even if empty! This means it will have to produce cuttings worth 925 + 480 = £1405 in a year to pay its way.

Reality. In reality no grower would attempt to carry out this exercise of total costing on every major crop every year. Many of the sections may prove difficult to fill in accurately and the time involved would be enormous. However the industries supplying us with polythene, petrol, pots, peat, tractors, etc. could tell us exactly what their costs are and can consequently "adjust" their prices to keep up with inflation, whereas we think we know what our costs might be. An exercise such as this costing may be worthwhile doing for a major crop or a dubiously profitable one as a once-off trial to see how near the truth your estimates were.

Value versus Cost. As the previous breakdown has shown, before analysing any work to try and reduce the amount of labour input we need to know what parts of the job add value to the business and what parts of the job add costs. If we study the operation of preparing and sticking cuttings we can break down the job as follows:

Value Operations	*Cost Operations*
1 Cuts made on the cutting in the correct position	1 Handling the cuttings between mother plant and preparation
2 Treating with hormone	2 Excessive handling at preparation
3 Sticking the cutting in the growing medium	3 Double handling at sticking
	4 Carry trays to rooting area

What we need to do is to concentrate on the value operations and reduce the cost operations to a minimum. In this situation all the cost operations are the handling of cuttings and trays and we therefore need to concentrate on four areas.

1. *Handling.*

We need to analyse whether we are handling the cuttings in the right way. Can the cuttings be prepared at the stock plant and then stuck straight away or can the cuttings be laid out all facing the same way in the handling container so that there is no need to sort them out at preparation? These are two questions that must be asked and answered objectively — which are often difficult when looking at our piece of work, although easy when looking at other people's work.

2. *Ergonomics.*

Ergonomics is the study of the body at work and how we can best position for easy work by improving the work layout. If the layout and body position are correct then work productivity should increase.

3. *Are we using the correct tools?*

Historically the knife has been the recommended tool for taking cuttings, but various other implements are now on the market which should be considered. If the cutting will snap clean using the fingers then no tools need be used but, assuming this is not possible, then one needs something with a clean sharp edge.

A number of propagators now use secateurs (clippers) or florists scissors, which are cheaper than the more expensive propagators knives, and stay sharp for long periods.

Even cheaper are Plasiplug knives which are now being recommended by the Agricultural Training Board in Britain as a cheap, reliable tool which can speed up the taking of cuttings and reduces the double handling of plant material at this stage.

One enterprising American nurseryman is using finger knives which were originally developed for the post office and, as they are cheap and easy to use, he finds that he can train school trainees very quickly.

4. *Sticking.*

A study of most people when they stick cuttings will show that they normally store the cuttings in one hand and stick with the other. This system has evolved through habit and may not be the most efficient.

If anyone new needs to be trained in sticking cuttings then they should be trained to stick using two hands with the store

of cuttings in front of them. Double-handed sticking is strange at first but like learning to drive a car, it improves with practice and a double-handed sticker can soon outstick someone doing it in the traditional way.

The system works very well for Sonoda Nurseries in California where the propagator has trained all the stickers in this method and it has helped greatly in reducing the labour bill in propagation.

APPENDIX — COSTING IN PROPAGATION

DIRECT COSTS	£	£
1 **Pre-sticking Costs**		
1.1 Maintenance of stock plants		
labour to maintain, sprays, etc	_____	
materials used, fertilisers, sprays, labels, etc	_____	
1 2 Rental value of area occupied by stockplants (take 5%		
p a of land sale value)	_____	
Divide 1 1 + 1 2 by number of stockplants for this crop =	_____	
1 3 Time to travel to, take cuttings and return from stockplants @ _____ per hour	_____	
Sub-total for 1	_____	_____
2 **Preparating and Sticking**		
2 1 Labour for preparing and sticking @ _____ per hour	_____	
2 2 Materials — hormone, fungicide, labels media, "one-trip" containers	_____	
2 3 Labour for preparing or mixing media @ _____ per hour	_____	
Sub-total for 2	_____	_____
3 **Rooting and Growing Cuttings**		
3 1 Labour for pest and disease control, removing dead or		
diseased material, watering, mist and environmental monitoring, shade control, etc @ _____ per hour	_____	
3 2 Materials used, fungicide, insecticide, growth regulators, polythene tent	_____	
Sub-total of 3	_____	_____
4 **Lifting and Grading and Clearing up.**		
4 1 Labour for lifting, labelling and grading cuttings @ _____ per hour.	_____	
4 2 Materials used to clean or wash cuttings, labels, packaging material for movement to customer or next		
area of use	_____	
4 3 Labour for disposal of waste, tidying up and washing		
down for next crop, including sterilizing used trays and containers @ _____ per hour	_____	
4 4 Material used in cleaning up and removal of waste, e g sterilizer	_____	
Sub-total of 4	_____	_____

