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CONTRACT REPORT

FINAL REPORT

THE INFLUENCE OF PRUNING, ROOTSTOCK TYPE, PLANTING METHOD AND UNDERCUTTING ON THE CONTAINERISATION OF BUSH ROSES

Horticultural Development Council
Project HNS 56
1996

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AUTHENTICATION

I declare that this work was done under my supervision according to the procedures described herein and that this report represents a true and accurate record of the results obtained.

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COMMERCIAL – IN CONFIDENCE

Final Report December 1996

HDC HNS 56

THE INFLUENCE OF PRUNING, ROOTSTOCK TYPE, PLANTING METHOD AND UNDERCUTTING ON THE CONTAINERISATION OF BUSH ROSES

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RELEVANCE TO GROWERS AND PRACTICAL APPLICATION

Application

A shallow undercut to a depth of 150 mm in early autumn in the budding year, offers potential for improving the root system of plants destined for containerisation, particularly when budded on 'Laxa' rootstock. While shallow undercutting resulted in lighter grade plants when lifted a year later in this trial, these grew and flowered for spring / summer sales as well as untreated plants.

Summary

An increasing proportion of field grown roses are containerised before sale, and the potting operation often involves pruning away a significant amount of root in order to accommodate the plant in the container. Under some circumstances, this may affect establishment, as well as slowing down the potting operation. A trial was established at HRI Efford to investigate a number of factors and potential treatments which might improve the fibrousness and distribution of roots on plants in the field, and reduce the amount of root pruning required at potting.

Rosa 'Laxa' and *R. canina* 'Inermis' were compared as rootstocks for the hybrid tea and floribunda cultivars Amber Queen, Indian Summer, Margaret Merril, Silver Jubilee and Royal William. In a second trial alongside, 'Inermis' alone was used for the patio and compact floribunda cultivars Baby Love, Trumpeter, Sweet Dream, Rosy Future and Festival.

Neither hand vs. machine planting, nor 'severe' vs. 'normal' pruning of the rootstocks at planting, had a very significant effect on rootstock establishment, budtake or subsequent root or shoot development.

Half the plants were given a shallow undercutting treatment to about 150 mm below soil level using an Egedal angled blade undercutter in October 1994 to try and encourage fine root production from high up the root system near to the neck. Note that this was a distinctly separate operation from the normal deep undercutting with a 'J'-blade a year later to aid lifting. This shallow undercut significantly reduced shoot growth of all cultivars the following year. Undercut plants were between two-thirds and three-quarters the height of non-undercut bushes, had about three-quarters the number of shoots in total and only half the number of thick shoots by October 1995. The spring and summer was particularly dry in 1995; more work is required to see whether additional irrigation would have reduced the check to shoot growth from the undercutting treatment.

Undercutting nevertheless improved the distribution and form of the roots for potting, with the creation of a more fibrous root and compact root system. The number and weight of roots requiring pruning at potting was greatly reduced by this treatment. Effects were particularly pronounced for 'Laxa', where many more thick and deep roots required pruning on non-undercut plants. Although 'Inermis' was also affected by the undercutting treatment, non-undercut bushes naturally produced a finer root system with fewer deep, thick roots than 'Laxa' requiring less severe pruning prior to potting.

Undercut and non-undercut plants on both rootstocks for three of the HT / floribunda and three patio cultivars were potted in early December 1995. They were held under a ventilated polythene tunnel overwinter before being spaced out on outside beds where they were given pot drip irrigation. Plants were assessed for the timing of key growth stages, early and final root development, and final size and numbers of flowers.

No treatments suffered any plant losses in the containers, and growth was generally good over the trial. The undercut treated plants tended to break bud and leaf out earlier than non-undercut ones, and also show slightly more rapid development of new roots in the container. This may have been due to the presence of more active root tips present at potting compared to plants which required more severe root pruning at that stage. Differences in plant size, root growth and numbers of flowers by the time plants reached a marketable stage were small and of little commercial significance.

It was concluded that roses can tolerate quite severe root pruning at potting if growing-on conditions are good, but that nevertheless a shallow undercutting field treatment may still be worthwhile if the potting operation and plant handling can be improved by reducing the pruning required. This is likely to be the case while 'Laxa' remains the predominant rootstock. Under less favourable growing on conditions, perhaps following later pottings, undercut plants may show improved establishment over non-undercut ones, but further work is needed to prove this.

Action points

- Rootstocks will tolerate quite severe root trimming prior to planting and this should be tailored to suit the mechanical planting operation. However the severity of trimming is unlikely to significantly influence the nature of the root system when plants are lifted two growing seasons later.

- Rootstock 'Inermis' will produce a root system naturally, which is easier to containerise, but this rootstock is not generally favoured because it suckers more freely. The source of 'Laxa' will affect the length of neck and, indirectly, the amount of subsequent root pruning required to bury the excess neck at potting.

- A shallow undercut operation to a depth of about 150 mm in the early autumn of the budding year (eg. October) should be considered for plants destined for containerisation. This will encourage a more compact, and more fibrous root system with fewer long, deep roots, requiring less pruning at potting, particularly on 'Laxa'.

- Shallow undercutting may result in less vigorous shoot growth in the bush production year in the field, particularly if dry. Attention to irrigation at this time is recommended. Nevertheless, if destined for potting, these lighter weight plants should produce as good growth when marketed for flowering spring / summer sales as conventional stock.

INTRODUCTION

In order to meet the increasing demand both for quantity and quality of containerised roses, it has been necessary to adapt and develop production practices. Of key importance is the successful survival, establishment and subsequent growth of the rose after potting. Many factors, including growing media structure, nutrition and timing of potting may influence this, but in addition, dealing with the root system from a field grown crop during the potting operation can be a significant problem. *Rosa* 'Laxa' rootstocks typically produce long tap roots with relatively little fibrous root. This, together with the long rootstock 'neck' which also needs to be buried, typically means that extensive root pruning is needed to pot the plant centrally and deeply enough, unless much larger containers are used than are strictly necessary, adding to the costs. Deep pots were developed in an attempt to overcome the problem, and those such as the 4 litre Optipot 17RX are now standard for many nurseries. Nevertheless, it is thought that the absence of much of the fine root on many plants, together with the severe root pruning still needed for the remaining structural roots, may be significant factors in contributing to the slow establishment or even death of some rose plants following containerisation.

The overall objective of the project was to identify techniques to improve the distribution and fibrousness of the root system formed in the field on two year bush rose crops destined for containerisation, and to monitor these effects on subsequent performance in the container.

This project was split into a rose bush production (field growth) stage followed by a container growth stage. The first stage, covering the period March 1994 - November 1995, was reported on in detail in the interim report issued February 1996. This report covers details of the second stage monitoring effects of selected field growth treatments on the establishment, growth and quality in the container, up to the point of marketing in summer 1996.

