

nursery, explained in seasonal order the mechanization involved in a 2-year rose production cycle. Implements ranging from heavy subsoilers to bundling and tying machines were discussed. There was much to be seen during the 40 minutes allocated to this part of our visit, but of particular interest were standard horticultural and agricultural implements which had been modified to accommodate the specific needs of the nursery. The plant carrying capacity of a Super Prefer planting machine had been almost doubled by fitting 2 side mounted panniers in place of a single front mounted pannier. For the same machine a reinforced nylon 'All Weather Cabin' had been constructed to protect operators from wind and rain. It was mentioned that the cabin could be easily detached from the planter and used as a canopy for detailed field work if required. Much interest was shown in a set of spring tine harrows which were suspended from an elevated tool frame by rigid arms to permit harrowing through a standing crop of bush roses. Other one-off machines included a Horstine Farmery Band Fertilizer Applicator on which the landwheel drive had been modified to facilitate operation under particular conditions which prevail at the Wheatcroft nurseries.

A rapid tour of a jacketed cold store and a quick examination of stored budwood completed a most successful and thoroughly absorbing afternoon. Grateful thanks were extended to all those concerned at the host nursery.

NOTES ON THE PROPAGATION OF VIBURNUMS

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(Ed. note. The ensuing report is the result of a request from the Executive Committee of the G.B. and I. Region, IPPS, to their members for information, particularly from personal experiences, in the technique of propagating viburnums. Ten persons contributed — R. D. Anderson, G. P. Chandler, D. M. Donovan, R. J. Hares, S. J. Haines, B. R. Halliwell, P. A. Hutchinson, J. G. D. Lamb, P. D. A. McMillan Browse and K. Mickelburgh. Mr. P. D. A. McMillan Browse collated the information into a report, which was circulated to G.B. and I. meetings in September, 1970. The exercise is a continuative one and we should like to have additional relevant information).

VEGETATIVE PROPAGATION

Viburnum x bodnantense and its vars. 'Charles Lamont', 'Dawn' and 'Deben', *V. fragrans* and var. 'Candidissimum', *V. grandiflorum*, *V. foetens*.

This group of deciduous, winter flowering Viburnums lends itself to several techniques of propagation; small quantities can be reliably produced by 'French' layering but for large scale production a system

of propagation from stem cuttings is the most economic method. These Viburnums regenerate quite readily from the softwood cuttings which are produced in the first flush of growth after bud break. If the soft tip is used at later dates it regenerates less readily because basically it is 'less vigorous' due to its slower growth. Later cuttings are more difficult to over-winter because of the fact that they have not had an opportunity to start growing again before leaf fall. Plants produced from softwood cuttings represent the longest time cycle of production, i.e. from propagation to saleable size, because of the small size initially of the young plants. Consequently the propagation of these plants is best achieved by rooting hardwood cuttings, as this represents a compromise in terms of the initial size of the young plant produced, the economic use of available propagating material, and the expense of the technique involved.

The most important factor is to develop stock plants which produce hardwood material of high capacity to regenerate (i.e. ability to root). This is best achieved by following the recommendations of Garner and Hatcher (1) which they prepared for the propagation of fruit tree rootstock material; this implies that stems developed as a result of continuous, annual, vigorous pruning have a high vegetative 'vigor', are less likely to flower and have a high capacity to regenerate. In addition, the cutting material should have a high level of stored carbohydrates and a low level of free nitrogen. The former is achieved by growing the stock plants in good light conditions and the latter by increasing root competition and hence the stock plants can best be managed on a 'hedge' system. In practice, suitable young, true-to-name, stock is planted in a row about 40 cm apart, cut back to a stool, and subsequently each winter, the annual growth is cut back to a basic framework or a stool. When established on good soil conditions the stock will produce good, clean straight stems of some 1.5m which can be used for hardwood cuttings. It is important, however, in order to maintain good material of high capacity, that the stock hedges are pruned correctly each year, whether the material is to be used or not.

Timing is also a relevant factor in the propagation of these subjects from hardwood cuttings and experience has shown that best results are achieved if the cuttings are made just prior to leaf fall, i.e. when it is possible to remove the leaves by running the hand speedily along the stem.

If plenty of material is available, then the basal sections of the shoots should be used, as there is a demonstrable positional effect on the capacity of the material to regenerate; in addition this also engenders a more prolific root system. In making the cuttings, size is the first factor to be considered. Ideally the cuttings must be big enough to contain sufficient stored food for survival and regeneration but must be small enough to use the available stem material effectively, and for most of its length to be easily inserted in the compost. Hence the cuttings are nodal and between 12 and 16 cm long.

