

operations. The speakers felt the ultimate answer would be to go back to single cell or liquid culture but this was some time in the future. In the short term some effort was needed to study the technique from a horticultural angle and adapt from the research methods; at present the most promising stage for mechanisation was during weaning from culture to the growing medium, using a system such as the NIAE bandolier.

*Rhododendron yakusimanum* was difficult to micropropagate. The problem was the hairs which made it difficult to clean without damaging the tissue and, if this happened, then the culture died. Young material had few hairs but if it was taken right back to the meristem then it was difficult to get it to respond. If buds are used from hybrids there is a good response, but bud tissue from *R. yakusimanum* itself will die. This seems to be a possible technique for distinguishing the species from the hybrids.

## **RESULTS OF THE IPPS QUESTIONNAIRE ON THE PROPAGATION OF SOFT AND SEMI-RIPE CUTTINGS**

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At the 1981 G.B. & I. Annual Conference, the topic of "Work Rates" was discussed at considerable length. It was suggested that an attempt be made to determine average commercial rates for a range of key nursery tasks.

Subsequently, in May, 1982 our Vice-President, Michael Dunnett, devised and sent out a questionnaire to selected members of the Society on the subject of "Propagation of Soft and Semi-ripe Cuttings". The instructions were, "to select any one week between 1st June and 30th October 1982, and record the number of cuttings which you take and insert during this period".

A recording sheet was provided for the relevant information, together with the questionnaire to be completed. Eighteen nurseries responded.

### **QUESTIONNAIRE**

The questionnaire asked the following:

1. a) Total number of cuttings taken
- b) Number of workers used

- c) Number of man-hours used
  - d) Dates the work was undertaken
  - e) List of the subjects propagated
2. Quality of facilities available — good; average; poor.
  3. Skill of staff carrying out the work — unskilled; skilled, combination of skilled and unskilled.
  4. Number of times the cutting material is handled after arriving on the propagation bench.
  5. Were the cuttings inserted in containers, or directly into the propagating bench?

## RESULTS

From the 18 nurseries which responded to the questionnaire, the number of operatives involved varied from one skilled propagator to a team of 10, including both skilled and unskilled workers. The quantities of cuttings varied from 6,000 to 96,000 — taken from late May to the end of October. The majority of cuttings were of the soft, fairly easily prepared subjects, although a number of nurseries included more difficult subjects, e.g. *Berberis*. Most propagators regarded their facilities as average or good. The cuttings were generally handled two or three times on the propagating bench, although three nurseries managed with only handling once. With the exception of one nursery, all respondents inserted into containers of some description. Two nurseries included the collection of cuttings in their rates. (See Table 1).

**Table 1.** Propagation work rate questionnaire. Summary of data collected.

Nursery	Facilities *	Recording period, 1982	LABOUR			CUTTINGS		
			Workers	Skill **	Man-hours	Number taken	Times handled	Stuck ***
A	A	22/10-26/10	8	C	320	40,000	1	C
B	A	13/9	9	C	351	82,000	2	D
C	B	9/8-13/8	3	C	120	29,000	1	C
D	A	18/10/22/10	4	C	120	19,530	2	C
E	A	1/11/-11/11	2	S	28	7,080	4	C
F	A	21/6-25/6	9	C	169	28,300	3	C
G	B	/8-13/8	8	C	238	40,187	2	C
H	A	13/9-17/9	6	C	174	14,637	2	C
J	A	5/7-8/7	2	C	48	12,960	2	C
K	C	28/6-2/7	2	S	80	6,720	3	C
L	A	19/7-23/7	2	C	65	13,702	2	C
M	A	24/5-29/5	2	C	80	13,535	1	C
N	B	27/9-1/10	4	S	133	13,300	3	C
P	B	5/7-9/7	5	C	160	30,000	2	C
Q	A	16/8-20/8	1.5	S	36	7,600	2	C
R	B	14/6-18/6	10	C	60	50,000	2	C
S	A	7/6-13/6	1	S	23	10,500	2	C
T	C	14/6-18/6	8	S	208	96,000	2	C

\* A = Good  
B = Average  
C = Poor

\*\* S = Skilled  
C = Skilled and  
unskilled

\*\*\* Cuttings stuck in  
C = Containers  
D = Directly into bench

On analysing the results to give the rate of work, it is seen that the number of cuttings per man-hour varies from 84 to 830. A difference of ten-fold! We have tried to identify reasons for this great variation, bearing in mind the number of workers, their skill and facilities available, together with the range of plants propagated. No clear pattern emerges. As we analysed the answers it became evident that more and more questions needed to be answered before any relevant conclusions could be reached. (See Table 2).

**Table 2.** Propagation work-rate questionnaire. Work rate comparison.

Nursery	Number of cuttings	Number of man-hours	Cuttings/ man-hour	Number of Operatives	Comments
A	40,000	320	125	8	<i>Berberis</i>
B	82,000	351	234	9	
C	29,750	120	248	3	
D	19,530	120	163	4	
E	7,080	28	253	2	<i>Leylandii</i> Collected material
F	28,300	169	167	9	<i>Berberis</i>
G	40,187	238	169	8	<i>Berberis</i>
H	14,637	174	84	6	<i>Berberis</i>
J	12,960	48	270	2	
K	6,720	80	84	2	
L	13,702	65	211	2	
M	13,535	80	169	2	
N	13,300	133	100	4	Collected material
P	30,000	160	188	5	
Q	7,600	36	211	1.5	
R	50,000	60	833	10	
S	10,500	23	457	1	
T	96,000	208	461	8	

Interesting though the returns are, each and every one needs qualification. One respondent was kind enough to offer a detailed list of subjects propagated, together with quantities and times taken for each subject. This shows a variation from 202 per hour to an amazing 1,925.