Of the original treatments carried out in the field, a shallow 150 mm depth undercutting treatment at the end of the budding year in October 1994, had the most significant effect on the nature of the root system. This treatment was a separate operation from the conventional deep undercutting with a 'J'-blade used at the end of the crop to aid lifting. These undercut plants, had a much more fibrous root system. For cultivars budded on to 'Laxa' rootstocks in particular, they also had to have much less root removed prior to potting than non-undercut plants. A consequence of the undercutting treatment in this trial was that shoot growth in the second year in the field was checked, and plants had a lighter shoot framework when lifted for potting. Of particular interest for the second stage of the project was whether the less heavily root pruned undercut treatment would establish better. Also whether the lighter weight top growth present on these plants would produce poorer plants for sale the following spring / summer.

MATERIALS AND METHODS

Field treatments continued to the container growing on stage

The field treatments of Machine vs. Hand planting rootstocks, and Severe vs. Standard root pruning treatments of rootstocks prior to planting, had little effect on the root system of the plants when lifted. Plants from these treatments were therefore bulked together within the other treatments - rootstock type and shallow undercutting treatments - which had made a significant effect on root and shoot growth in the field. Also, only six of the original ten cultivars used in the field were taken through for container assessments.

Rootstock selections:	*Rosa dumetorum* 'Laxa'		
	Rosa canina 'Inermis'		
Undercutting:	Shallow undercut to 150 mm by Egedal undercutter in October 1994		
	Not undercut		
Flowering cultivars:	Silver Jubilee	HT	pink
	Indian Summer	HT	creamy orange
	Amber Queen	Fl	amber
(Patios on 'Inermis' only)	Festival	Patio	scarlet
	Rosy Future	Patio	bright pink
	Baby Love	Patio	yellow

Design and layout

HT / Fl cultivars:
2 rootstocks x 2 undercutting treatments x 3 flowering cultivars = 12 treatments.

Patio cultivars:
1 rootstock x 2 undercutting treatments x 3 flowering cultivars = 6 treatments.

Treatments were replicated 4 times.
Plot size: 10 plants per plot.

18 treatments total x 10 plants/plot x 4 replicates = 720 plants total.

After plants were moved out of the ventilated tunnel environment where they were overwintered, they were arranged on the outside growing beds in a split-plot design (Appendix I, p. 26). Rootstock and undercutting sub-plot treatments were randomised within main plots consisting of flowering cultivars. The possibility of undesired shading effects occurring from cultivars of

different heights was thus minimised by keeping all plots of the same cultivar, within a replicate, together.

The ten plants per plot were arranged in two rows of five plants across the bed at a 300 mm x 270 mm pot centre spacing. The HT plus floribunda cultivars, and the patio cultivars were laid out on the beds, and records analysed as two separate experiments.

Culture

As described in the previous interim report, the plants taken on for root assessment and containerisation were lifted from the field, and assessed in mid November 1995. The shoots of all plants were trimmed to about 120 mm from the bud union. The roots were trimmed to fit the shape of a deep 4 litre pot (ie. Optipot 17RX) as part of the root assessment. In practice, this meant that the longest roots were about 200 mm as measured from the bud union.

Following the root assessment, plants were heeled back into the field and held for a short period until early December when they were potted into deep 4 litre Optipot 17RX containers in the following growing medium:

100% Premium Grade (medium / coarse) Shamrock Irish Moss Peat containing:

	kg/m^3	rate per 270 litre bale
Magnesian limestone	2.4	650 g
Ficote 140 TE	3.0	810 g

Plants were watered in well after potting but held under a polythene tunnel overwinter, mainly to protect against waterlogging from excessive rainfall (Plate 2, p. 29). Temperatures were kept cool, particularly during sunny spells, by raising the tunnel side and end vents. On 14 March, when most cultivars were at the first leaf expansion stage, the plants were moved outside onto a permeable woven polypropylene covered base. They were set at their final spacing of 270 mm x 300 mm pot centres at this time. Overhead irrigation by hand was used in the tunnel and initially outside until 1 May, when most watering was provided via a low level system with a single dripper outlet per container. Occasional backup hand watering was still required during the season in hot periods, particularly on exposed ends and edges of the beds.

Dichlofluanid (as Elvaron at 5.0 g/litre) plus heptenophos (as Hostaquick at 0.75 ml/litre) as a high volume spray was used as a general disease prevention precaution and for aphid control in late February once new growth started to develop. Further pest and disease control sprays were applied at about 14 day intervals throughout the life of the crop. Fungicide sprays consisted of a rotation of carbendazim + dodemorph (as Bavistin DF at 0.5 g/litre + F238 at 1.25 ml/litre), myclobutanil (as Systhane 6W or Flo at 1.0 g/litre or 1.0 ml/litre) and bupirimate + triforine

(as Nimrod T at 3.2 mls/litre). Insecticides, mainly for aphid control, were added to most fungicide sprays either as dimethoate (as Dimethoate 40 at 0.85 g/litre), deltamethrin (as Decis at 0.7 ml/litre) or heptenophos (as Hostaquick at 0.75 ml/litre). A spray of nicotine (as Nicosoap at 6.6 ml/litre) was also applied alone in mid July for aphid control. A single application of oxadiazon (as Ronstar 2G at 20 g/m^2 bed area) was applied on 15 April for weed control.

Records

Shoot growth development

The dates of key development stages for shoot growth were recorded using a system based on that developed for the HNS 65 and MAFF funded projects on container rose scheduling.

Key growth stages:

Bud burst (i.e. the point of the bud begins to open and the tips of individual leaflets can be distinguished).

First expanded leaf (i.e. when the first leaflets had flattened out and were no longer folded along the midrib).

First appearance of flower bud (i.e. when terminal flower buds can be easily seen in the apex of shoots).

Colour visible in flower bud (i.e. prior to flowers opening when petal colour is visible between the flower bud calyces).

These stages were determined for observations on a whole plot basis. For bud burst and first expanded leaf, the date was recorded when >50% of the terminal buds on the main shoot framework of all the plants in a plot reached that stage. For the later stages, the point at which >50% of plants in the plot had one or more flower buds visible or showing colour was recorded. Plants were recorded for growth stage typically twice a week, and interpolations of dates made for in-between days (e.g. for plots which had 'just passed' a stage when observed).

Root development

Early root development was observed on 28 March 1996, shortly after plants were stood outside. Because the root system was not yet fully established in the pot, and there was a danger of the growing media potball falling apart as plants were turned out, only two replicates of the cultivar Silver Jubilee (HT) and all four replicates of Baby Love (patio) were recorded at this stage. Root cover visible on the outside of the potball was scored 1, 3 or 5 (Plate 3, p. 30).

Root development by the time plants reached a marketable stage was also recorded, but on all plants in the trial. All five degrees of a 1 - 5 scale for quantity of root was used, but as a relative scale was not directly comparable to the earlier assessment (see Plate 4, p. 32) where only scores 1, 3 and 5 shown).

The colour of the root was also scored as an indication of the age / maturity of the root system:

1 = mainly brown root present
2 = similar proportions of brown and white root
3 = mainly white root present

Finally, as there appeared to be a difference in the amount of strong, thick, new roots visible as opposed to finer fibrous roots, plants were scored either:

1 = predominantly 'thin' roots
2 = predominantly 'thick' roots

Visual appearance at 'marketing stage'

As a particular cultivar and batch of plants will typically be marketed over a period of time, there is no clearly defined 'marketing stage' for container roses in flower. However the stage when flower buds are just beginning to show colour, but before too many flowers have fully opened, is generally regarded as the optimum time. Final 'marketing stage' records of plant size, flowering and root appearance were carried out as each cultivar reached this optimum stage, or shortly afterwards. Cultivars were recorded about one to two weeks after they had reached the first 'bud colour' stage; this also allowed sufficient time for all the flower buds in the early summer flush to become visible. Recording was also done 'by replicate' to minimise any bias towards individual treatments.

