

bother with and what he would chuck out in the case of this particular cultivar.

If each "number rooted" figure be expressed as a percentage of the total number originally taken, and the corresponding date be expressed as the period from when the cuttings were taken, the former figure divided by the latter will give a series of indices which reduce the complicated number/time concept to its simplest form.

The question has probably arisen in many minds, whilst I have been talking, "What is all this going to cost?"

The answer is "Nothing at all, if I get my way". I visualise a central body of some kind (if possible I want a world-wide one — since as some of you know, I do nothing by halves) to co-ordinate research on mist propagation throughout the world. As well as licking my proposed "Standardised Presentation" into shape this body would be able to say to Mr. Martyr here, "You do so-and-so at Pershore" and to Mr. Macdonald "You do such-and-such at G.C.R.I., and make similar allocations of responsibility to our friends at Boskoop, Tokyo, Arnold Arboretum, Cornell University etc. In this way the present duplication, *ad nauseam*, of cost and effort would be saved, and instead of the present flow of more or less useless data from the printing presses everywhere there would soon begin to build up a bank of reliable, standardised, complete and therefore usable information. Every effort then would be of immediate and cumulative value, thereby cutting out the present waste or duplicated and abortive effort.

A centralised study of the universally applicable standardised records of research resulting from this procedure would soon point the direction for further research, again saving cost, and my fond dream is that the results of my suggestions will be — at least it could be — such a building up of our actual knowledge of mist propagation of plants that even the humblest of us propagators will soon have no need to rely on the "good luck" in which even such an eminent propagator as Mr. James Wells confessed to putting some reliance, when he visited us at Syon House.

Whether, by giving this paper, I shall have stimulated extra sales of my forthcoming book, or have lost many potential buyers of it, is an interesting question which time alone will resolve.

YEAR-ROUND CHRYSANTHEMUM PRODUCTION

J. L. KITCHEN,
Framptons Nurseries, Ltd.,
Chichester, Sussex

Year round Chrysanthemum growers produce flowers each week of the year by growing to a previously agreed written programme. This programme sets out the details as to when

cuttings must be planted and when light or shade should be applied to ensure a regular supply of flowering stems.

The task of the chrysanthemum cutting propagator is to produce the correct quantities of the required varieties each week of the year as dictated by these growers programmes.

This entails putting into the rooting bench in excess of 1 million cuttings each week and removing a similar quantity for despatch to the customers, and our problems are therefore to a large extent organizational.

Cuttings are produced on stock nurseries in the South of England and to obtain the benefit of winter light we produce a large percentage of our sale cuttings in the Canary Islands.

The stock nurseries take cuttings from stock plants by snapping them off at a previously determined length according to the use to which they will finally be put. Pot plant varieties, and those which tend to stretch excessively in the rooting bench are taken at a shorter length than cut flower varieties, and the lengths are also varied with the seasons of the year. At this time the slower rooting varieties are treated with a 0.1% I.B.A. rooting hormone powder and the cuttings wrapped in polythene, are placed in cool storage at 33°F until required.

Each week the required number of cuttings are inserted into steam sterilized benches of sand and peat. The spacing of the cutting in the rooting bench varies with the time of year as they can be much closer spaced in summer without suffering a loss of quality. The rooting medium we use at present is a mixture of 70% peat and 30% local sand which gives us a relatively cheap well aerated medium.

To ensure that varieties rooting at differing speeds are ready for despatch together they have to be in the rooting bench for varying times. We have split our varieties into the 3 broad categories of slow, medium and fast rooters. The slow rooters are stuck first some days ahead of the medium and fast rooters and the rooting time varies from 13 to 18 days.

In addition to this we further split each week's stick into groups according to the day on which they will ultimately be despatched, as this gives us closer control over the amount of root they produce. Southern produced cuttings must be stuck in separate beds from the UK produced material to enable the Plant Health Authorities to inspect them easily and pot plant varieties are rooted in separate houses from the cut flower varieties as a much smaller cutting is required.

This gives us a total of 10 variable factors to take into account when planning the sticking operations.

During the first week in the rooting bench the cuttings are misted regularly and when rooting begins they are gradually dried off to get them into the right condition for packing.

