14. Rowe-Dutton, P. 1959. Mist propagation of cuttings. *Comm. Bur. Hort. and Plant. Crops, Digest No. 2.*

15. Sharpe, R.H. 1956. Observations on rooting softwood cuttings of peach. *Proc. Amer. Soc. Hort. Sci.* 67: 102-106.

16. Snyder, W.E. 1965. A history of mist propagation. *Proc. Inter. Plant Prop. Soc.* 15: 63-67.

17. Snyder, W.E. and C.E. Hess. 1955. An evaluation of the mist technique for the rooting of cuttings as used experimentally and commercially in America. *Rep. 14th Inter. Hort. Cong.*, 1955. Scheveningen. pp. 1125-1132.

18. Stoltz, L.P., J.N. Walker and G.A. Duncan. 1977. Mist nozzles. *Proc. Inter. Plant Prop. Soc.* 27: 449-454.

19. Templeton, H. 1965. Mist systems and their controls. *Proc. Inter. Plant Prop. Soc.* 15: 67-71.

20. Welch, H.J. 1973. Mist propagation and automatic watering. Faber and Faber, London.

PLANNING PROPAGATION FACILITIES FOR THE 1980S

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Ivan Dickings, Propagation Manager for Notcutts and myself, have had a once in a lifetime opportunity of planning and constructing a new propagation and liner facility which will take Notcutts into the 80s.

While the time scale for the operation could be simplified into one year planning, one year construction, one year debugging, the decision, in principle, to build a new propagation facility had been made a few years earlier — in fact, at least 28 years ago, according to the oldest member of the propagation staff. In preparation for the new unit, Ivan has been building up a team of staff capable of exploiting the new facilities for the past four years. We had also reappraised the propagation systems we were using including rooting media, direct rooting systems, types of liner pots, etc.

Objectives in planning a new propagation and liner unit:

1. Provide near optimum growing environment facilities for the wide range of plants propagated and techniques used. Maximize use of space in this controlled environment.

2. Plan for economical labor utilization, with an integrated materials handling system, including:

a) maximize use of skilled labor on skilled jobs.
b) keep heavy, dirty and monotonous jobs to a minimum.

c) reduce need for unsocial working hours, such as weekend duty.

3. Compromise between initial capital expenditure and future running costs. Plan for efficient use of energy and water.

4. To allow for increased production capacity, including additional space for:

a) "forcing" stock plants for early season propagation.
b) "accelerated" growing of selected liners of summer flowering plants such as fuchsias.

5. The design should be flexible for future changes, allowing for:

a) improvement in propagation techniques and liner production.
b) ever-changing market requirements.
c) installation of gantry materials handling system.
d) expansion.

How we set about the detailed task.

1. Quantified existing facilities and targets (amalgamated two existing propagation units and transferred the remaining production of saleable plants to container unit).

2. Visited other establishments:

a) propagation units abroad and in U.K.
b) other glasshouse nurseries, specializing in pot plants and bedding plant production.
c) glasshouse exhibitions, including B.G.L.A. and N.V.T., Holland.

3. Analyzed main operations involved:

a) preparation and handling of compost
b) box filling
c) cutting and grafting preparation
d) insertion of cuttings
e) movement of cuttings from propagation area to rooting environment
f) movement of rooted cuttings to potting on area and liner area

4. Appointed a company of glasshouse consultants to help with design of the mechanical services, including the glasshouse construction, heating, irrigation and electronics.

The Site. We originally planned to build a propagation unit side by side with our container unit, which we started to construct in 1972. In recent years, it became clear that there would not be room for the two units on one site. Three main factors influenced our final position:

1. *Environment.* The site chosen was reasonably sheltered from wind; although in a frost pocket this was considered less important as the main propagation glasshouse would be heated.

2. *Proximity to services.* Three phase electricity supply within 50 yards. Main Woodbridge sewer within 20 yards. Mains water and borehole water within 200 yards.

3. *Staff accessibility.* The site chosen was in cycling distance from the town of Woodbridge, with its reasonable reservoir of married women, whom we expect will form the nucleus of staff expansion.

The Work Area. *This has been formed from a double span* of 22 ft wide Robinson aluminum glasshouse, double glazed with polystyrene, providing shade and insulation. The area has automatic ventilation. Within this work area we have created three heating regimes, reflecting the type of work to be carried out, including compost mixing, potting on and cutting preparation. The zones have been created by the use of mobile PVC vertical screens/curtains; the fans of the heat exchange unit can also be used to provide further air movement in summer months. Mechanical assistance in this preparation area is provided by a Turner compost mixer and a small Plantarex potting machine.