Cultivar	Recording period
Baby Love	6/6 - 11/6
Indian Summer	11/6 - 13/6
Amber Queen	13/6 - 18/6
Silver Jubilee	18/6 - 19/6
Festival	19/6 - 20/6
Rosy Future	20/6 - 25/6

Plant height was measured from the surface of the growing medium to the end of the longest shoot (typically to the base of a terminal flower). Width was measured at the widest point and at 90° to it.

Flower numbers were counted, both as the number of buds at the 'bud colour' stage and beyond (including any 'blown' or dead blooms), and immature buds not yet showing colour.

Statistical analyses

Note on statistical terms and usage

NS	Not significant.
LSD	Least significant difference. I.e. the minimum difference when comparing two means within a data set that is required for the means to be statistically different at the quoted probability level.
$P<0.05$	The probability of this result occurring by chance is equal to or less than 1 in 20 ($0.05 = 5\%$). The other lower (more stringent) probability levels often quoted are $P<0.01$ (1%) and $P<0.001$ (0.1%).
SED and df	The standard error of difference (SED) indicates the amount of unwanted variation associated with the data, and the degrees of freedom (df) is related to the sample size of the data being analysed. These values are required in calculations to obtain the LSD, for example, and are included for readers requiring more complete statistical information.

Plot means for all variates recorded were subjected to analysis of variance (ANOVA) to assess the significance of the results. The HT and floribunda cultivars were analysed separately from the patios. In some cases, where one cultivar was clearly very different for a variate being measured (such as Silver Jubilee which carried less than 40% of the number of flowers of Amber Queen and Indian Summer), analysis was repeated excluding the dissimilar cultivar.

The ANOVA helps determine which treatments or combinations of treatments have shown statistically significant effects, and gives an estimate of the 'background' or non-treatment induced variation present. Where appropriate, treatment means can then be compared to see whether the difference between them is likely to be real, (ie it is 'statistically significant'), or whether the probability of it occurring by chance is unacceptably high.

The $P<5\%$ level is widely used for biological experiments as an acceptable probability level that the treatment differences observed are not due to chance, and are thus 'significant'. Note that the absolute size of treatment differences required for significance will be influenced by many factors contributing to the precision of the experiment, and what variate is being measured. It may thus be possible to detect very small differences to a high level of significance in a controlled trial, for example, but these differences may be of little practical importance. Conversely, large and apparently important differences between treatment means may not be statistically significant if there is a lot of non-treatment related variability associated with them. Clearly, careful interpretation of the results is therefore required to take these factors into account.

RESULTS

Shoot growth development dates were analysed and have been tabulated as day numbers to make relative comparisons between treatments. The table in Appendix II, p. 27 converts day number to date for the 366 day leap year of 1996. Root cover scores, flowering and size data is summarised graphically.

For clarity, where interactions between sub-plot treatments (e.g. rootstock x undercutting) have not been significant, data tables or histogram charts may show means for one treatment (e.g. undercutting) averaged across both levels of another (e.g. rootstocks). LSD's appropriate to the comparisons that are valid for each analysis have been given in tables and as LSD bars on the charts.

Establishment and general crop growth

In this trial, establishment of plants in containers was excellent across all treatments, and there were no plant losses throughout the assessment period. Pests and diseases were kept at low levels.

Some scorching of young leaf growth occurred in late April / early May following the application of the Ronstar 2G granular herbicide. This was attributed to some of the granules sticking to foliage which had not completely dried from early morning dew, even though overhead watering was applied immediately after application to rinse off plants. Damage to new growth was transient and not severe, however, and plants appeared not to suffer any long term check.

The overall impression when viewing the plants outside, was that of a good quality and uniform crop with no very marked differences in overall plant quality between plots.

Shoot growth development stages

Dates, as day number, for the key growth stages of bud burst, first expanded leaf, flower bud appearance and flower colour visible are summarised in Tables 1 - 4 respectively.

In most cases, as might be expected, differences between cultivars in development times were large and highly significant. However early bud burst did not always lead to early flowering. Indian Summer, for example, was 16 - 19 days later to burst bud on average than the other cultivars (Table 1, p. 11), but was the earliest cultivar to develop flower buds (Tables 3 & 4, pp. 13 & 14). The patio cultivars rapidly expanded leaves once they had burst bud, but flower buds took longer to appear subsequently, compared to the HT and floribundas.

Table 1 Date of bud burst. Day number 1996.

	'Inermis'		'Laxa'		Mean for cultivar (date)	
	U/cut	Not U/cut	U/cut	Not U/cut		
HT / Floribundas						
Amber Queen	36.0	39.0	36.5	44.0	38.9	(8 Feb)
Indian Summer	52.5	55.0	53.8	57.0	54.6	(24 Feb)
Silver Jubilee	36.0	36.0	36.0	36.0	36.0	(5 Feb)
Horizontal comparisons of means within same cultivar						
SED (27 df)	*0.970*					
LSD (5%)	*1.99*					
Vertical comparisons between overall cultivar means						
SED (6 df)	*0.335*					
LSD (5%)	*0.82*					
Patios						
Baby Love	36.0	36.0			36.0	(5 Feb)
Rosy Future	36.0	36.0			36.0	(5 Feb)
Festival	36.0	36.0			36.0	(5 Feb)

The undercut treated plants burst bud earlier than the non-undercut ones for Amber Queen and Indian Summer, but there was no difference for Silver Jubilee or the patio cultivars. Amber Queen budded onto 'Laxa' rootstocks gave the largest difference of 8 days in the date of bud burst.

The date of the first expanded leaf was not significantly affected by the type of rootstock, but this stage was reached by undercut plants 11 days earlier for Amber Queen and 3.5 days earlier for Indian Summer, but the 2 days earliness for Silver Jubilee was not statistically significant (Table 2, p. 12). Expanded leaf stage was advanced by undercutting by about 2.5 days for the patios on average, although the difference was very small for Rosy Future.

Table 2 Date of first expanded leaf. Day number 1996.