The base of the cutting is usually treated with Seradix 3 but it would be a useful exercise to see whether higher levels of IBA would improve the rooting performance. One correspondent suggests slitting the basal 50 mm of the cutting before dipping in hormone powder. The cuttings are then inserted in a cold frame containing a well-prepared compost, to a depth such that only the top 1 or 2 cm are exposed. As the cuttings will remain and establish *in situ* until the following autumn sufficient space must be allowed—say 6 to 7 cm by 10 cm. The cuttings are watered in and the frame closed and, if necessary, shaded until light intensity decreases and, subsequently during the cold part of the winter, the frames are insulated with rush mats or similar material. In spring the frames are not allowed to dry out but, as the cuttings break into growth, the frames are aired to keep the young shoots hard; because of their early flushing habits, special attention should be paid to *V. foetens* and, to some extent also, *V. grandiflorum*. During the ensuing summer the rooted cuttings are watered and fed so that by autumn good rooted cuttings for field lining have been produced.

This latter system is indeed just a standard technique for propagating hardwood cuttings in cold frames, the significant factors, which raise it from a marginally useful method to a successful one, are the provision of material of high rooting capacity, and the timing of the operation.

V. carlesii, its vars. 'Aurora' and 'Charis', *V.* 'Anne Russell', *V. x juddii*, *V.* 'Fullbrook', *V. x burkwoodii* and var. 'Park Farm Hybrid', *V. bitchiuense*, *V. x chenaultii*, *V. macrocephalum*, *V. x carlcephalum*.

Traditionally this group of early summer-flowering Viburnums has been produced by bench grafting onto pot-grown rootstocks, although many nurseries have produced good crops by layering, or by budding onto lined-out rootstocks in the field. Layering has the advantage that the crop is produced on its own roots and is, therefore, free from the problem of rootstock suckering which troubles those who graft or bud onto rootstocks of *V. lantana*. The use of *V. opulus* as a possible alternative rootstock appears to give perfectly good results with a minimum of sucker production. However, the economic production of large numbers of these plants can only be achieved by propagation from stem cuttings.

The rooting of stem cuttings of this group is not a great problem, especially under mist, provided that a few simple precautions are observed; it is the survival of the cuttings during the ensuing winter which is the greater problem. If this can be surmounted, however,

the rooted cuttings grow away well the following spring and produce good-sized bushy shrubs in a further two growing seasons.

Winter survival appears to depend on two alternative systems:

- (1) the encouragement of secondary vegetative growth once the cutting has developed and established its initial root system, thus producing before the winter not a rooted cutting but an integrated and established young plant, or,
- (2) keeping the rooted cutting itself, which can be done by not disturbing it (i.e. leaving it in its propagating container) and keeping it relatively dry and cold.

As it has been often emphasized the success of any propagating technique depends on a source of stock material which has, inherently, a high capacity to regenerate. Well established plants which are flowering prolifically tend to produce slow growing extension shoots which ripen quickly and exhibit a low capacity to regenerate, whereas stock plants which are pruned regularly each year produce rapidly grown shoots of high capacity.

Vast numbers of stock plants are not necessary, as properly prepared plants produce many cuttings, a well-established hedge of 6 to 8 plants spaced 80 - 100 cm apart and between 120 and 150 cm tall, should produce 1,000 or more cuttings; obviously this figure will vary according to the particular species. The time of taking the cuttings appears to be of some significance although the season appears to extend well into July for some of the easier types. Later cuttings appear to have hardened too much and do not regenerate well, although high levels of hormone appear to improve matters during the marginal July period, i.e. high hormone appears to compensate to some extent for the lack of 'softness'. Most of the correspondents favour an early cutting, not necessarily because it is soft, but because it roots readily at this stage and thus allows a longer season for the secondary regrowth to develop which is necessary for winter survival. A nodal cutting with one pair of fully expanded leaves and the tip intact appears to be most favoured. Heel cuttings also represent satisfactory material, but if large quantities are stripped from the stock plants this can have a reducing effect on the yield in the following year; ideally at least one pair of leaves should be left on the stock plant from each stem where a cutting has been taken.

Wounding of the base of the cutting appears to be favored by some propagators but, as with hormones, little can be concluded from the evidence available. Where cuttings are relatively soft neither treatment appears to be especially effective; it is only when the material begins to harden that treatments may be critical.

The cuttings are inserted under a mist propagation unit using a well-drained compost and are well-rooted in 5 to 8 weeks — dependent

upon the condition of the material inserted — the earlier the cuttings the shorter the period of rooting.

