leggy cuttings some 12 to 15 in. tall. These were pruned back by about half their height and then planted in peaty soil under lath shades.

This method was by far the most rewarding, giving the following results:

> Young plants surviving in 1969, expressed as a percentage of cuttings taken in 1968 — Exbury, 70%; Mollis, 64%; Ghent, 50%.

Propagation facilities vary from nursery to nursery, so I do not think it wise to recommend a blue print for azalea production; instead I have summarized the important points, as I see them, in order of priority:

(1) The lights should be in position by the beginning of September and the time switch adjusted so that the plants have an 18-hour day. Azaleas also grow well under Grolux fluorescent strips — these being rated at 40 watts — they are cheaper to run but more expensive to install.

(2) The glasshouse or frame should be frost-proof; in fact the higher the temperature the better. With a temperature of 55° to 60° F and an 18-hour day the plants would continue to put on new growth throughout the winter.

(3) Cuttings should be soft and still hairy — approximately 2 to 3 in. long. I believe it is still worthwhile to have stock plants in pots because they are easier to manage and one can regulate growth to get the right type of cuttings, although I have now found that it is not strictly necessary to force stock plants for early cuttings. The right type of cutting taken in July roots and grows without any difficulty.

(4) The initial theory of minimum root disturbance should also be borne in mind as azalea roots are by nature delicate fibrous things — very easily broken. Any root damage particularly in the move from the propagation bench, is bound to result in a check to the plant and obviously should be avoided.

This makes me think that the ideal site for azalea propagation would be a frost-proof frame that could be wired for misting units, bottom heat, and lighting at the appropriate times. Cuttings would then occupy the frame from June of one year to April or May of the next year.

PLANT PROPAGATORS' QUESTION BOX

BRIAN HUMPHREY, *Moderator*

The subjects discussed include, in order, the following:

1. Control of Red Bud Borer
(*Thomasiniana oculiperda* Rubs.)

2. Propagation of Leyland cypress
(x*Cupressocyparis leylandii*)
3. Excessive callus formation in Leyland cypress
4. Hormone application to cuttings
5. Effect of loss of light in cold storage of conifers
6. Possibility of rooting rhododendrons by *in vitro* culture
7. Timing of soft wood lilac cuttings.

QUESTIONER: Does Mr. Garner always grease the buds with petroleum jelly after budding his fruit stocks and does he recommend this procedure for other subjects?

R. GARNER: The object is to prevent damage by Red Bud Borer (*Thomasiniana oculiperda* Rubs.). This little fly is looking for a wound, such as the slit in the bark made during budding, to lay its eggs and the larvae hatch and feed in the cambium layers. This is a frequent cause of bud failure in apples and is common enough in Kent to warrant routine use of petroleum jelly. It does not occur in all districts. It is particularly bad on apple stocks and can occur on some other fruit stocks and on ornamentals, though we have not seen it on stone fruits. You must be very careful not to damage the bark when cutting off the raffia, because the Borer is still about at that stage.

D. HARRIS: It can cause damage to Acers and Aesculus.

S. HAINES: I notice that Mr. Garner does not remove the wood from the buds. Is this his normal practice?

R. GARNER: Yes, at East Malling, it is. All our trial work at the Station suggests that this is perfectly satisfactory.

P. McMILLAN BROWSE: In my view it is only necessary to remove the wood when stocks are very small, as sometimes with Norway maple, when the bud is more pliable with the wood out.

D. HARRIS: I should like to ask Brian Halliwell which are the best times of the year for rooting Leyland cypress cuttings? Usually September and May have been regarded as the best periods, but we have rooted throughout the winter and have found that we get much better rooting after the stock plants have been subjected to sharp frost. Thus, in late October, our rooting was better than in September; the weather became milder in November and, again, the rooting fell off and improved later. We were rooting under mist.

B. HALLIWELL: Yes, in spite of the convincing evidence supporting September rooting, I agree with Douglas Harris that rooting does seem to be improved after the stock plants have been subjected to frost. I prefer to root without mist in the winter as there is less tendency for the plants to rot off.

P. McMILLAN BROWSE: At Hadlow we have rooted Leyland at various seasons with 99% success. As far as our experience is concerned it is not so much a question of season as of selecting the right kind of material. We use leaders that are taken from lateral shoots and

take them with about two scales of brown wood at the bottom. These are inserted directly in a peat and grit mixture and we find an advantage in using a rather higher temperature with Leylands than with most cuttings—about 75° F. We find no benefit from wounding or from the use of any hormone, except Seradix 3. We use mist but during the winter this is manually operated.

