TECHNICAL SESSIONS

Tuesday Morning, December 10, 1985

The thirty-fifth annual meeting of the Eastern Region of the International Plant Propagators' Society convened at 8:00 a.m. in the Ballroom of the Biltmore Plaza Hotel, Providence, Rhode Island.

PRESIDENT SAVELLA: Good morning members of the Eastern Region of the International Plant Propagators' Society and guests. On behalf of the Eastern Region Board, I welcome you to our 35th Annual Meeting here in Providence. Your program chairman, Elton Smith, has put a very informative program together for you and I hope you all take a very active part in the meeting.

At this time I would like to turn the meeting over to your program chairman, Elton Smith.

ELTON SMITH: Thank you, Len and good morning. I think we have an excellent program and I hope you will take an active part in it and ask questions. The moderator for this morning's session is Dr. Paul Read.

ETIOLATION AS A TOOL FOR ROOTING CUTTINGS OF DIFFICULT-TO-ROOT WOODY PLANTS

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Abstract. The stockplant pretreatment techniques of etiolation and banding were used with success in the cutting propagation of 13 woody ornamental species. Each pretreatment alone was noted to have a significant effect on rooting while the combination of the two resulted in optimal rooting in most trials. An alternative banding method has been developed, using reusable adhesive bands of Velcro, which allows for the addition of root promoting chemicals as a part of the banding procedure. Substantial improvements in rooting response were obtained in a number of species previously considered difficult to root.

INTRODUCTION

The etiolation of stock plants as a pretreatment to cutting propagation involves growing shoots in the absence of light. The etiolated shoots which result from this treatment are typically chlorotic, possess smaller leaves, longer internodes, and are more succulent than their light-grown counterparts (5).

Banding of shoots as a stockplant pretreatment refers to wrapping an opaque material, usually black plastic tape

around that part of the shoot that will become the base of the cutting. Banding may be applied early in the growth of a light-grown shoot, and would properly constitute blanching, or may be used in conjunction with etiolation to maintain an etiolated zone at the base as the rest of the shoot is permitted to green-up. The goal of these stockplant pretreatments is to obtain stem cuttings with basal tissues that have developed in the absence of light. In this way these techniques are similar to the well known propagation techniques of air layering and stooling (12).

The techniques of etiolation and banding were first combined by Gardner (3), for use in apple propagation. Recently, much work has been done with these techniques at the East Malling Research Station, Kent, England. Their research with M.9 apple rootstocks and other woody species has shown that 80% shade or more produces shoots which root significantly better than light-grown controls (7,8,9). This permits the use of ventilated shading materials instead of black plastic, reducing temperature and humidity build-ups under the covers that can stress the etiolated shoots and promote disease (7,8,9). This also results in cuttings which are stronger and larger than those grown in complete darkness (4). The use of etiolation and banding at East Malling involves erecting shade enclosures as bud-break commences, and leaving the cover in place until shoots have elongated to a length sufficient for banding (8 to 10 cm) (11). Banding is applied at this time and left in place as the shoots green up (4).

Several decades of work, on a variety of plant materials, have soundly established the benefits which may be obtained using etiolation and banding as stock plant pretreatments to cutting propagation of apple (2,3,7,8,9), hibiscus (6), lilac (10), pistachio (1), and linden (7).

RESEARCH OBJECTIVES

In our earlier work with the banding of woody ornamentals we used black plastic tape as the banding material. During that process we became aware of a number of drawbacks to the use of this material. Plastic tape is difficult to use in that small pieces of the sticky tape must be cut and handled carefully in the process of banding. Furthermore the tape has been observed to unwind in a number of instances, allowing light to impinge upon the etiolated stem tissues. Finally, the degree to which the etiolated stems must be handled, both in putting on and removing plastic tape, can result in damage to the stems, which are by nature of being etiolated very delicate. In beginning our present research we sought a banding material which could be quickly and easily applied, necessitating as little

handling of the etiolated shoot as possible. Hence we have modified the banding technique to make use of a reusable adhesive banding material commonly known as Velcro. This opaque banding material excludes light in the same way as tape, but may be more easily applied and removed. Furthermore, the unique adhesive nature of the material permits the application of root promoting chemicals as a part of the banding process.

MATERIALS AND METHODS

In our present work, the techniques of etiolation and banding were used alone or in combination, as pretreatments to the cutting propagation of a number of woody ornamental species which are listed with their rooting responses in Table 1.