	Undercut	Not undercut	Mean for cultivar (date)	
HT / Floribundas				
Amber Queen	74.6	86.0	80.3	(20 Mar)
Indian Summer	94.0	97.5	95.8	(5 Apr)
Silver Jubilee	81.6	83.9	82.6	(23 Mar)
Horizontal comparisons of means within same cultivar				
SED (27 df)	*1.51*			
LSD (5%)	*3.1*			
Vertical comparisons between overall cultivar means				
SED (6 df)	*1.34*			
LSD (5%)	*3.3*			
Patios				
Baby Love	63.0	67.5	65.3	(5 Mar)
Rosy Future	65.5	66.0	70.3	(10 Mar)
Festival	67.3	70.3	68.8	(9 Mar)
Mean	65.3	67.9		
Horizontal comparison of u/cut vs not u/cut overall means				
SED (9 df)	*0.86*			
LSD (5%)	*1.9*			
Vertical comparisons between overall cultivar means				
SED (6 df)	*1.09*			
LSD (5%)	*2.7*			

The effects of undercutting on development time appeared to have virtually disappeared by the time plants had developed flower buds. Thus on average there was only 1 days advancement in the date of first flower bud visible for the HT and Fl cultivars, and no difference for the patios (Table 3). Some undercutting effects were evident again later for the dates when flower colour became visible, but now Silver Jubilee, which had shown little earlier effects was now 4.5 days earlier from the undercut treatment (Table 4, p. 14). Conversely, flowering time of Amber Queen appeared little influenced by treatments whereas undercut plants had clearly been significantly earlier to leaf out.

Table 3 Date of flower buds first visible. Day number 1996.

	Undercut	Not undercut	Mean for cultivar (date)	
HT / Floribundas				
Amber Queen	130.0	130.8	130.4	(9 May)
Indian Summer	128.3	129.5	128.9	(8 May)
Silver Jubilee	133.8	135.3	134.5	(14 May)
Mean	130.7	131.8		
Horizontal comparison of u/cut vs not u/cut overall means				
SED (27 df)	*0.35*			
LSD (5%)	*0.7*			
Vertical comparisons between overall cultivar means				
SED (6 df)	*0.71*			
LSD (5%)	*1.7*			
Patios				
Baby Love	132.5	132.5	132.5	(12 May)
Rosy Future	149.3	150.8	150.0	(29 May)
Festival	138.0	138.0	138.0	(17 May)
Vertical comparisons between overall cultivar means				
SED (6 df)	*0.64*			
LSD (5%)	*1.58*			

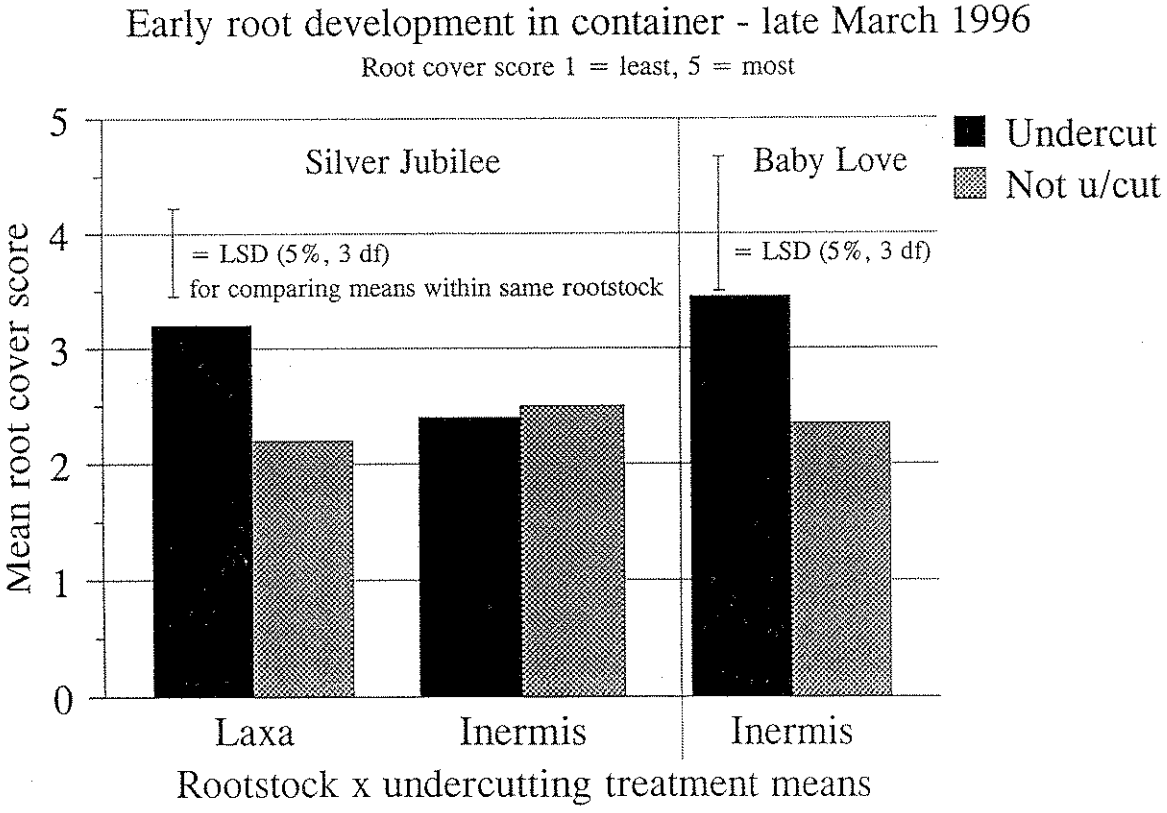
Table 4 **Date of colour visible in flower bud. Day number 1996.**

	Undercut	Not undercut	Mean for cultivar (date)	
HT / Floribundas				
Amber Queen	159.0	159.8	159.4	(7 June)
Indian Summer	150.3	153.1	151.7	(31 May)
Silver Jubilee	162.4	166.9	164.6	(13 June)
Horizontal comparisons of means within same cultivar				
SED (27 df)	*0.80*			
LSD (5%)	*1.7*			
Vertical comparisons between overall cultivar means				
SED (6 df)	*0.91*			
LSD (5%)	*2.2*			
Patios				
Baby Love	154.0	154.3	154.1	(2 June)
Rosy Future	165.5	167.0	166.3	(14 June)
Festival	162.5	163.5	163.0	(11 June)
Vertical comparisons between overall cultivar means				
SED (6 df)	*1.29*			
LSD (5%)	*3.2*			

Root development

The observation of early root development on just two of the cultivars, did suggest that undercutting had encouraged slightly more early root development by the end of March (Figure 1). However, with Silver Jubilee, this showed up only on 'Laxa' (where the non-undercut plants required a lot more root pruning during the potting operation than the other three treatments for this cultivar). Although budded on 'Inermis' only, undercut Baby Love plants did show a trend towards earlier rooting (almost significant at $P<5\%$), and these plants had also needed much less root pruning at potting than the non-undercut ones.