K. LAWRENCE: I get large calluses but no roots on Leyland Cypress. Why is this?

B. HALLIWELL: I should like to comment on the question of heavy callusing. I was getting this problem and found that if I reduced the Seradix 3—for example, if I mixed it with Captan—I got reduced callusing and better results with much less tendency to rot off during the winter.

B. HUMPHREY: This is not restricted to Leyland, of course; at Hilliers' as a general rule we consider that, when this happens, the concentration of hormone has not been high enough. Aeration of the compost will affect the amount of callus formation, excessive aeration causing excessive callus.

P. McMILLAN BROWSE: I think when we saw Dave Staton's cuttings this afternoon it gave us a good indication of why we get a lot of callusing on Leyland Cypress. If you looked closely at the series of cuttings he put out you could notice that he had some which were well rooted and some which had a lot of callus but not much root. One factor which could be correlated between the two was the amount of hard wood at the base of the cutting. Where there was a fairly soft cutting, only just into the brown scales, there was good rooting with little callus; where the cutting had a base of harder wood there were large lumps of callus at the bottom. At Hadlow, now that we are using the softer type of cutting, we have no problems of callusing at all.

C. D. DEMPSTER: I like to take cuttings in July in mist or leave them until November or December when they are inserted under double glass in a glasshouse. I find I get too much callus production in September and the percentage of rooting falls off. For use under mist I do not have the normal sand and peat mixture but use a compost I discovered in Canada where it is used for rooting rhododendrons in British Columbia. This comprises 40% perlite, 40% pebble polystyrene, 15% mica and 5% peat. The peat could probably be left out altogether provided your mist never lets you down.

A QUESTIONER: Has anyone any experience of propagating Leyland cypress in cold frames outside?

B. HALLIWELL: Yes, I find this satisfactory and have propagated Leyland extensively in this fashion. Of course, if bottom heat is provided in the outside frames, conditions for propagation will be just about as good as possible.

A. THOMSEN: Why does Dr. Howard now recommend dipping only the base of the cutting into a hormone solution rather than wetting the sides by deeper insertion? Does this apply to a powder also?

DR. B. HOWARD: The deeper you dip a cutting the more solution is taken up; you can do this by leaving the cutting longer in the solution but the deeper you dip the more gets forced up inside. We have found that with the deep dipping so many root initials may form and so much of the internal substances of the cutting used up that none of the roots may develop. We did observe from sections of these cuttings that root initials began to grow, suddenly stopped, then began to lay down very thick-walled cells at their terminal end; this is reminiscent of the effect that is caused by treatment with high concentrations. We know that root initiation requires many thousand times the concentration of hormone required by root growth. Thus it is easy to appreciate that after deep dipping young roots may well meet a barrier of very high concentration; all this implies that there is fairly free movement of hormone into the cutting.

With a powder, of course, there is not the same movement, though there will be some diffusion into the cutting during the first few days or weeks. That is why one is recommended to use a higher concentration of hormone with a powder formulation than with a solution; the uptake of a hormone and its transport within the plant is much slower when the hormone is in powder form.

MRS. ABDEL-WAHEB: Can anyone give any information on the effect which lack of light might have on conifers held in cold storage for any length of time?

A. THOMSEN: I have no personal experience with this but I know that growers spray them with magnesium sulphate once or twice a week during winter.

J. GAGGINI: I know one grower who sprays Mahonias with a foliar feed and, I understand, that the Danish advice is that this should be done.

B. HUMPHREY: It is possible that there could be a confusion between yellowness caused by nutrient deficiency and yellowness caused by a breakdown of chlorophyll. However the Danes have had more experience with this than we have. I remember some reference from an American source of a grower who used illumination over his conifers in cold store but I cannot remember the details.

A. CARTER: I do not think lighting is necessary because we are aiming to keep the plants as dormant as possible. Furthermore if we want to get the maximum capacity from the stores we do not really want to keep them upright in such a way that they could be adequately illuminated.

H. JACKSON: In the one year's experience we have had we have seen no deterioration and, in fact, there has been no difference whether the lights were on or off. Towards the end of the season we tried the

effect of leaving the lights on all the time. My own feeling was that in spite of keeping the plants around freezing point you could start these plants moving, particularly around June.