The most reliable subsequent treatment is the 'non-disturbance' technique which involves feeding the cuttings after they are well-rooted and weaned from the mist; if they produce new growth, so much the better, but at leaf fall the containers are cleaned up, dried off and then kept in a well ventilated cold glasshouse. Watering or a damp atmosphere should be avoided as the buds rot very easily and the danger increases if the atmosphere is warm; presumably the buds begin, perhaps imperceptibly, to break and are more subject to rotting. Potting-on should take place in the following early spring just prior to bud break. If the cuttings are struck early and are potted-on it is most important that new vegetative growth should be produced; this may occur naturally if potting is done early enough and provided the plants are kept warm and humid but, if it has not occurred by mid-August, supplementary light (14 hour day length) to delay leaf fall will be necessary. As soon as some new growth occurs — and only a very small amount is necessary — the plants can revert to normal conditions and be over-wintered in a cold glasshouse.

When early season (soft) cuttings are employed, it is advisable to allow the rooted cuttings time to establish, as experience has shown that potting-on freshly rooted soft cuttings often causes the buds to rot although the root system may remain vigorous and healthy.

The only plant of this group which does well consistently, regardless of propagating season and subsequent treatment according to most correspondents, is *V. x burkwoodii*.

Most of this group can also be readily propagated by budding onto *V. lantana* rootstocks. Well-established field-lined rootstocks are budded in August using a conventional 'T' bud as near ground level as possible. Non-rotting ties, such as raffia, need releasing immediately a union is made because of the continued expansion of the rootstock, otherwise considerable constriction will occur. The rootstocks are headed back in February after which continued attention to remove sucker growth is necessary.

The traditional system of production is by bench grafting during August and September. Seedling rootstocks of *V. lantana* are potted during the autumn into 3-inch pots using 7 to 8 mm grade. These potted stocks are then plunged into a cold frame in peat and are subsequently never allowed to dry out during the growing season, so that a good root system is developed and the stocks grow vigorously.

The stocks are headed down to within 5 mm of the soil level and are grafted with a scion containing two pairs of buds, using a whip graft or based whip graft. The grafts are tied firmly and are plunged into peat in a grafting case, keeping the air temperature at 17° to 18° C. The frame is covered with 250 gauge polythene and then closed with the top lights, shading being necessary on very bright days. A good union

should develop in 4 to 5 weeks, after which air can gradually be admitted.

The use of rootstocks produced from cuttings which have had the lower buds removed is steadily gaining favor because of the elimination of the problem of suckering. Because of ease of rooting, *V. opulus* appears to be replacing *V. lantana*.

V. tomentosum and its vars. 'Lanarth', *mariesii*, 'Plicatum' and 'Sterile Grandiflorum'.

This particular group of summer-flowering Viburnums presents problems and no method of propagation seems foolproof. The plants can, of course, be grafted or layered but economic production can only be achieved by a successful system of propagation from stem cuttings.

Perhaps the most reliable method of production is by layering. These plants, if stooled back to produce a stock plant with a low crown and many vigorous annual shoots, can be very successfully 'French' layered. All damaged, small or thin shoots are removed, leaving 10 to 12 of the most vigorous shoots during the early winter. The surrounding soil is well-prepared and all these shoots are pegged down to ground level early in the New Year. The timing is important to allow sufficient time before bud break for apical dominance to be dissipated. In the spring when the buds have grown out 10 to 15 cm in length, the layer leads are dropped to 10 cm into the soil and then earthed up to the tips of the young shoots. Further attention is unnecessary until the autumn, when the layer leads are severed close to the crown, lifted and divided up to provide a number of rooted layers for field lining. As these plants have opposite buds some plantlets will have two shoots. Bushy layers can be produced if the tips are stopped early in the season. Meanwhile a new crop of shoots will have arisen in the crown of the plant and the whole process is repeated.

Stem cuttings, however, present the most economic form of production and this can be achieved successfully either by hardwood cuttings in a cold frame during the winter or summer cuttings under mist.

Hardwood cuttings can be easily rooted if the source of material is in a vigorous vegetative condition, i.e. if the stock plants have been pruned hard to induce this sort of material. The amount of stem growth is by no means as great as that obtained from *V. fragrans* types and, at the most, two cuttings will be obtained from each shoot; otherwise the technique is the same as for winter flowering deciduous types. If only large plants are available these can be prepared by pruning reasonably hard, which also induces a fair number of 'feather'

shoots from the old stems during the following season which can be stripped with a heel and trimmed to length. The cuttings are made at or about leaf fall, nodally, about 15 cm long, and are inserted into a well-prepared compost in a cold frame, exposing only one pair of buds. Providing sensible frame management is then followed, the method should be reasonably successful, but further observations on the hormone level to be applied to the base of the cutting might help to improve the technique.