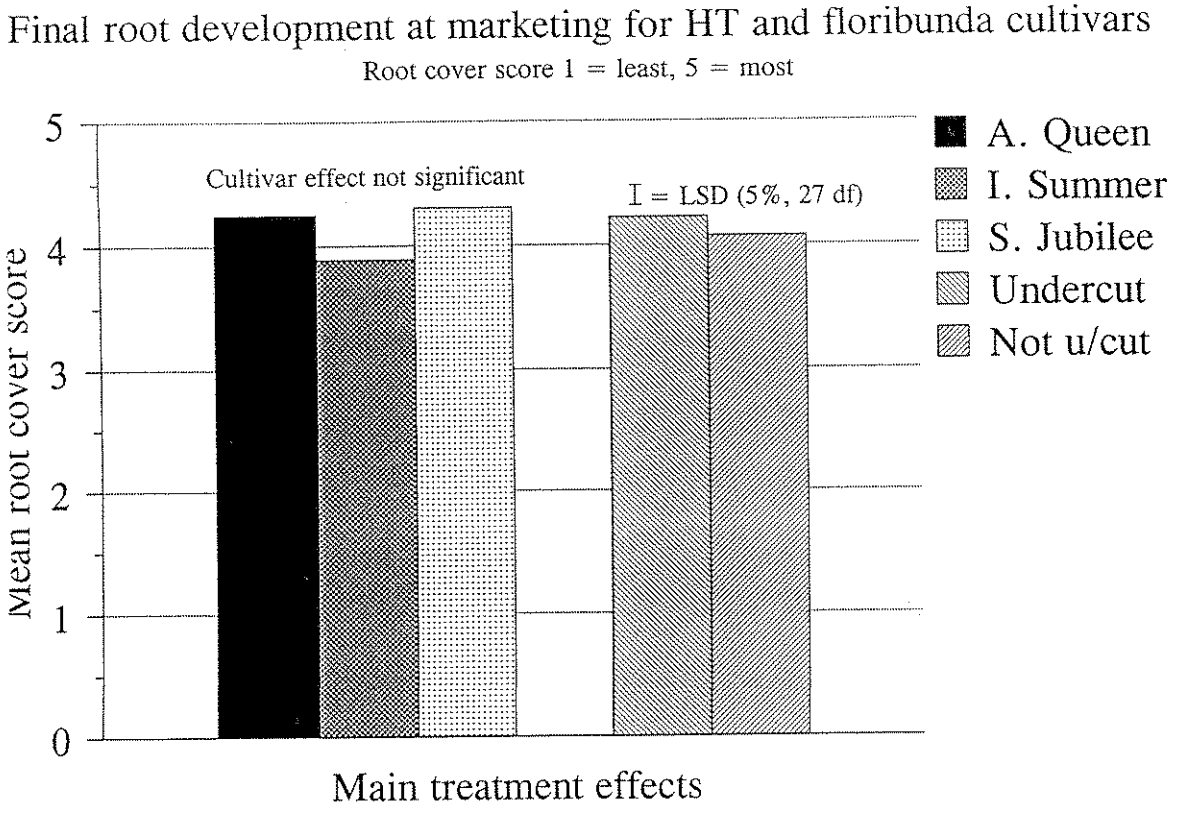
Figure 1.

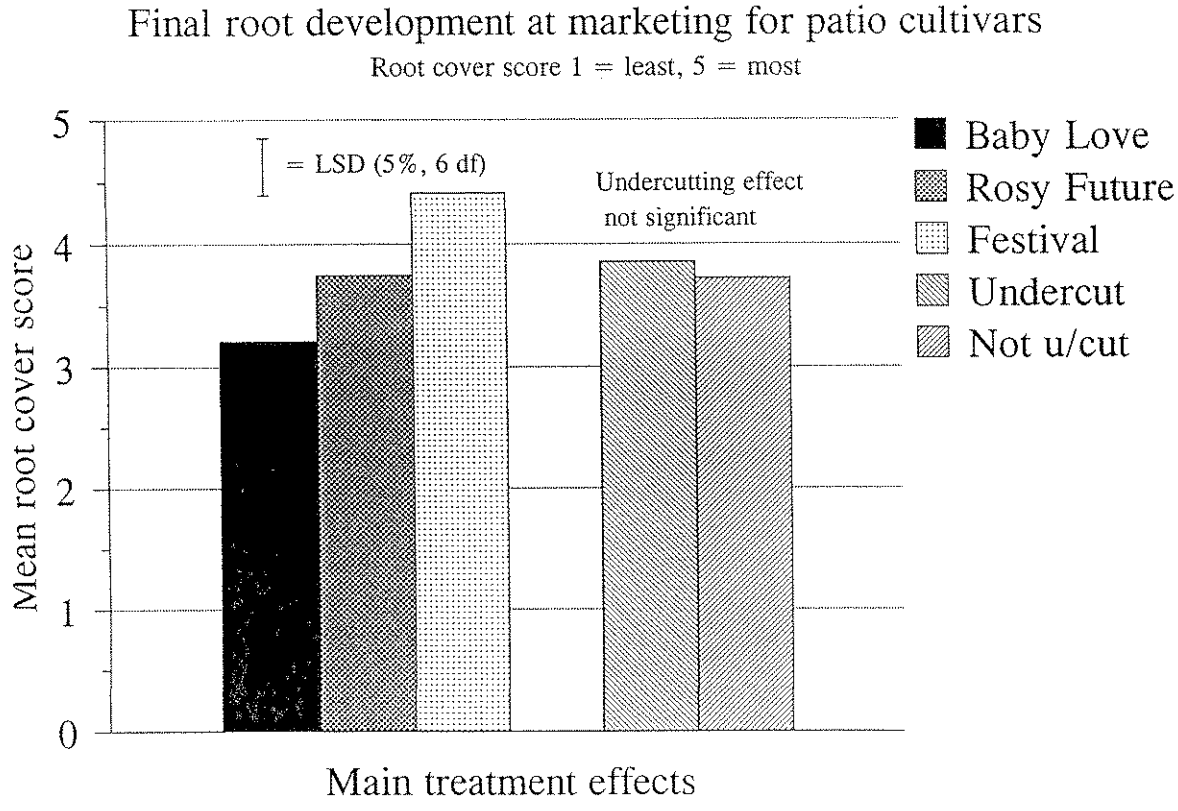


By the time plants had reached marketing stage, effects of the undercutting treatments were minimal or not significant on the amount of root visible on the outside of the potball. The type of rootstock also had no effect. Differences between cultivars were more obvious; while these were not statistically significant for the HT and floribunda cultivars, Festival gave the highest score and Baby Love the least amongst the patios (Figures 2 & 3, p. 16).