The Propagation Environment.

1. *Heating Zone.* Four distinct heating zones have also been created by the use of mobile PVC vertical screens/curtains. The use of these mobile screens maximized the possibility of using gantries and other materials handling equipment in the glasshouse area. A medium pressure gas boiler provides the heat for both air and soil heating, although a heat exchange is used to reduce the pressure and temperature of water for soil warming to 38°C (100°F). Automatic ventilation is provided throughout.

2. *Mist.* Overhead mistlines have been installed over the total area to eliminate the need for moving materials within the propagation area; 888 mist nozzles have been used.

3. *Irrigation and Feeding.* A separate irrigation system has been superimposed over the mist unit for the same reason as above, and also to enable soft water to be used for mist and mainswater for irrigation when soft water is scarce.

4. *Water.* Soft water for the mist is collected from the roof of both the glasshouse and the Nico-Poly structure and stored into above-ground tanks with a capacity of 20,000 gallons.

5. *Shade/Thermal Screen.* A dual purpose shade/thermal screen has been installed over the total area. This is controlled by a photoelectric cell during the daytime for shading and a

clock at night for thermal screening. The material utilized is a white woven acrylic, providing 50% shade. I would like to emphasize that the installation requirements of a thermal screen conflicts with the installation requirements of the irrigation system and both of these conflict with the materials handling and heating system and electrical installation.

The Liner Structure.

The cuttings and grafts are rooted and weaned in the controlled environment of the aluminum glasshouse and are transferred to a Nico/Poly structure for hardening off, growing on and overwintering. We consider that the Nico-Poly structure provides ideal liner conditions:

a) cool temperatures in summer
b) drier conditions during winter

The Fordingbridge Linkspan Multi-span house was custom built to include the following features:

a) 22 ft wide bays, rather than the normal 21 ft to facilitate the same materials handling system as used in the glasshouse.
b extra clearance under the gutters to provide extra space required for automatic shading, and allow the use of the battery operated forklift within the house.

Materials Handling/Crop Maintenance.

When we designed our container unit in 1972, materials handling was given the very highest priority. In planning the propagation unit the provision of the growing environment was given first priority but the materials handling came a close second.

In designing the materials handling system, we took into account the following operations:

a) unloading and movement of peat and other bulky sundries
b) movement of boxes, trays and pots from work area to growing area, to liner area
c) loading and dispatch of the finished product (liners)
d) routine maintenance during propagation, i.e. the moving of dead leaves etc.

The materials handling system has three components:

a) A number of narrow, aluminum tiered trolleys which can be picked up by the pallet truck.
b) Battery operated low profile pallet truck designed for glasshouse use.
c) Gantries. We are investigating the use of gantries for two operations: crop inspection and maintenance, and

materials handling.

To enable us to install a gantry we have:

a) installed the heating pipes with extra supports.
b) installed overhead mist and irrigation to keep the floor area clear.
c) planned the glasshouse layout to allow for easy transfer of the gantry across the main access path and also to transfer it transversely from one section to another.

Alarm System. We are currently installing an alarm system which will monitor ten pre-determined criteria including electricity supply, water supply, air temperature. In the event of breakdown, it will automatically ring a predetermined telephone number and report which of the ten criteria is faulty. If no one is home, it automatically dials a second number. This procedure is repeated up to five times and, by changing a casette, the order sequence of the numbers can be changed. We hope this will reduce the amount of weekend duty and reduce the time it takes to get a specialist mechanic to correct the problem.

The Cost. Allowing for grants, various other allowances and a return of 25% on capital, the capital cost will work out about 1p per liner produced.

TAKING STOCK — MANAGEMENT OF STOCK BLOCKS

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This is a review of the work with stock beds at Efford E.H.S. and deals with why and how they were started, their management, and some data on cutting production, particularly in relation to pruning treatments.

The experimental programme with hardy nursery stock deals mainly with container production plus some work on propagation. Between 1973-78 there was a rapid expansion in the volume of work. In order to have confidence in the accuracy of results from experiments, uniform batches of cuttings were required. This proved virtually impossible to obtain with bought-in material. Often greater differences occurred among plants within the same treatment than among the treatments themselves. Neither could there be firm guarantees of when cuttings would be available and occasionally mixed cultivars occurred which made interpretation of results more difficult. Hence it was decided to propagate our own material for trials.