To meet the usual schedule the bench temperature is maintained at 70°F, measured at the cutting base, and the air at

60°F, but by adjusting these temperatures we can speed up or slow down the rate of rooting.

As a general rule no fungicides are applied to cuttings in the rooting bench as it is extremely easy to damage material which is in such a soft condition. When necessary spot application of a botryticide such as Elveron can be applied.

In the rooting bench we can affect the height of the final product by the application of water and growth regulators and the speed of rooting by the use of heat and rooting hormones, but the quality of the final article is largely determined by the cutting which is taken from the stock plant. If the unrooted cuttings are soft and vegetative, of an even length and leaf number, and free from pests and diseases the rooting operation becomes a problem of organisation.

The type of compost used affects the type of root produced much more than the speed of rooting and we find that an increasing peat content gives a shorter more bushy type of root, at a temperature of 70°F.

Once rooted, the cuttings are lifted from the bench, graded for size, and packed on the bench into boxes of 500, which are already labelled, for despatch. After checking in the packing shed they are held in the cold store for despatch the following day.

In a system such as this it is very difficult to deal with varieties which fall far outside the average, due to taking an excessive time to root or being very prone to disease etc., and we do everything possible to avoid having to include varieties of this nature in our catalogue.

Our breeding unit is actively engaged in producing new varieties which will improve on the colour, shape and size of existing varieties, and also varieties which are good producers of cuttings which root easily and are not prone to the tendencies shown by present day varieties eg tip scorch of BGA Hurricane.

This whole propagation system entails a vast amount of paper work, many aspects of which only became possible when we installed the GE.115 computer, which now handles the greater part of the documentation involved.

In the future we need to reduce the number of varieties of chrysanthemums in commercial cultivation to enable the propagator to streamline his operation and thereby keep down the cost of the rooted cuttings. We hope to see the day when each nursery will have cold storage facilities, as this will give the propagator greater flexibility in the timing of cuttings despatched. On the question of cold storage we need to find a technique which will allow us to cold store unrooted cuttings for a longer period than the present average of 3 weeks, as this again would put more flexibility into the system.

Looking further into the future, as labour becomes more difficult to obtain, and more expensive, we must hope that more mechanization of the operations involved might become possible.

Is it possible to breed varieties which lend themselves to greater mechanization in their propagation? Will it be economic in the future to stick cuttings in containers which are eventually despatched to the customer? What part will growing room play in the future of the plant propagation business? These and many other questions are being raised when propagators meet together and we can be sure that there is an exciting time ahead of us in this particular field of propagation.

BRIAN HUMPHREY: Are there any adverse affects from steaming the peat in the cutting compost?

J. L. KITCHEN: Constant steaming will break peat down but we are removing a lot of compost with the cuttings sold to the growers. This means that we have to top up regularly. We churn up the peat regularly to make sure that the fine particles do not remain at the bottom of the benches. After steam sterilisation a very thorough watering is given to leach out anything which might be harmful.

A MEMBER: Do you have any experience with Finnish paper pots?

J. L. KITCHEN: No. The problem is that we really want something large enough to root a cutting in and also send to the grower. There is a Japanese paper pot we might use but we have not tried the Finnish paper pots.

D. HARRIS: Why do you maintain an air temperature of 60°F? Could this not be dropped to 55°F? On rooting cuttings with bottom heat or under mist how necessary is it to keep the air temperatures as high as we do by traditional methods?

J. L. KITCHEN: The reason is that the whole plant, from the stock plant until flowering, is grown at 60°F. Propagation takes place at the same temperature; you can let it vary a degree or two but anything more may upset the flowering response. The grower is relying on the variety to flower in the stated time, 10, 11, 12 or 13 weeks. We therefore maintain this uniform temperature.

NOTES ON THE GRAFTING OF *PICEA PUNGENS* 'KOSTERIANA'

FRANK WILLARD

Messrs. A. Goacher & Son,

The Nurseries, Washington, Pulborough, Sussex, England

Although the advances made in recent years by the use of mist techniques, have made it possible to propagate difficult subjects from cuttings, a few notes on my experiences in raising *Picea pungens* 'Kosteriana' by grafting, may still be of interest to those who, for one reason or another still continue the practice of grafting this very beautiful tree.

My first experience of grafting this subject dates back to the early days of the Second World War, when for obvious