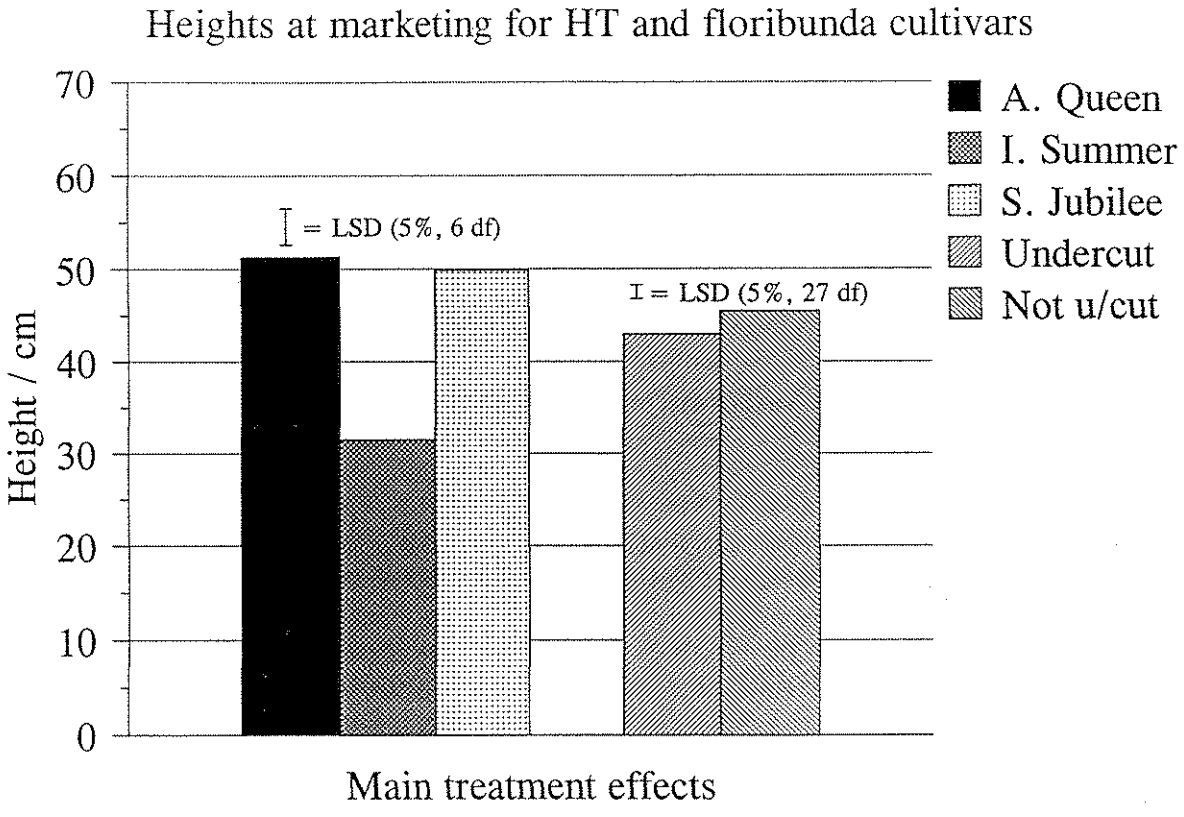
The thickness of root present, or its colour was not markedly affected by rootstock or undercutting treatment. Baby Love had a slightly higher proportion of brown root, however, than the other patios, as did Indian Summer amongst the HT and floribundas (data not shown).

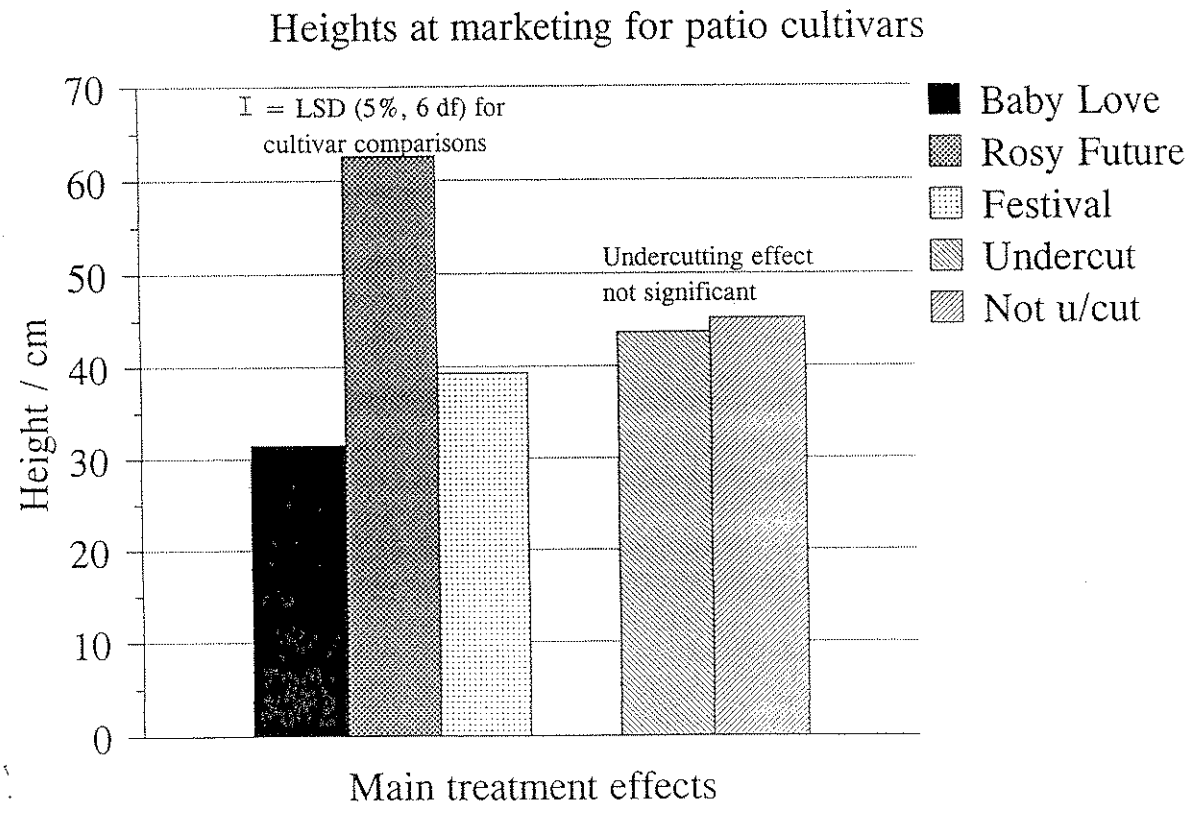
Figures 2 & 3.


Final root development at marketing for HT and floribunda cultivars
Root cover score 1 = least, 5 = most
Cultivar effect not significant
I = LSD (5%, 27 df)
A. Queen
I. Summer
S. Jubilee
Undercut
Not u/cut
Mean root cover score
0
1
2
3
4
5
Main treatment effects


Final root development at marketing for patio cultivars
Root cover score 1 = least, 5 = most
= LSD (5%, 6 df)
Undercutting effect
not significant
Baby Love
Rosy Future
Festival
Undercut
Not u/cut
Mean root cover score
0
1
2
3
4
5
Main treatment effects

Figures 4 & 5.


Heights at marketing for HT and floribunda cultivars
70
60
50
40
30
20
10
0
Height / cm
I = LSD (5%, 6 df)
I = LSD (5%, 27 df)
A. Queen
I. Summer
S. Jubilee
Undercut
Not u/cut
Main treatment effects

