CONCLUSIONS

"Levington Trays" have been used for two years for growing a wide range of shrub and conifer species. The use of the "trays" is meeting all the objectives aimed for, i.e.

— easy, low cost handling, which means that short periods under cover after potting to get the roots moving and before standing outside become feasible;

— even watering to each pot becomes a reality, removing losses due to localised drought;

— complete isolation and protection from the soil and soil-borne diseases; and

— good management is possible with less skilled staff.

These all combine to assist in the production of a good, healthy, vigorous standard product by standardised methods at an economic cost.

POT-GROWN LINER PRODUCTION IN DENMARK

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If I look back to 16 years ago most conifer production in Denmark consisted of striking cuttings in frames where they remained for two years, followed by two years set out in well prepared beds before being planted out in the field. Today, approximately 80% of the conifer liners are produced by four nurseries, on a similar but not identical method to the one we use, which I will describe.

In 1967 we built two aluminum greenhouses 20 × 61 m to rationalise production of liners. Half of one house was equipped with mist propagation, the remainder of the glasshouse area was used for winter potting of rooted cuttings. This was to produce better liners and make good use of labour in the winter. Today we have four greenhouses of this size, using one for propagation and the others for potted liners.

Our present production of liners is outlined. From July to October *Juniperus*, *Chamaecyparis*, some *Thuja* and *Berberis*, *Euonymus fortunei*, *Skimmia*, and *Ilex* cuttings are struck in flats, using a medium of peat and styrofoam balls. From the end of January until mid-March they are potted in rigid plastic pots, using a potting machine. From the end of May to mid-June the liners are moved from the greenhouse to outdoor frames.

Taxus are struck from mid-September and have to be finished by Christmas, beginning with *Taxus baccata* cultivars and finishing with *Taxus* × *media* 'Farmen'. Cuttings of most *Thuja occidentalis* cultivars are taken from mid-February until April, when we again have empty space in the propagation unit. These plants will be well-rooted by May and are potted in the empty greenhouses in July and moved outside in November or December, covered with white plastic to shade and protect them from frost and wind. In our area the temperature will be down to −30°C in some years, and generally down to −20°C for at least a few days, often with no snow cover on the plants. Because Denmark is surrounded by sea the weather changes frequently, so that in one month we might range from −25°C with snow to 10°C with rain. This makes it very difficult to take the right precautions.

Picea abies cultivars and *Picea glauca* 'Conica' cuttings are the only cuttings struck outside. They are struck in June under plastic tunnels with mistlines and left a year before potting in 10 cm pots outdoors. After a further year they make beautiful 15/20/25 cm plants by July or August. If numbers are short, they can be potted in January under glass and will produce a fairly good 12/18 cm plant by June.

Slow-growing *Cotoneaster* 'Cotali', *C. cochleatus* 'Taja', etc., *Hypericum calycinum*, *Pachysandra terminalis* 'Green Carpet', *Vinca minor*, and other ground cover plants are struck directly in 9 or 10 cm pots under polythene tunnels or in greenhouses. We expect to produce 75 to 90% saleable plants and, if a species does not do well in our standard compost, we do not grow it.

All liners are potted in 9 or 10 cm rigid plastic pots, using the following compost mix: 20% fumigated clay soil, 20% rockwool, and 60% good quality peat, with 1¼ kg NPK and ¼ kg lime/m^3. All watering is automatic and we are using liquid fertilizer (the Hornum mix) and occasionally extra potash and nitrogen. Only overhead watering is used, but as pots are stood on 2 cm sand over polythene, there is some capillary watering effect as well.

We know that this system of producing liners doubles the workload of moving the plants, but we feel that the faster liner production and evening out of labour peaks repays the extra expense. However, I must admit that the higher oil prices we have to pay because of the high dollar rate make it more difficult to recover the extra costs.

The liners are kept clean with the use of Simazine and Tenoran plus a little handweeding. Diseases are controlled

with sprays of Zineb and Maneb or Benlate at three week intervals from about the middle of July.

For transport we use homemade lightweight trolleys with linked wheel axles which trail further trolleys in their tracks, thus saving space at the end of beds. In the greenhouse we always fill the last metre by the middle aisle with a fast growing plant which can be potted last and moved out first, which makes use of all the available space. The liners are moved out by means of tractor and trailers. For internal transport I had an engineer design a container with shelving to carry liners in 40 × 60 cm plastic flats. This container fits onto a Europallet and can be carried by two men when empty. It is made of very light steel which our men make during the winter. Each container measures 80 × 120 cm and has five shelves which take 20 flats in total. As it is up to 10 km between the nurseries this saves us a lot of time.

In a discussion of the wastage factor in liner production, the speakers estimated that of the total cuttings taken, 70 to 90% would make saleable liners. This took into account losses during propagation and establishment, outgrading of poor cuttings, etc., and a proportion remaining unsold.

MECHANICAL LIFTING AND COLD STORAGE OF FRUIT TREES AND ROOTSTOCKS

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Our nursery produces fruit trees and rootstocks and some ornamental trees. We are wholesale suppliers to the nursery trade and to the fruit grower establishing fruit plantations. We are, therefore, dealing with very intensive field production of bareroot material that necessitates autumn and winter harvest. The majority of our trees are sold as one-year (maiden) trees; this allows us to mechanically lift and store most of these prior to delivery to our customers. Following our tree lifting of around 150,000 trees we harvest ½ million rootstocks from stoolbeds. Due to the deteriorating weather we aim to have all the field work finished by Christmas as we know from experience that we rarely have uninterrupted working conditions in the field after this. This enables us to organise our labour force efficiently, having six weeks work under cover during January and February.