MISS DICK: Can I ask Dr. Marston if, in view of the fact the tissue differentiation occurs from callus, would it be possible to use the callus which forms on a cutting in *in vitro* culture?

DR. MARSTON: This has been suggested from time to time. It might work but you would have to take a lot of care to get it sterile.

B. HUMPHREY: I would like to make a comment here. Many years ago we experimented rooting rhododendrons, amongst others, *R. g.* Loderi. These did not root but when we sectioned them it was obvious, from examination under the microscope, that root primordia were present in the stem. This indicated that it must be possible to root this species and, indeed, the next season we did succeed in rooting it. The original cuttings formed copious callus and, in the sectioning, one was able to see tissues (prosphaeroblasts) differentiating into vascular systems within the callus. This seems to suggest the possibility of making new plants. If callus readily differentiates into vascular tissue in rhododendrons is it an indication that it is a good subject for *in vitro* culture?

DR. J. LAMB: With *Picea pungens* the first step towards success is the formation of vascular tissue but that is as far as I can go.

B. HUMPHREY: On these grounds then, I can mount my hobby horse, which is that rhododendrons could make a very good subject for *in vitro* culture.

S. SHERRARD: We saw at Coles Nurseries yesterday lilacs that had been rooted from cuttings taken whilst the plant was flowering. We have always understood that the cuttings should be taken 3 weeks before this.

P. McMILLAN BROWSE: We carried out an experiment with lilacs taking cuttings as soon as they were long enough in the spring and continued every 5 days. We found that regeneration was best with the first two or three batches of cuttings when the material was very soft; but these soft cuttings did not stand up to the misting conditions very well and subsequently rotted off with only the odd plant surviving. We found the same experiences as Coles have, namely, by taking cuttings as soon as the leaves mature, about flowering time, the survival was much better.

B. HUMPHREY: We get on fairly well with the very soft cuttings but I did notice that the cultivar 'Madame Lemoine' was good at Coles, whereas we have difficulty with this one. Perhaps this is one we should try with firmer cuttings, for this variety might not put up with our mist conditions.

P. McMILLAN BROWSE: Yes, this is, I feel, a varietal characteristic. Some varieties will survive but as a general rule I think that the firmer wood is safer.

B. HUMPHREY: I would expect to see a lilac at the end of the first year of rooting 8 inches high. They respond to high nitrogen which makes them more susceptible to blight (*Pseudomonas syringae*).

This is the last session and I have been left to wind up the proceedings, and it is indeed a great privilege to be allowed to do so. I have most sincerely enjoyed the meeting and hope you have all done so as well. It has all been thoroughly worth while and I look forward to seeing you when the Society visits our Nurseries in July or, failing this, let us make a date for the next Annual Conference at Merrist Wood in September, 1971.

THE CONFERENCE VISITS

(1) James Coles and Sons, Thurnby, Leics, England

23rd July, 1970

D. C. HARRIS

Conference Secretary

On both sides of the A47 road, 3 miles west of Leicester, the urban landscape suddenly relaxes into 65 acres of well-cultivated trees, shrubs and roses. This is the nursery of James Coles and Sons, renowned growers of top quality nursery stock and, on this particular afternoon, host to members of the I.P.P.S. A smiling William R. Coles with his son Geoffrey invited the visiting party to see as much as possible of the nursery and to ask questions freely during the brief 2-hour tour. With this hospitable welcome in mind, the visitors divided into small groups and, ably guided by members of the nursery staff, embarked on a detailed and rewarding study of the production areas.

Ornamental trees are an important crop within the nursery industry and budded trees of the more popular and valued cultivars are recognized as a speciality of the Coles nursery. Nursery Manager, Steve Haines, explained that the budding season for trees normally extends from late May until mid-August. *Acer platanoides* are budded first, followed in chronological order by *Acer pseudo-platanus*, *Crataegus*, *Prunus*, *Tilia* and finally *Malus*. In spite of the extra time required to produce a saleable tree especially with certain *Prunus* cultivars, such as *p.* 'Kiku Shidare' ('Shidare Zakura'), most understocks are budded just above soil level and are not top worked. Experience has shown that a better shaped head can be grown when the main stem is of the cultivar material. Understocks are headed back during the February after budding. Thereafter trees are staked, tied and grown on for 3 or 4 years before sale. Those few cultivars, for which propagation by budding is not always reliable, are normally whip grafted from the middle to the end of September. The graft union is tied with plastic tape and protected from wind by a clear