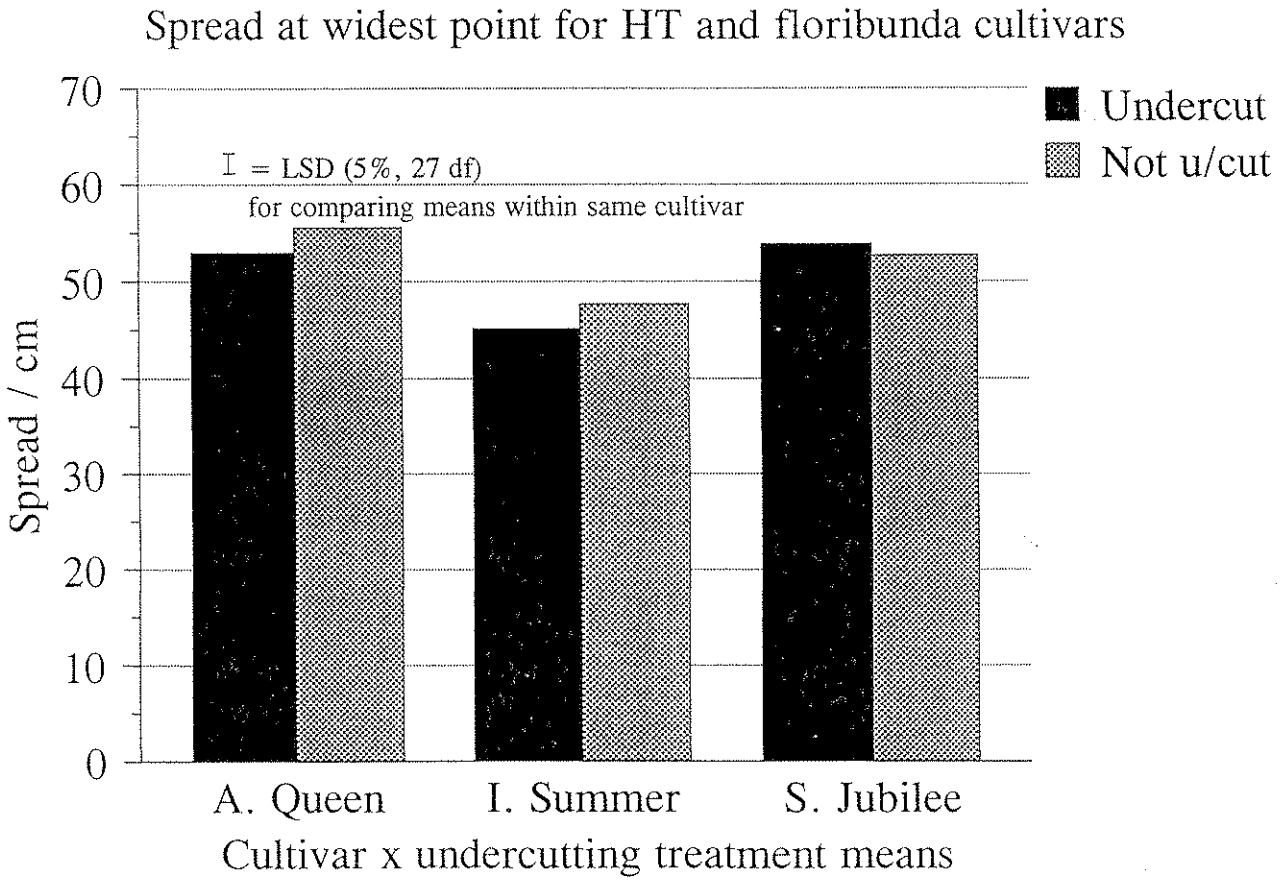

Heights at marketing for patio cultivars
70
60
50
40
30
20
10
0
Height / cm
I = LSD (5%, 6 df) for
cultivar comparisons
Undercutting effect
not significant
Baby Love
Rosy Future
Festival
Undercut
Not u/cut
Main treatment effects

Plant height and spread

Cultivars varied markedly in height, Silver Jubilee and Amber Queen averaging 50 cm compared to Indian Summer at 30 cm (Figure 4, p. 17). Amongst the patios, Rosy Future was unusually tall for a cultivar described as a patio, averaging over 60 cm, but this was due to each plant carrying several tall flower cluster bearing shoots above the bushier growth below (Plate 7, p. 34). Festival averaged about 40 cm in height with Baby Love the most compact at 30 cm (Figure 5, p. 17).

Again, there was no influence from rootstock treatments, and undercutting had only a small or non-significant effect. For the HT and floribundas, where mean differences between undercutting treatments were statistically significant ($P < 1\%$), this only represented 2.5 cm or about a 5% difference in height. Likewise, undercut Amber Queen and Indian Summer plants had a spread of only about 2.5 cm or 5% less than the non-undercut plants (Figure 6). There was no difference in spread for Silver Jubilee or the patio cultivars (data not shown).

Figure 6.