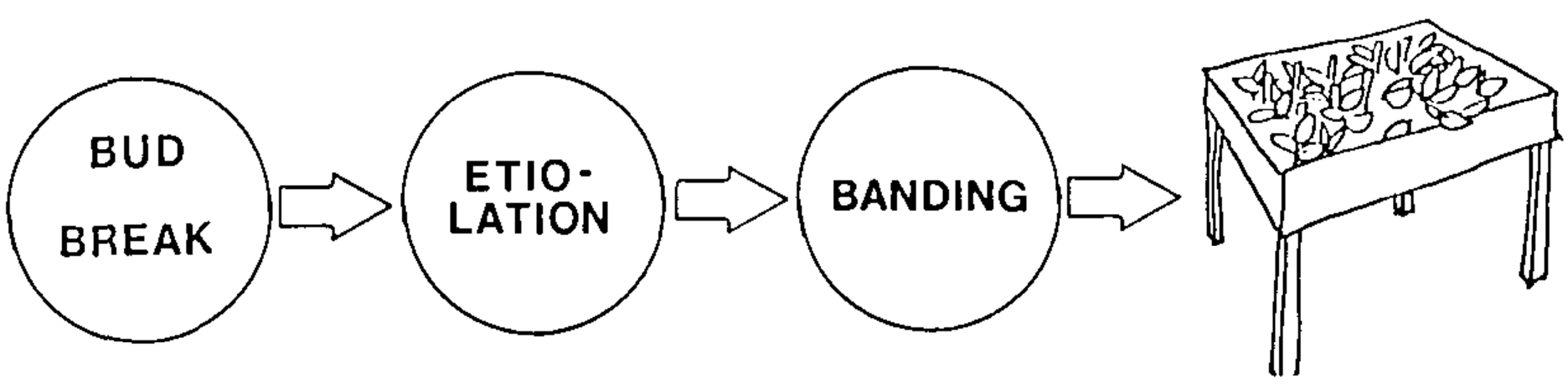
The procedure of etiolation involves erecting a black cloth covered structure over the shoots to be etiolated at the time of bud break and prior to the appearance of leaves. The structure is left in place, excluding light from the developing shoots, until the shoots have elongated enough for bands to be applied (2 to 5 in.). The progress of shoot elongation may be determined by visual inspections made briefly every couple of days. This does not appear to compromise the benefits of etiolation (11). At the time that etiolation is completed the banding material is applied to the base of the etiolated growth. Caution must be exercised at this point because etiolated shoots, lacking protective pigmentation, are susceptible to sun scorching. It is our practice to apply the banding material and then replace the shading cover partway. This allows the entry of a small amount of light. Over the course of one week the cover is gradually rolled back or lifted, allowing shoots to green up. After one week or so the shoots will tolerate exposure to full sunlight; however, the speed with which shoots adjust to higher light levels varies among species. The technique outlined above is presented graphically in Figure 1.

Hormone may be applied with the Velcro band at the time that the shoot is banded. In the present work we used Hormodin 3, a talc preparation containing 8000 ppm IBA. The hormone is applied to the band by pressing an opened band into a layer of the hormone. Excess hormone may be tapped from the band before application to the stem. The hormone laden band is then pressed firmly onto the stem, forcing the hooks of the band into the succulent stem tissues. Wounding of the stem occurs at this time.

After 4 weeks the cutting is made by severing the shoot from the stock plant, just below the band. The band is removed, and the cutting is then placed in the propagation mist

bench for rooting. Before sticking, the cuttings were treated with a talc preparation of 4000 ppm IBA and 25% Captan fungicide. In our research we used a rooting medium of perlite, peat, and white sand (2:1:1 v:v:v). The cuttings received bottom heat of 25°C and incandescent lighting was used to maintain a 16 hour photoperiod.

Figure 1. Etiolation and Banding as Stock Plant Pretreatments



1) Shade placed over shoots before leaves appear, and left in place until shoots reach 2″ to 5″.

2) Shade removed gradually over 1 week.

3) Banding applied when shade is first removed, and bands left on for 4 weeks as shoots green up.

4) Cuttings made just below band. Band removed before cuttings are placed in the propagation bench.

RESULTS

The rooting results for each trial presented here represent 4 treatments which were applied to the stock plants before the cuttings were made. The four shoot treatments were:

(1) light grown and not banded (control);

(2) light grown and banded with Velcro plus hormone;

(3) etiolated and not banded; or

(4) etiolated and subsequently banded with Velcro plus hormone.

The rooting responses of 22 trials, representing 13 species, are presented in Table 1. Information on stock plant age and disposition, and the time allowed for rooting in the propagation bench have been included.