Summer cuttings under mist appear to root tolerably well if the stock plants are pruned to produce vigorous young growth annually. Providing the softer tip of the shoot is used the cuttings will root from early May (when the cuttings are only 8 cm long) to late July, but as with the *V. carlesii* group, over-wintering of the rooted cuttings is the chief problem although it is perhaps not quite so critical. It is not so difficult to encourage new vegetative growth after rooting for — given warmth and humidity — these plants will continue to grow well on into late summer.

V. opulus and its vars. 'Xanthocarpum', 'Sterile', etc., *V. sargentii* and var. 'Flavum'.

This group of summer-flowering Viburnums is particularly easy to propagate and presents few problems. For small quantities layering is a satisfactory method, either by simple layering of individual stems in mid-summer or by operating a system of 'French' layering. In either case it is necessary to stool the plants so that sufficient annual, vigorous shoots are produced from a low crown. Although no information is available it is probable that these plants would propagate satisfactorily from hardwood cuttings if the method already described is adhered to; the only salient feature that would need attention is to ensure that the cuttings are made nodally as these plants tend to develop a large pith.

Soft summer cuttings are relatively simple to root and respond well to the usual conventional treatments. If the cuttings are taken as softwoods from the first flush of growth in early summer and placed under mist, this provides a long growing season and well-established plants will be produced by autumn.

It is probable that this group would succeed under the misted, polythene tunnel system now gaining ground, especially if the cuttings were among the earlier batches to be inserted in early June.

V. tinus and its vars. 'Variegatum', 'Purpureum', 'Eve Price', 'French White', 'Pink Prelude', etc.

This species, with its varieties, is particularly easy to propagate from stem cuttings and it is merely a question of determining when is the best time to fit this work into the propagation calendar.

Soft tip cuttings in mid-summer will succeed very well under mist; autumn evergreen-type cuttings placed under mist will also do well; still later, cuttings taken in the winter will succeed if the mist unit is used as a heated bench and the mist itself as manually controlled irrigation. Cuttings in a cold frame during the autumn, autumn cuttings under thick-gauge, polythene tunnels or softer, summer cuttings under misted, thin-gauge, polythene tunnels are all feasible methods of propagation.

V. rhytidophyllum and its var. 'Roseum'.

Although the species itself is often produced from seed it is equally easily propagated by vegetative means. The only drawback to vegetative methods is the coarseness in growing habit and the size of the leaves. Where small quantities only are required, simple layering in the spring is a reasonably easy technique provided that the stock plant has been pruned to produce some strong annual shoots for the purpose.

Propagation from cuttings is relatively simple and as this plant is evergreen it can be propagated at a number of seasons. Summer cuttings, fairly small in size, can be rooted very successfully under mist with apparently no seasonal decline in rooting capacity. Perhaps autumn cuttings, overwintered under a misting system, is a more economical use of space; the cuttings are necessarily bigger but it is usual to reduce leaf size to save space. Wounding, plus the use of Seradix 3, appears to produce the best results under these conditions.

V. cinnamomifolium and *V. davidii*.

These two very similar and closely related species are fairly readily propagated from stem cuttings and appear to respond well at any of the conventional propagation seasons. Very soft tips, taken early in the season and placed under mist, root well. Autumn cuttings, taken when growth has ceased and with any flower buds removed, can be given the winter 'mist' treatments already described; Seradix 3 is beneficial at this period. It has been suggested that cuttings of male plants root better than those taken from female plants!

V. dentatum.

According to the literature this plant is easily propagated from root cuttings and can also be produced from hardwood cut-

tings. However, softwood cuttings under mist root easily and growth re-establishes quickly.

V. buddleifolium.

Cuttings root reasonably well if treated in the same way as described for *V. carlesii*.

V. hupehense and *V. betulifolium*.

Cuttings can be rooted under mist as described for *V. tomentosum*.

SEED PROPAGATION

Little information has been forthcoming on the propagation of Viburnums from seed and all that comes to light from surveying the literature is confusion! The only facts that can be reported are that most Viburnums exhibit fairly complex forms of seed dormancy and to overcome this problem the only technique one might recommend is to collect the berries before they ripen, extract the seeds and sow before the seed coat hardens and before dormancy factors develop. The stratification of the seed in cold conditions does not necessarily overcome dormancy as many Viburnums require a warm period prior to the cold. It is often this factor which delays germination until the second spring after collection; in other words, the limiting factor is not necessarily cold treatment in the first winter.

In British nurseries it would appear that *V. lantana*, *V. opulus* and *V. rhytidophyllum* are the only species commonly raised from seed. The experience of one correspondent suggests that if germination can be induced in the first spring after collection much larger and more vigorous seedlings are produced.

LITERATURE CITED

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