SOME APPROACHES TO PROPAGATION PROBLEMS IN THE EARLY MULTIPLICATION OF NEW CLONES OF WOODY FRUIT PLANTS

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Fruit research stations repeatedly have to rapidly increase small quantities of new plant material for wider testing under commercial growing conditions. Those cultivars which meet exacting current day standards must then be rapidly multiplied so that they can be supplied to commercial nurseries specialising in elite stock propagation in sufficient quantity to justify the expense of setting up new production beds, often in isolation from existing material.

Very limited quantities of material are initially available when originally virus-infected clones are made "virus-free" by heat therapy which provides, in the first instance, one meristem to start the new clone. In the case of a newly bred cultivar, the original plant is often supplemented by others during the early screening procedures for disease resistance and propagation ability, but initially few plants are available.

Scion cultivars. A simple approach can be used for a new cultivar destined to become a scion cultivar because fruit cultivars are traditionally budded onto rootstocks which contribute specific characteristics of size control and cropping ability to the composite tree. Because the propagule is a bud, the objective is to produce as many of these as possible; this is done by budding or grafting some of the original material onto suitable rootstocks, which are virus-free and of sufficient vigour to encourage the production of large numbers of shoots. Budwood trees produced in this way are often referred to as "mother trees", despite their asexual role in propagation.

Rootstocks. Much greater difficulty is encountered in the early bulking of new cultivars destined as rootstocks because of the need to induce adventitious rooting from the stems of cuttings or layers. Successful rooting of cuttings usually comes from a special study of particular plants, justified by their commercial importance, as in the case of fruit rootstocks (1). It follows, therefore, that until potential rootstocks have been screened for rooting ability and any propagation problems overcome, attempts to root the small quantities of initially available material might result in irreplaceable losses. This particularly applies to the bulking-up of material such as rootstock M.9, whose importance as a dwarfing rootstock for intensive orchards has outweighed the fact that it is difficult to propagate,

and which recently needed to be quickly multiplied following introduction of virus-free material. The problem should not be as great in the future because of the current emphasis on ease-of-propagation during breeding and subsequent screening. An extreme example is the new cherry rootstock, 'Colt', which like other clones from crosses between *Prunus avium* and *P. pseudocerasus* produces preformed roots on current growing stems and roots readily from softwood (4) and hardwood cuttings. Our approach with difficult subjects has been to exploit the fact, as already discussed, that buds are produced more readily than adventitious roots on stems. Nurse-rootstocks have been grafted or budded with buds from the rootstock being bulked-up, so that the first stages in the multiplication programme have maximised shoot multiplication and ignored the rooting stage. When adequate numbers of shoots had been obtained in this way, rooting was induced either by earthing-up soil to the bases of low-budded shoots, or by using the shoots as cuttings, without the risk that some failures would jeopardise the programme (Table 1).

Table 1. Comparative schemes for multiplying one twenty-bud plant by conventional stooling, or by multiplying buds initially using nurse-rootstocks. (Assume twenty buds available per shoot per season).

STOOLING METHOD	NURSE-ROOTSTOCK METHOD
Year 1	
Plant established in nursery	*Spring: 5 × multiple bud grafts* worked onto nurse-rootstocks Summer: 300 buds produced and budded onto nurse-rootstocks
Year 2	
Cut to near ground level and 3 rooted shoots produced	6,000 buds produced and budded onto nurse-rootstocks
Year 3	
3 new plants established, 5 shoots produced by original plant	120,000 buds produced and budded at ground level onto nurse-rootstocks
Year 4	
9 + 5 rooted shoots produced, together with 4 established plants — total 18	*Approximately 100,000 rooted shoots harvested*
N.B. This figure may be doubled by growing-on non-rooted and small shoots from each year's crop.	N.B. In practice a target of 5 to 10,000 is usually set because of limitations from the availability of nurse-roots, land and labour. Success during the fourth year will mostly depend on the rooting ability of the "scion". Constricting with wire at the base of the shoot has been used to enhance rooting.

The characteristics required in nurse-rootstocks are that they should be freely available, virus-free, have distinctive growth, such as leaves or stems of a different colour to the scion, and induce vigorous growth in the scion. In apple rootstock multiplication programmes, *Malus* seedlings are suitable and seeds from 25 distinctive species or selections are being tested for their suitability as nurse-rootstocks. In species such as *Prunus* where, unlike *Malus*, some viruses are seed-transmitted, care must be taken to obtain seed from healthy trees.

In-vitro micropropagation. Multiplying plants by inducing meristematic tissue to proliferate under controlled conditions in sterilised culture media has been successfully applied to orchids and appears to offer potential for other herbaceous plants. Until recently, the prospects for using this method with woody plants were poor. Recent developments in which phloridzin, a phenolic glycoside naturally occurring in apples, has been shown to promote vigorous multiplication of apple meristems has greatly improved the potential use of *in-vitro* methods for woody plants. The use of relatively large pieces of vegetative buds as starting tissue and omitting cytokinin from the rooting stage of the culture also appears to significantly contribute to success (3). The principles of micropropagation are similar in some respects to those of the nurse-rootstock system, whereby the early stages of propagation are given over to multiplying vegetative shoots, with conditions subsequently changed to induce rooting at a final stage when failure of some propagules to root is least important.

Collection from the wild. When woody plants are collected from their natural habitat even less is known of their propagation potential than when they are derived from a breeding programme. Grafting onto rootstocks likely to be compatible with the collected material is an important first stage in ensuring its survival. Once established, marcotting, layering and cutting tests can be carried out to determine the best regenerative approach. If long-term cold storage is developed for woody plants, the same system will need to be introduced at periodic regenerating stages of the stored material. (2).

LITERATURE CITED

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