Fifty Years of Progress in Plant Propagation©

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INTRODUCTION

The Fiftieth Anniversary of the formation of I.P.P.S. is a major milestone and provides an excellent opportunity to take stock and reflect on the way plant propagation technique and practice has progressed. This paper presents a personal view of some of the major advances I have witnessed and considers the significant contribution that I.P.P.S. has made to the understanding and sharing of propagation knowledge and skill during the past half century.

PROPAGATION AND PRODUCTION 1950–1959

After World War II UK nurseries struggled to meet home demand and much stock, in the form of both bare-root and root-balled finished plants (in giant reed bundles) and many crates of young liners, had to be imported.

Most production was field grown. We produced some seedlings and had etiolated layer and stool beds to provide stocks that were T-budded in summer or grafted in spring with both fruit and ornamental scions. Shrubs were mainly grown from hardwood cuttings, inserted in autumn into slits filled with sharp sand and left to the vagaries of the winter weather. A wide range of herbaceous perennials were field-lined from divisions.

Propagation facilities were primitive by today's standards. The traditional propagation house or "pit", as detailed by Jim Wells (1955) was semi-underground and consisted of bottom-heated closed cases at ground level, with a sunken path for ease of access for the frequent syringing necessary to provide humidity and to allow for inspection and the wiping of condensation from the glass on a daily basis. Semi-ripe cuttings of evergreen shrubs, together with a limited range of easy rooting subjects that could be supported when taken soft, were dipped in IBA hormone rooting powder before direct insertion into the prepared beds of peat and sand.

The range of plants that could be rooted successfully was limited and many subjects that are routinely rooted today were bench grafted or produced by layering. Clay pots were used for growing-on in John Innes compost, and placed in cold frames where they could be given protection with reed mats or plunged in beds and the pots covered with clinker ash for winter protection.

Seeds that required stratification to germinate were sown in pans under vermin protection to germinate the following year. Easy seeds, such as bedding and vegetable plants, were sown and then pricked off in wooden trays of John Innes compost. There were no herbicides and only a limited range of pesticides. Nutrition was provided using blood fish and bone meal and sheep's droppings dissolved to make a stock mix for liquid feeding.

KEY TECHNOLOGICAL DEVELOPMENTS OF THE LAST 50 YEARS

Plastics. The introduction of polythene provided an economic means of creating a supportive environment for plants in propagation. This was quickly adapted for soft and semi-ripe cuttings and grafts, replacing the glass closed case and bell jar. Fine

gauge sheeting can be laid directly on the plants without support, while tents and sun tunnels can easily be constructed using heavier film with metal or wire supports. Pest and disease build up, so familiar a problem under glass, can be avoided by simply disposing of the sheet after each crop. Clear or opaque film can be used depending on time of year and optimum light level for the plant. The wide use of polythene within the industry is now commonplace and one cannot imagine what we would do without it.

Plastic pots have replaced clays and plastic trays have replaced wooden flats, both developments resulting in an increased efficiency of plant handling during propagation, virtually eliminating the sticking of cuttings into open propagation beds, and the subsequent transplanting shock so familiar when potting off in the past. The ease of plastic moulding led to the ability to develop plugs and cell units to further improve the efficient and successful establishment of young plants; and to the many mechanised handling systems that are based on specially designed plastic trays and boxes.

Control of the Propagation Environment. Thermostats now automatically and accurately control air and root zone temperatures—taking some of the guesswork out of predicting the night weather that once accompanied stoking the coke boiler. Advances in environmental control, with the introduction of humidistats linked to thermostats and ventilation systems have given us the fully automated propagation and growing houses we are used to today.

Mist. Experiments with mist in the 1950s were the main content of the 1956 Conference of the Eastern Region, North America. Early experiences were widely reported and in the UK mist was trialled and developed by Ron Frampton of MacPenny. The early control for intermittent mist consisted of electrodes with soft paper between—simulating the leaf surface and known as the electronic leaf. When wet, current passed with little resistance, as the paper dried resistance increased and opened a valve giving high pressure delivery of water to the mist nozzles, which created a mist that damped the paper, reducing the resistance and closing the valve.

