as intensive and a feature of one of the Belgian pot plant nurseries was the high speed battery operated trucks used to move plant material and people around the glasshouses. Control of all the environmental factors was highly automated and several systems of plant conveyors suspended from overhead heating pipes were used to take plants from the benches to the packing table at the central path. The heating pipes also served to support a fully automatic, travelling supplementary light unit for use on young stock.

At another Belgian azalea nursery the high cost of a new glasshouse was being recovered by maximising the production of plants by using mobile benches supported on heating pipes at waist height. The crop was irrigated by a spray boom suspended from heating pipes at eaves level, and travelling half the length of the house. When ready for marketing each bench unit was rolled off the production line onto a compatible trolley ready for packing and thence despatch.

In conclusion, may I record the appreciation of the group for the work put in by the tour organisers, Raymond Evison and Tom Wood, and all the members of the Dutch and Belgian advisory and research units, and the nurserymen who made this tour possible. Without their unstinting efforts this very memorable and instructive tour would not have taken place.

QUESTION BOX

CHAIRMAN — JOHN GAGGINI

1. What action is the Ministry taking to communicate the results of their cutting handling system to the industry?

B. MORGAN: ADAS has been closely involved with ATB on this handling system. We have had a Masters course at which 10 propagators from different nurseries attended and since then they have spread the word. The ATB have already held over 20 courses around the country attended by 130 people, and another 30 courses are planned for the future. The technique has been promoted at major conferences like BGLA and Four Oaks. A video film has also been made for refresher courses showing the hand movements involved in the technique. In addition, a booklet which is a training guide has been produced in conjunction with the ATB. This training guide will have an outline of the times taken to insert a 1000 cuttings of different plant types, i.e. heathers, rhododendron, conifers, and *Berberis*. Not just one time but a range of times embracing estimates of good, typical, and poor. What ADAS has, in fact, done here is identified a problem, done something

about it, and then passed it onto the people best able to do something with it, namely the ATB.
2. *Elaeagnus pungens* 'Maculata' is generally considered a difficult plant to root. Could members give their own experiences with this species.

J. BEESLEY: We have gone back to inserting the cuttings around the edge of a clay pot in a 5 parts grit:2 parts peat mixture. Cuttings are wounded and dipped in 8% hormone powder with Captan incorporated. The clay pots are then plunged in peat in a heated bench, and we get almost 100% rooting.

M. FARMER: I do all my propagation in clay pots including a range of golden and silver forms of *Pittosporum* which have brittle roots and would break very easily in trays.

C. CHOISEAU: When are these cuttings taken?

J. BEESLEY: Anytime during the winter.

M. SCOTT: I don't know if it is the particular clone we have at Efford but we have not found *E. pungens* 'Maculata' difficult. We take ripe cuttings in late October/November, use a 2500 ppm IBA solution as a quick dip and root in a 75% peat:25% grit mix in plastic seed trays. We get an average of 80 to 85% rooting.

D. GILCHRIST: Last year we reverted back to the old-fashioned cold frame and from an October strike, only achieved 10% rooting.

M. SCOTT: Yes, base heat is essential, we use a probe control maintaining 15°C in the compost, which means between 18° to 21°C in the sand, beneath the tray.

J. BEESLEY: We maintain 20°C, and also use a probe in the compost.

3. Is any work being done on the pH of the rooting medium? We are now buying peat from different sources and the pH ranges from 3.8 upwards.

M. SCOTT: Basically Irish peat is around 4.3 which seems OK for a wide range of species. The Dutch add lime to their rooting media but they are working with peat which has a pH in the 3.5 range. We have only done a small trial with *Thuja*, and found that the addition of ground limestone to Irish peat to bring the pH up to 5.0 improved rooting by around 10%. So increasing the pH could be a benefit to some species, but a lot more work needs doing before any recommendations could be made.

M. HELLIAR: With hardwood cuttings of apples, the addition of lime has been found to improve rooting. Along similar

lines a response was also achieved by changing the pH of the hormone mixture which in this case was a dip.

J. GAGGINI: Perhaps we should pay more attention to the pH of our rooting media. Is this a line of work the Experimental Centres could take on for a wider range of species?

M. SCOTT: Yes, especially if the Conference felt this was work which should have greater priority than at present. It is difficult to do a very wide range of species experimentally. We need guidance on those species which are difficult or have problems.