The results show that in 16 of the 23 trials the combination of etiolation and banding resulted in the greatest increase in rooting response. The rooting responses may be grouped into those which responded primarily to etiolation, and those which responded primarily to banding. In the former category we have the shoots taken from a 10-year-old hedge of *Carpinus betulus*, young plants of *Castanea mollissima*, seedlings of *Quercus palustris*, and a 30-year-old hedge of *Q. robur*. Responding more to banding were shoots taken from either seedlings or a 30-year-old hedge of *Carpinus betulus*, a 30-

year-old hedge of *Corylus americana* 'Rush', 6 cultivars of *Syringa vulgaris*, and 3-year-old seedlings of *Pinus strobus*. Shoots from stock plants of *Q. coccinea*, on the other hand, required both pretreatments for a rooting response.

Table 1. Effect of etiolation and banding stock plant pretreatments on the percent rooting of 14 woody ornamental plant species

	Percent rooted[1]				
	Light grown		Etiolated		
Plant	No band	Velcro + hormone	No band	Velcro + hormone	Rooting time (weeks)
Species:					
Acer griseum 1 yr old seedlings	7	12	14	34	4
A. griseum 30 yr old trees	0	0	0	5	4
A. saccharum 1 yr old seedlings	47	64	65	86	2
Betula papyrifera 1 yr old seedlings	51	65	71	100	2
Carpinus betulus 1 yr old seedlings	0	63	5	94	2
C. betulus 10 yr old hedge	19	65	96	92	2
C. betulus 30 yr old hedge	14	52	37	72	2
Castanea mollissima 4 yr old seedlings	0	0	44	100	
Corylus americana cv. Rush 20 yr old hedge	4	83	0	87	4
Pinus mugo 3 yr old seedlings	41	64	–	–	12
P. strobus 3 yr old seedlings	29	79	58	83	12
Quercus coccinea 1 yr old seedlings	0	0	0	46	4
Q. palustris 1 yr old seedlings	31	24	50	44	4
Q. robur 1 yr old seedlings	36	70	53	58	4
Q. robur 30 yr old hedge	0	9	27	36	4
Q. rubra 2 yr old seedlings	37	50	29	35	4
Syringa vulgaris 4 yr old potted shrubs					
'Belle de Nancy'	28	65	21	38	5
'Charles Joly'	0	51	26	63	5
'Charles X'	20	70	45	79	5
'Michel Buchner'	21	79	43	83	5
'Mme. Lemoine'	10	10	21	83	5
'Pres. Grevy'	17	48	35	42	5

[1] Twelve or more cuttings used per treatment. Replicated 3 times when the availability of shoot material permitted.

We observed in nearly every case in which stems were banded with Velcro plus hormone, that the area under the band was swollen by the time the bands were removed after 4 weeks. Moreover, in two of the species, *Betula papyrifera* and *Carpinus betulus*, visible root primordia formed under the band on the stock plant. Cuttings made from these pre-rooted shoots rapidly developed root systems in the propagation bench. This response was noted previously in etiolated and banded apple shoots by Gardner (3) and Howard (8).

DISCUSSION

In the present research the stock plant pretreatments of etiolation and banding yielded very favorable increases in rooting response of a wide range of difficult-to-root woody ornamental plant species. Considering that these trials were the first attempts using etiolation and banding with the majority of these species, the results are especially encouraging. It is anticipated that continued work using these techniques on the same species will result in impressive increases in rooting response. The results obtained with several of these species represent, to the best of our knowledge, the best rooting responses yet achieved. Notably: *Carpinus betulus* (96%), *Castanea mollissima* (100%), *Q. coccinea* (46%), *Q. palustris* (50%), and *Q. rubra* (50%).

It may be recommended, based on this work and the works of previous researchers, that the use of etiolation and banding as stock plant pretreatments to cutting propagation will result in substantial increases in rooting response. In a number of species it appears that the response to one of the treatments alone, i.e. etiolation or banding, may be sufficient to warrant the use of only that stock plant retreatment. For example, the work of a number of researchers on the cutting propagation of apple has indicated that for that species etiolation is about twice as effective as banding in promoting rooting, though the combination of the two pretreatments always resulted in the optimal response (2,3,7,8,9).

The technique of etiolation and banding is especially useful for the propagation of particularly difficult-to-root species, where the value of the propagules warrants the moderate cost of the material needed to etiolate and band the stock plants. It also represents a viable alternative, we believe, to other, more expensive and labor intensive propagation techniques, such as grafting. Etiolation and banding may be applied on any one of a number of scales, from single branches to entire hedges, and even small potted trees. Furthermore, the components involved: the shade enclosure and reusable adhesive bands, are

easily obtained, and may be recycled indefinitely, with a minimum of preparation.

