Propagation of *Cercis canadensis* 'Forest Pansy'©

Nicholas J. Murphy
Harley Nursery & Plant Centre, Harley, Shrewsbury, Shropshire SY5 6LP U.K.

***Cercis canadensis* 'Forest Pansy' is a deciduous shrub or tree cultivated for foliage and flowers. It is difficult to propagate vegetatively. Grafting and hardwood cutting trials were carried out in a glasshouse at Pershore College using a hot-pipe callusing system for the grafts and Malling bins for the hardwood cuttings. Four grafting techniques were used in four separate trials carried out over 3-week intervals. Two temperature treatments were used for the hardwood cutting trials. Apical wedge grafts at the earliest date resulted in the highest success rate. In the hardwood cutting trials no callus was produced and no roots were formed at either temperature, however the cooler treatment did yield more cuttings with vegetative growth than the warmer treatment.**

INTRODUCTION

Cercis taxa are deciduous shrubs or trees that can be found in woodland, at woodland margins, and on rocky hillsides in the Mediterranean, Central and East Asia, and North America (Brickell, 1999; Raulston, 1990). *Cercis canadensis* 'Forest Pansy' is cultivated for its foliage and small, pink, pea-like flowers, which are borne profusely in spring (Brickell, 1999; Raulston, 1990). In today's hardy nursery-stock industry, small, compact-flowering trees are in high demand; the genus *Cercis* contains many desirable candidates that can meet this requirement because they can either be grown as a single or multi-stemmed tree in a container, as a specimen in a lawn, in a border in a commercial or residential landscape, or as a specimen tree in a residential street (Gilman and Watson, 1993; Raulston, 1990).

Cercis canadensis cultivars are difficult to propagate vegetatively so for my dissertation at Pershore College I was determined to find a successful method. The time my research could be carried out (October to mid-April) meant that softwood or semi-ripe cuttings could not be taken and that budding couldn't be used; this meant grafting and hardwood cuttings were the two propagation methods trialled. There was very little information on past trials on propagation of *C. canadensis* cultivars so I wrote to growers asking them what grafting technique they used; it was from their replies that I decided on four grafting techniques to trial. The aims of this experiment were to find a successful grafting technique for the propagation of *C. canadensis* 'Forest Pansy' and to examine whether hardwood cuttings were another viable method of propagation.

MATERIALS AND METHODS

The experiments were conducted in a glasshouse at Pershore College. The stock plants used for the scion wood and hardwood cutting material came from a *C. canadensis* 'Forest Pansy' growing at Avonbank Nursery and from plants imported from Holland; the propagation material from the two sources was mixed to randomise its distribution. The rootstocks were bare-root *C. canadensis* seedlings graded at 4 to 6 mm diameter from Oakover Nurseries Ltd. in Kent. The grafting

techniques used were whip and tongue, saddle, apical wedge, and side-cleft; these techniques were carried out at 3-week intervals beginning on 14 Dec. 2004 and ending on 15 Feb. 2005.

Grafts. At each date, 160 grafts were made, i.e., 40 grafts from each grafting technique. Each grafting technique had a control and three replicates that consisted of 10 grafts in each. The finished grafts were dipped in low-melt-point wax then lined out for 14 days on a hot-pipe callusing system at a temperature of 23 ºC. The roots of the grafts were covered with growing medium to prevent drying out. After 14 days the grafts were potted into 2-L pots and lined out on a glasshouse bench in a systematic block design. Observations on callus formation and vegetative growth were made at weekly intervals beginning when the grafts had been completed (Table 1 and Table 2). The Kruskal-Wallis test was used to test the results from the callus formation and stages of vegetative growth scores for statistical significance.

Hardwood Cuttings. Straight hardwood cuttings (20 cm long) were used in the trials. The cuttings were taken on 15 Jan. 2005. The trials were set up in two Malling hardwood-cutting bins run at 10 and 20 ºC with 60 cuttings in each. The cuttings were dipped in Doff hormone rooting powder then lined out in a randomised block design in the bins at equal spacing with nine per row at a 45º angle in a 1 peat : 1 perlite (v/v) growing medium with the top two buds exposed. Observations on root formation and vegetative growth were made on 2 April 2005 (Table 2). The *z* test was used to test the results from the root and vegetative growth scores for statistical significance.