I would, therefore, suggest that we now have many more questions than answers and I would now like to put forward a few ideas. Let me first go back to the original motivation for the questionnaire:

1. Establish training standards.
2. To influence training bodies to improve proficiency testing standards.
3. Provide information from which future I.P.P.S. workshops/discussion periods can be developed.

4. Establish reference rates, in order to compare new techniques.

5. Provide a reference standard for member's nurseries.

**Table 3.** Propagation work rate questionnaire. Work rate comparison on species.

Plant	Cuttings/Hour
<i>Ceratostigma plumbaginoides</i>	1,157
<i>Ceratostigma willmottianum</i>	276
<i>Chaenomeles speciosa</i> 'Umblicata'	274
<i>Cornus alba</i> 'Elegantissima'	392
<i>Coronilla emerus</i>	300
<i>Cotinus coggygia</i> 'Royal Purple'	385
<i>Cytisus purpureus</i>	315
<i>Daphne cneorum</i>	857
<i>Deutzia</i> × <i>kalmii</i> flora	400
<i>Euonymus europaea</i> 'Red Cascade'	367
<i>Euphorbia griffithii</i>	360
<i>Fuchsia magellanica</i> var. <i>macrostema</i>	510
<i>Humulus lupulus</i> 'Aureus'	202
<i>Hypericum calycinum</i>	1,035
<i>Jasminum humile</i> f. <i>wallick hianum</i>	440
<i>Lippia citriodora</i> = <i>Aloysia triphylla</i>	600
<i>Parrotia persica</i>	240
<i>Philadelphus</i> × <i>lemoinei</i> 'Manteau d'Hermine'	516
<i>Philadelphus microphyllus</i>	920
<i>Potentilla fruticosa</i> 'Vilmoriana'	510
<i>Ruta graveolens</i> 'Jackman's Blue'	440
<i>Sambucus nigra</i> 'Aurea'	250
<i>Viburnum</i> × <i>bodnantense</i> 'Dawn'	1,440
<i>Viburnum</i> × <i>carlcephalum</i>	278
<i>Viburnum carlesii</i>	280
<i>Viburnum farreri</i>	429
<i>Viburnum farreri</i> 'Nanum'	450
<i>Viburnum plicatum</i> 'Lanarth'	1,266
<i>Viburnum plicatum</i> forma <i>tomentosum</i>	1,200
<i>Viburnum plicatum</i> forma <i>tomentosum</i> 'Mariesii'	1,283
<i>Viburnum opulus</i> 'Sterile' = <i>V. opulus</i> 'Roseum'	1,925
<i>Viburnum opulus</i> 'Notcutts Variety'	1,500

Note: Rates vary by up to 950%.

## CONCLUSIONS

It is clear each nursery has its own unique facilities and staff. However, there are many areas where techniques could be standardised and useful comparison made.

- a) Composts — variable constituents — degree of compaction; sandwich layers, e.g., *Clematis*
- b) Containers — depth of tray — dimensions — weight
- c) How cuttings are collected — trimmed individually, or whole branches
- d) Maturity of cuttings, and their turgidity for leaf removal

- e) Necessity of leaf removal — last year's project prize winner
- f) Use and type of rooting hormones and auxins — powder or liquid formulation
- g) Wounding, or shoot tip removal
- h) Presence of spines, e.g., *Berberis*
- i) Most useful tools — knives, secateurs, scissors
- j) Quality selection of material

These are areas which require definition and — most important of all — DO THEY ROOT!

I believe there is a great necessity for basic knowledge on the fundamentals listed above to be set down in some agreed format. My suggestion would be to follow the precedent already set by the British Container Growers Group, in trying to tackle the specification of standards for container-grown plants.

It would be a long but very worthwhile job. Take a typical subject from each species, and try to clearly specify the requirements under the following headings:

- |   |  |
|---|--|
| 1. Time of year   | 5. Specify rooting hormone/<br>fungicide |
| 2. Length and type of cutting<br>— number of leaves               | 6. Type of container                     |
| 3. Treatment of cutting —<br>tipping — leaf removal —<br>wounding | 7. Spacing of cutting                    |
| 4. Specify compost, and its<br>physical state                     | 8. Labelling                             |
|   | 9. Use of cool rooms                     |
|   | 10. Layout of work areas                 |

My proposal would be to take, say, ten subjects, representative of a number of genera in common production and specify, if possible by general agreement, the criteria for the preparation and insertion of these subjects.

During the discussion which followed, a request was made for the committee to undertake another survey to obtain definitive rates which could be disseminated to the ATB, ADAS, and the industry. More members should be invited to participate. There was a need to specify subjects and limit species to get some basic information first. Outside bodies with expertise in devising surveys should be approached, as well as contact to be made with ADAS or other bodies with specialist work-study knowledge.