Reusable Velcro adhesive bands represent an improvement over plastic tape in that (1) they are easier to apply and remove, (2) they are reusable, (3) and they serve an added advantage in permitting the application of root promoting chemicals while simultaneously wounding the area of the stem in which we hope adventitious roots will form.

LITERATURE CITED

1. Al Barazi, Z. and W.W. Schwabe. 1984. The possible involvement of polyphenol-oxidase and the auxin-oxidase system in root formation and development in cuttings of *Pistacia vera*. *Jour. Hort. Sci.* 59:453-461.
2. Delargy, J.A. and C.E. Wright. 1979. Root formation in cuttings of apple in relation to auxin application and to etiolation. *New Phytol.* 82:341-347.
3. Gardner, F.E. 1936. Etiolation as a method of rooting apple variety stem cuttings. *Proc. Amer. Soc. Hort. Sci.* 34:323-329.
4. Harrison-Murray, R.S. 1982. Etiolation of stock plants for improved rooting of cuttings. I. Opportunities suggested by work with apple. *Proc. Inter. Plant Prop. Soc.* 31:386-392.
5. Hartmann, H.T. and D.E. Kester. 1983. p. 278 *In* Plant Propagation: Principles and Practices. 4th ed. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
6. Herman, D.E. and C.E. Hess. 1963. The effect of etiolation upon the rooting of cuttings. *Proc. Inter. Plant Prop. Soc.* 13:42-62.
7. Howard, B.H. 1982. Plant propagation. *Rep. E. Malling Res. Stn. for 1981.* pp. 57-72.
8. Howard, B.H. 1983. Plant propagation. *Rep. E. Malling Res. Stn. for 1982.* pp. 59-75.
9. Howard, B.H. 1984. Plant propagation. *Rep. E. Malling Res. Stn. for 1983.* pp. 77-91.
10. Bassuk, N., D. Miske, B. Maynard. 1985. *Proc. Inter. Plant Prop. Soc.* 34:543-550.
11. Rowell, D.J. 1981. Etiolation of stockplants for the improved rooting of cuttings. II. Initial experiences with hardy ornamental nursery stock. *Proc. Inter. Plant Prop. Soc.* 31:392-397.
12. Ryan, G.F. 1969. Etiolation as an aid to propagation. *Proc. Inter. Plant Prop. Soc.* 19:69-71.

PETER VERMEULEN: Do you have a list of plants that were not responsive to your technique?

BRIAN MAYNARD: *Acer rubrum* was not, but all treatments gave easy rooting. *Tilia cordata* also did not respond but work at East Malling showed positive results with that plant.

JOHN SMUGULA: Is the length of etiolation important?

BRIAN MAYNARD: We like the shoots to be long enough so that the shoot tips are not damaged during banding. Probably 2 to 5 in.; however, we have let them go longer.

ART DE WIT: What was your propagation procedure?

BRIAN MAYNARD: We put them in a medium of peat: perlite:sand (1:2:1, v/v/v) under mist and with an extended photoperiod.

MIKE DODGE: I tried the technique after Nina's talk last year but got into trouble when I took the cover off. The shoots just dried up. What did I do wrong?

BRIAN MAYNARD: You have to gradually remove the cover and it is best to start on the north side. You need to get the feel of your own individual plants and environmental conditions.

SEED TREATMENTS TO ENHANCE GERMINATION

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Seedlings are an important source of planting stock for nursery production and, in our case, over 200 species of both coniferous and deciduous plants are seeded. Most kinds of seeds will germinate readily, especially when fall-seeded, and I will not concern myself with them. Instead, I will address the problem seeds, those that have given us poor or no germination in the past, and describe the treatments that we use to produce seedlings of consistent quality and size required for field and understocks production. A number of reasons can be advanced for poor germination, such as, embryoless seed, dried out seed, impermeable seed coats, seeds that have not fully ripened, seeds exhibiting various internal dormancy problems, and last but not least, a reliable seed supplier who supplies fresh seeds in good condition. It is still a good idea to pick as much seed yourself as possible to avoid some of the above problems.

Before any treatment is attempted — as a matter of fact before seeds are collected, a cutting test is conducted to check for the presence of well developed embryos. It has been our experience that during stressful growing conditions, seeds are often devoid of embryos even though the seed coat looks perfectly normal. *Carpinus caroliniana, Liriodendron tulipifera, Rhus typhina* are prime examples of plants that show this problem.

Seed propagation is a fascinating and challenging way of propagation that can often be unpredictable. The treatments