A wide range of subjects that had previously been impossible to root were successfully propagated by either soft or semi-ripe cuttings in specially designed mist propagation units. Plants that had been scarce as grafted or layered stock were suddenly available in quantity and on their own roots. The *International Plant Propagators' Society Combined Proceedings* contain many accounts of specific experiences and successes with mist—one of the major advances in propagation in parallel with the development of I.P.P.S.

Fog. Fogging—a means of supplying high humidity with even finer droplets than mist—was the next development, becoming widely available during the 1980s with much work on development and management in the UK being undertaken at both East Malling and Efford research stations. It provides a most supportive propagation environment and is particularly useful in the weaning of micropropagated propagules from the sterile safety of the laboratory to the harsher life in the propagation house (see below). There are two types of fog: ventilated fog, as produced by the spinning rotors of the Agritech system, which tends to produce a gradient of wet to dry throughout the propagation unit; and high pressure fog, in which fine water droplets are carried on compressed air and which tends to be dry and may therefore need additional wetting of the plants to avoid stress.

Hardwood Cuttings. Field production took a major step forward in the mid 1950s with the arrival of the East Malling cutting bin (or Garner bin) in which hardwood cuttings from controlled stock hedges were callused by applying local basal bottom heat while keeping the tops cold—before lining in the field.

Composts and Rooting Media. Various substrates were trialled and in the late 1950s the University of California (UC) range of composts, which were to be the forerunner of today's soilless composts, were introduced together with their necessary nutrient combinations. Later we were to come to rely on peat as our main potting and cutting medium ingredient—in combination with bark, wood fibre, coir, polystyrene, and mineral fibre—and to learn about controlled-release fertilisers, air-filled porosity, and slumping composts.

Pest, Disease, and Weed Control. Advances in field production included the increased use of chemical sterilisation for seedbeds to control some soil pathogens and weed seeds. Other key developments included translocated herbicides to control perennial weeds, and residuals such as simazine for seedling weeds. The removal of weed competition without mechanical damage to the plant or the soil was one of the major advantages of a sound herbicide programme.

Health Status and Clonal Selection. The use of virus-tested clonal scion material from high health status mother plants, in combination with clonal rootstocks, produced a consistent crop with reduced grade out. The Clonal Selection Scheme for ornamentals, initiated at Long Ashton in the mid 1970s, identified true-to-type cultivars of many plants that are now available to the propagator. Selection of a range of clonal rootstocks for ornamentals was started at East Malling.

Budding and Grafting. During the 1970s the practice of chip budding was investigated at East Malling Research Station (Howard 1977). Considerable improvements to quality, uniformity, and success rates were achieved.

There were considerable advances in the tying materials used for budding and grafting. Raffia and cotton twine were replaced by rubber strips and polythene tape which could stretch with the girth expansion of the stock. Rubber patches held by a staple were ideal for roses. Later, biodegradeable tape eliminated altogether the need to check ties.

Micropropagation. The development of this technique from the experimental stages of the late 1960s to the establishment of the first commercial laboratories in the late 1970s, revolutionised the capacity to produce vast numbers of plants rapidly. Bruce Briggs presented an update on the range of species available on the West Coast of the United States (Briggs, 1983) and it is now possible to culture and root many species with ease, with implications for the rapid bulking-up of new introductions. One useful spin-off is that juvenility induced during culture renders the new plants more easily propagated by traditional methods.

MORE RECENT DEVELOPMENTS

Much current research and development is "fine-tuning" to meet today's exacting demands and standards, including work on water quality, recycling, and management, following up Margaret Scott's earlier work on acid-dosing of hard water for propagation which in hard water areas had successfully removed the calcium deposits from slow-rooting cuttings. Other key developments have included stool

bed management and nutrition and studies on the levels of energy and rooting potential in cuttings; plant scheduling, especially roses; the "designer liner" and pruning and feeding during propagation; trialling alternatives to peat in propagation and growing; controlled-release fertilisers in propagation; plant handling during propagation; direct sticking of cuttings and larger cuttings; and research into the relationships of water, light, and temperature gradients on a range of subjects, to ascertain optimum conditions for guaranteed and repeated success.