RESULTS

Grafting Trial. The results from all four grafting trials were affected by two fungal outbreaks. Samples of the fungal spores were examined under a microscope: one remained unidentified, but the other was identified as coral spot (*Nectria cinnabarina*). Because the fungus affected later results for the first three grafting dates, the results for the statistical analysis were selected from the 8th week after each date.

Callus Formation and Stages of Vegetative Growth. The most successful grafting technique for callus formation and vegetative growth was the apical wedge graft; it resulted in the highest number of successful grafts from each grafting date. The side-cleft graft was the least successful with the percentage of failed grafts increasing with each successive grafting date while mean callus formation and vegetative growth score decreased with successive grafting date. The most successful grafting date for callus formation and vegetative growth was the earliest (14 Dec.); it resulted in the highest number of successful grafts of each type.

Hardwood Cutting Root Formation. Hardwood cuttings failed to produce any callus or show any sign of forming roots at either temperature.

Stages of Vegetative Growth. The majority of the hardwood cuttings failed to show any sign of producing vegetative growth at either temperature. However, the cooler treatment resulted in more cuttings with vegetative growth than the warmer treatment.

DISCUSSION

Grafting Trial. The apical wedge graft at the earliest grafting date (14 Dec.) resulted in the highest number of successful grafts. *Cercis* has a very thin cambium layer, which makes matching the rootstock and scion difficult. The apical wedge graft exposes cambium on two sides so it increases cambial contact and the chance of the cambial layer being matched successfully. At the 14 Dec. grafting date the propagation material was fully dormant, so when they were lined out on the hot-pipe callusing system it was only the graft union that had its dormancy broken by the heat and was able to form callus. These grafts also had longer to continue to heal before phloem and xylem became "active" in the spring, whereas in the later trials the rootstock and scion might have to become "active" before the graft union had healed, flooding it and causing failure.

Hardwood Cutting Trial. For a cutting to be successful it needs to callus over the wound and develop roots. The type of hardwood cutting used could have affected callus and root formation. Instead of using the cuttings from the current season's growth, a heeled or mallet cutting that retained a piece of the previous year's wood at the base of the cutting could have been used because this serves as a larger store of carbohydrates, which could have improved rooting.

If a hardwood cutting fails to produce vegetative growth it will die because it can't replenish its store of carbohydrates, which it uses to survive the dormant season and produce roots. The cooler treatment cuttings produced more vegetative growth than the warmer treatment, in agreement with the findings of Dick (1982), who states a lower temperature for longer period of time is better than a warmer temperature for a shorter period of time. Whalley and Loach (1981) also state that the longer a hardwood cutting is kept in a heated bin the more its stores of carbohydrates will deplete and with it its chance of establishing itself. Perhaps if the cuttings had been kept at a low temperature then potted on after a shorter period they would have been more successful.

Table 1. Callus formation scoring system.

Callus formation scoring	Callus characteristic
0	A lightening in the colour of the scion material. When a knife edge is lightly scraped over the surface of the bark the cortex will be pale, not green.
1	There will be a mass of undifferentiated parenchyma cells, which are visible around 0% to 25% of the edge of the graft union.
2	There will be a mass of undifferentiated parenchyma cells which are visible around 26% to 50% of the edge of the graft union.
3	There will be a mass of undifferentiated parenchyma cells which are visible around 51% to 65% of the edge of the graft union.
4	There will be a mass of undifferentiated parenchyma cells, which are visible over 76% of the edge of the graft union.

Table 2. Stages of vegetative growth scoring system.

Stage of development	Bud characteristics
1. None	No expansion in length or diameter. Bud colour dull, like that of an overwintering bud. Bud tip acute.
2. Slight	Slight increase in length, but little or no increase in diameter. Bud colour brown-red. Bud tip acute.
3. Slight to medium	Acropetal one-fourth to one-half increased in length, but little increase in diameter. Colour similar to Stage Two. Bud tip acute.
4. Medium	Acropetal one-half to three-fourths increased in length, but only slight increase in diameter. Colour similar to Stages 1 and 3. Bud tip acute.
5. Medium to maximum	Bud increased in length over the entire bud surface and exhibited a marked increase in diameter. Colour similar to Stages 2, 3, and 4. Bud tip blunt (obtuse)
6. Maximum	Buds much increased in length and diameter over Stage 5 buds. Colour much lighter than in the previous stages due to extreme expansion of bud. Bud tip rounded.
7. Burst	Bud scales separated; leaf tips exposed; new stem not visible.
8. Expanded 1–7 inches	New stem visible and stem elongated 1 to 7 inches.

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