INDIRECT COSTS

5 **The Propagation House**

5 1 Replacement cost (current value)
(a) Glass amortized over 15 years @ _____% _____
or
(b) Polythene/plastic — amortized over 7 years
@ _____% _____

5 2 Heating system (replacement cost) amortized over
10 years @ _____% _____

5 3 Environmental control equipment, vent gear, mist/fog
machinery, electronics, irrigation, amortize over
7 years @ _____% _____

5 4 Other items (e g concrete, benches, partitions, shade
material) amortize over 10 years @ _____% _____

5 5 Returnable containers (if used) or trays (if returnable)
20% of current replacement cost (5 year life) _____
Sub-total for 5 _____ _____

6 **Services**
Electricity, oil/gas, water cost if metered _____
or allocate in proportion to % labour used in crop or batch (see notes) _____
or allocate in proportion to % output of crop or batch in
relation to total nursery output (see notes) _____
Sub-total for 6 _____ _____

7 **Overheads**

7 1 Labour and systems management — take 15% of hired
labour costs for propagation _____

7.2 Interest on working capital, because of seasonal production Add up previous sections 1.1, 1 3, 2, 3, 4 and 6 and take ⅓ of this total (equivalent to three crops, each four months long) and charge at _____%
of annual interest (prevailing borrowing rate) _____

7 3 Annual rental value of area occupied by propagation dept , take 5% of land sale-value _____

7 4 Proportion of administration, office costs, advertising,
general maintenance of nursery, insurance,
miscellaneous small tools + sundries Allocate as in section 6 either by Labour-hours method, or _____
Output method _____
Sub-total of 7 _____ _____

Summary

X = Total of Direct Costs 1+2+3+4 _____
Y = Total of Indirect costs 5+6+7 _____
Number of rooted/sold cuttings from this crop
= _____(z)
Cost of propagation per cutting
(divide line X+line Y by line Z)

Accompanying Notes

(i) Rental is charged in lines 1.2, 5.5 and 7.3 because the

opportunity to rent out the site, if owned, to another business must be considered as an alternative way of generating money from the unit (opportunity cost principles).

(ii) Labour, whenever charged, should be at the cost of employment, including National Insurance, holiday and training days pay, *not* at gross wage cost. This is then divided by the actual hours worked in a year.

(iii) Whenever amortization is included it represents the cost of depreciation *and* interest on capital over the chosen life span of the item at the prevailing interest rate.

(iv) Sections 5+6+7 can be used to express the "standing charge" of the propagation unit *whether a crop is produced from it or not.*

In fact, it is the charge that represents the existence of the unit and all the cash that it requires to remain functional. If the service charge is subtracted, then the resulting figure shows what it costs to have an empty propagation unit!

(vi) Line Z uses the number of cuttings successfully rooted or the number sold (which may not be the same thing).

(vii) Allocation of indirect costs in sections 6 and 7.4 can be either in relation to the proportion of hours worked on that crop when compared to the financial output of the whole nursery (see paper for examples).

(viii) In 7.2 interest is charged at borrowing rate per annum whilst the costs incurred that totalled up for 7.2 are divided by 3 to represent a four month crop. A six month crop would necessitate dividing the costs incurred by 2.

Acknowledgements. Ann Fisher, Sacramento, California, and Oregon State University, Agricultural Extension Service.