One major change has been the increased production of stock under protection. With garden centres making increasing demands for stock, particularly for shrubs "looking good" out of their normal season, an increasing amount of propagation has to be scheduled to meet the changed growing cycle; often involving cold storage of plants. Second-hand cold glass, formerly used by the salads and flower industry, is increasingly being brought into service for growing this stock—and for container trees, often from 1-year bench grafts, that complete their seasons growth at the correct size to be put in a car far more easily than field-grown and containerised trees.

THE ROLE OF I.P.P.S.

The most important event for propagators in the British Isles in the past 50 years was the formation of the Great Britain and Ireland Region of I.P.P.S. Inspired and motivated by the missionary zeal and determination of Jim Wells at the 1968 Pershore Winter Conference, when a session was devoted to promoting the Society, an ad hoc Committee including Richard Martyr, Robert Garner, Brian Humphrey, and others was formed. On 18 Sept. 1968 the Region of G.B.& I. was formed (see IPPS 1968 for details).

From the onset there was a happy mix of growers, researchers, college lecturers, and advisors within the membership and herein lies its strength. The links to the colleges were particularly important and opportune at a time when specialist courses were training young propagators and growers. The ideals of the Society were passed to young propagators who are our leaders in the industry today. Similarly, researchers were sharing the fruits of their research directly with the practising members. I.P.P.S. members ensured propagation needs were always an important element of the research stations' programmes and when, in 1986, public research funding was reduced and the Horticultural Development Council (H.D.C) was formed, the nursery stock panel that commissioned levy funded research included Brian Howard from East Malling and Margaret Scott from Efford—both past I.P.P.S. Presidents.

Nursery visits and the recent development of training workshops provide a vital contribution to propagation knowledge. The nurseries that have opened their doors to visits, and the sharing of knowledge and skills during the past 30 years have done so much to foster and build fellowship within our Society. To the officers and committee of the Society, from the early days when Bruce Macdonald agreed to be Secretary and held the post and the region together during the early formative years, through all who have served the Society to the present day team, we owe a great debt of gratitude.

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What Future for Plant Propagators?©

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INTRODUCTION

In the not so distant past, the plant propagator was portrayed as the eccentric whose role was only to put roots on the cuttings, graft the scions, and peg down the branches of stock plants in the layer beds during winter. The only apparent measure of success was technical excellence as measured by rooting percentage or graft-take: Glory! Yes! Roots! "The euchryphias have rooted, not quite 100% but next year we will strive to get the 100%. A little more heat, less humidity, maybe a different hormone." Plant propagators had their office in the shed where they were surrounded by a library of "Black Books" they called their "bibles", together with authoritative monographs and periodicals giving many useful tips on different species — not always relevant to the task at hand.

Today's propagators are no different. They are passionate about all plants. They still have their black bibles—books of religion, guides for life in the future: the propagator has only an average of 47 shots at goal and the goal is to achieve that elusive 100% rooting. But this author contends there are, perhaps, more important measures of a propagator's success and contribution to the wider horticultural profession.

EDUCATION AND TRAINING FOR PROPAGATORS

There are basically two categories of work for plant propagators—academic (in research organisations, botanical gardens, and other plant collections, for example) or commercial propagation. Whichever side of the profession a propagator ends up in, education is the most important beginning. There once was a passion in the educational institutes of the UK and Ireland but alas that is all but gone. Money has taken over as the ruler of the faculty whether it is in a university or college. Doctors, lecturers and professors, are just too busy to take time to nurture their students. "Mol an Óige agus Tiocfaidh Siad—Praise the young and they will come with you" is an old Gaelic proverb, but today's student botanists or propagators are just not encouraged by the enthusiasm of their elders as in the past.

One major failing is that the teachers or trainers do not get out to see what is happening "in the field". How many academics from your local horticultural college have visited your nursery, or trade shows or exhibitions, such as, Four Oaks, Plantarium, Hortiflora — N.T.V. or I.P.M.? It is interesting to note that I.P.M. in