H. SHEPHERD: Trials at East Malling on a limited range of species showed that pH had relatively little effect on rooting compared with all the other variables.

T. PRICE: Coming back to *Elaeagnus*, we had two batches, one green and healthy, the other yellow and starved in appearance. Analysis showed that the green batch had a low pH, the yellow batch a high pH of 6.7.

J. GAGGINI: I have always considered *Elaeagnus* an an ericaceous species, as far as pH was concerned.

M. SCOTT: *Elaeagnus* is one of our indicator plants for phosphate, being very sensitive to too much, and this effect becomes progressively worse as pH increases. This would explain the yellowing effect as a lime-induced chlorosis.

B. MORGAN: A pH of 6.7 is far too high for *Elaeagnus*, it needs to be around 5.0 for good growth.

T. WOOD: We have very hard water, and under prolonged mist this chlorosis does occur. We have even gone as far as using sequestrene to counteract it on cuttings which take a long time to root.

D. GILCHRIST: Our *Elaeagnus* stock plants are in ground with a pH between 7 and 8, and, while having no chlorosis symptoms, cuttings do not root easily.

M. CLIFT: *Elaeagnus* has root nodules, as does *Genista hispanica*, which roots more readily in acid compost. Would this be the case for *Elaeagnus*?

B. MORGAN: There is no experimental evidence yet as to its specific requirements.

4. How can *Kalmia latifolia* cuttings be rooted?

J. ELLIS: We have germinated seed but the resulting seedlings were very tiny.

P. MACMILLAN-BROWSE: Some of the newer cultivars are easier to root from cuttings, and Richard Jaynes has written on the subject in previous IPPS Proceedings and in the *American Nurseryman*. He has also written "The Laurel Book".

P. HUTCHINSON: This book can be obtained from the RHS Bookshop at Wisley.

T. WOOD: We had excellent germination of *Kalmia* seed this year, the seed collected from bushes in my own garden. This was sown in early spring with a little bottom heat and the resulting germination was fine. We "patched off" some of this as you would *Begonia* seedlings, expecting them to stop growing, which they did. However, in a warm spell in September they developed quite large true leaves in the greenhouse. This relates to the natural conditions in Virginia, USA, where summers are hotter than here. Thus, if we artificially induce these hot summer conditions under glass or polythene we should improve their growth rate.

5. Has anyone any observations on polarity of sowing horse-chestnut seeds? For instance, if sown with the scar downward a straight vigorous seedling results but if the scar is uppermost, the stem has a bad kink and, if on its side, the stem is bent. (P. MacMillan-Browse)

J. GAGGINI: This is a similar situation to *Quercus ilex*, where good results were obtained by sowing with the point down. However, this was done because it was easier to sow in Jiffy 7's this way.

D. FORDHAM: On chestnuts we sow scar down, otherwise we could lose up to 30% with out-of-grade stems.

P. MACMILLAN-BROWSE: I would like to ask members who sow these large seeds if they could try different orientations in sowing and monitor the results, even on a very small scale. It is a subject we need more information on since it becomes very expensive to have waste seedlings in these low density crops.

T. WOOD: We have gone even further than this and graded our seed, particularly oak. Our prime seed is used for pot-grown oaks, and here we check where the radical will emerge before sowing, as we cannot afford a poor stem in a container. The larger seed also produces the more vigorous growth. This can also be done with certain maples. When the radical can be seen, the wing can just be poked into the compost in the correct orientation.

VOICE: With acorns has anyone tried pre-chitting and breaking off the tip of the root to stop a fang-root growth, getting instead a mass of roots more suited to containers?

P. MACMILLAN-BROWSE: That used to be the traditional method in Holland for producing horse-chestnuts in the field for budding.

T. WOOD: With oaks we sow them into a type of pot

which is moved shortly after germination to break the tap root.

L. DICK: This subject has the potential for an OND project, but we would need a supply of seed.

J. GAGGINI: Botanic Gardens should be able to help.

D. FORDHAM: With most of the seeds sown on the bed surface their own weight tends to orientate them naturally for the emergence of the root straight down. The horsechestnut, however, is the one which has the problems.

P. MACMILLAN-BROWSE: Dennis is correct about the germination, but I still believe that you can get a difference in the quality of growth according to the orientation of sowing the seed. It is something we need experimentation on with published results.