N. CLAYTON: What basic rate of wages did you use in your calculations?

I. BALDWIN: The figures were based on a skilled craftsman rate (£6.00/hr) plus his overtime, and we looked at all the costs involved including management time.

K. LAWRENCE: Are the finger knives available in this country?

J. STANLEY: It can be arranged! At present the American post office one is not, but I believe the German one is. The American one is more robust[1].

W. MATHEWS: The metal one is available in Holland, but I imagine continuous use would make the finger very swollen.

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[1]Ed Note Available in the U S from A M Leonard & Sons, Piqua, Ohio; sold as "ring knives"

I. BALDWIN: The people we saw had no trouble after three weeks continuous use.

M. SCOTT. Are the blades replaceable?

I. BALDWIN: No, when blunt they are thrown away and a new one used.

M. HELLIAR How much do they cost?

I BALDWIN: Just under a dollar.

D. CLARK: Do you have any further breakdown of cutting costs prior to sticking, such as average percentage of cost of collection?

J STANLEY: I have not got the figures to hand but remember that if you did not have your own stock beds the cost was doubled.

B MORGAN· Do you have any information on number of people collecting cuttings in relation to those preparing?

J. STANLEY: Around one to two in the American situation where a lot of labour is used. Labour costs in the States may appear relatively low, but preliminary studies in the UK suggest that the percentage labour cost is similar, i.e. 63% of total costs. While the Americans employ a lot of cheap labour, the reduced labour in British nurseries is used more effectively.

W. MATHEWS. How can you arrive at your costs with the different speed of workers?

J. STANLEY We had to base the costs on an average nursery situation rather than comparing output to different workers.

D. CLARK. We have looked at aptitude tests for people going into propagation and find marked differences among people, particularly in agility of finger work. If this can be sorted out early enough, it will make a tremendous difference to the efficiency of the section.

A. BRIANT. Some of your percentage figures surprise me The cost of actual striking of cuttings seems low compared with collection costs.

I. BALDWIN: Included in these costs were those involved with the maintenance of the stock ground, its rent, travel to and from the area in time and petrol, and costs of collection and trimming labour.

L. RUDIN: Have you any comparison between hardwood and softwood cuttings and have you considered the direct striking into pots for some of the more easily-rooted container species?

J. STANLEY. The work study in America was done with *Photinia*, a very easily handled cutting. There would be big

differences in costs for harder or more difficult to handle material. The direct striking method is the next stage to consider once the basic figures have been obtained. It will increase indirect costs as more land and protection is needed, but reduce overall production costs

L. RUDIN: Direct striking is increasing in Sweden for species like *Pyracantha* and *Cotoneaster* where three cuttings are inserted in a 1.5 litre pot.

PROPAGATION USING THE FOGGING TECHNIQUE

MARTIN J. HALL

H. Evans & Sons (Europa) Ltd.
Hadlow, Kent

We have mist so why use fog? A question often levelled at our Company over the past two seasons since we installed the MEE Fog System at our Sidcup Nursery in an existing wooden glasshouse block of 9,000 square feet.

At a time of uncertainty and financial constraint any capital investment has to be certain of obtaining a quick return on investment In our case the results obtained by using the fog have surpassed our original expectation.

The use of fog in propagation isn't new and work with Fog Pots in Holland and Switzerland is well documented. Recent engineering technology, much of it derived from N.A.S.A. Space Research, has enabled this system to become a commercial reality

It should be stressed that this equipment is of a far higher precision than anything so far seen and, as such, needs careful attention in its location, installation, and running.

In the United Kingdom the system is being used for green plants and nursery stock propagation, A.Y.R. chrysanthemum cutting propagation and the production of cress. The system is, at the moment, being considered for mushroom production on a large scale.

What is fog? The MEE Fog System is a device for humidifying and cooling the plant environment. It is also a method for controlled application of foliar feeds, insecticides, fungicides, or any liquid or water soluble substance. Fog can be used to control transpiration and evaporation losses during plant propagation and multiplication. It is far superior to the use of misting because overwetting of the growing medium is no longer a problem. Fog can be used during cold weather for freeze protection of outdoor plants and as a means to supple-