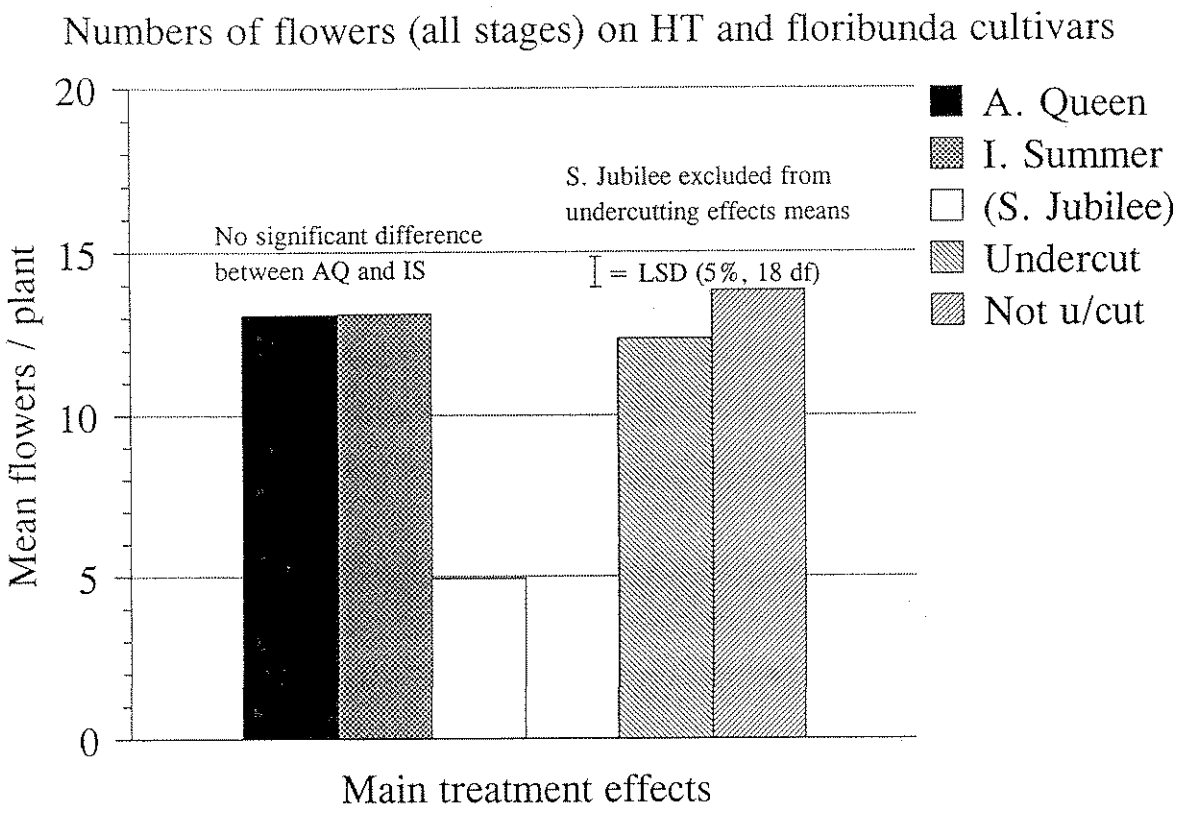


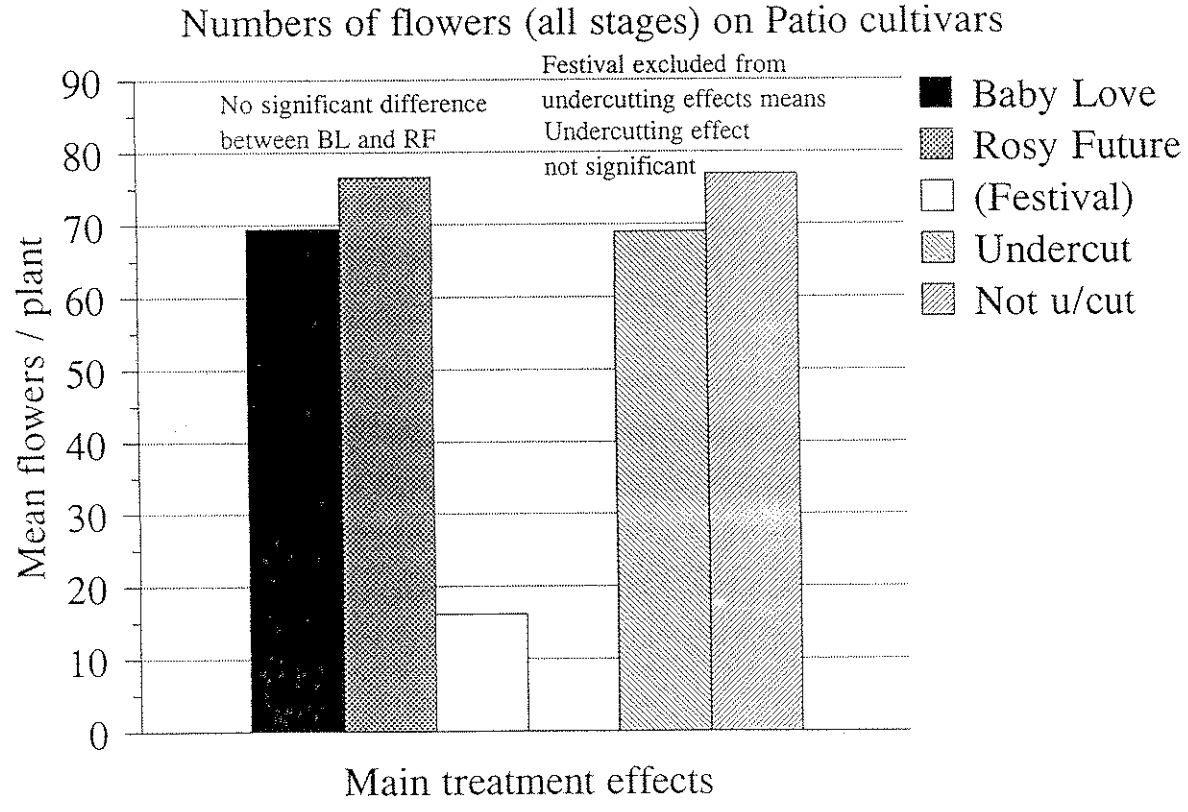
Numbers of flowers

Although the numbers of flowers present at the pre- and post bud colour stage were recorded and analysed, the total number of flowers (all stages) is presented here for simplicity, as it illustrates the most important trends. These are shown in Figures 7 & 8, p. 20. See also Plates 5 - 7, pp. 32 - 34.

A consequence of the cultivar characteristics of Silver Jubilee and Festival was that they carried considerably fewer flowers than the other two cultivars in each of their groups, which meant that it was appropriate to exclude them from the same statistical analysis, although their mean numbers of flowers are included in Figures 7 & 8. For the remaining cultivars in both the HT / floribunda and patio groups, undercut plants carried about 10% fewer flower buds in total than the non-undercut ones on average, although due to the variability in flower numbers amongst the patios, this difference was not statistically significant.

Figures 7 & 8


Numbers of flowers (all stages) on HT and floribunda cultivars
Mean flowers / plant
20
15
10
5
0
No significant difference
between AQ and IS
S. Jubilee excluded from
undercutting effects means
I = LSD (5%, 18 df)
A. Queen
I. Summer
(S. Jubilee)
Undercut
Not u/cut
Main treatment effects


Numbers of flowers (all stages) on Patio cultivars
Mean flowers / plant
90
80
70
60
50
40
30
20
10
0
No significant difference
between BL and RF
Festival excluded from
undercutting effects means
Undercutting effect
not significant
Baby Love
Rosy Future
(Festival)
Undercut
Not u/cut
Main treatment effects

DISCUSSION

An important finding in this trial was that, despite some marked differences in field growth of roots and shoots as a result of the influences of rootstocks and shallow undercutting treatments, when trimmed and potted up, regrowth and flowering the following summer was remarkably similar. It is unlikely that the relatively small differences in size of plant, numbers of flowers, and amount of rooting shown between the undercutting treatments for some of the cultivars at the marketing stage were of practical significance in this particular study. Nevertheless, the presence or absence of even small treatment effects are worthy of discussion if they lead to a better understanding of plant responses which could be applied to other situations.

Plant quality at potting was generally good for both undercutting treatments in terms of numbers of shoots per plant, even though large differences did still exist, and in particular the lighter 'weight' or thickness of shoots present on the shallow undercut plants (see Plate 1, p. 28, and 1994 - 1995 interim report). Plants were also disease free, and this, together with the time of potting and use of protection overwinter, clearly favoured good overall establishment.

The project has also positively demonstrated that, under conditions of good establishment, roses can withstand severe root pruning without plant losses or long term check to growth. In the field stage of the project, rootstocks grew just as well following a hard root trimming at planting, and relatively few losses were directly attributable to the shallow Egedal undercutting done in October of the budding year, even when a dry summer and spring followed. Finally, those plants that had not had the shallow field undercut required much more severe root pruning at potting, particularly those on 'Laxa' stocks.

These results bring in to question the importance of severe root pruning at potting as the most significant factor in explaining subsequent failures in establishment. Other factors, including disease or other physiological causes may be as, or more, important and are being investigated in another HDC project, HNS 75. Nevertheless, further experimentation is required to test whether establishment would have been as good from such severely root pruned plants if potting had been later in the winter, or overall establishment conditions had been poorer.

In this trial, the good overall establishment meant that it was not possible to test whether the field undercutting treatment conferred any advantage in terms of plant survival. However, there could well be worthwhile labour savings in terms of easier plant handling and reduced root pruning required at potting through the use of these shallow undercut plants.

When considering containerised rose products, it is important to distinguish between those destined for spring / summer sales in flower, as in this project, and those potted early for sale as dormant plants in autumn. Because the undercut plants had fewer thick stems, on average,

in this trial, they may have been regarded by the trade as of poorer quality, even though this work has shown no important reductions in subsequent growth or flowering. Thus, these plants may be most suited for the spring / summer market when the equally strong new growth has developed. Future work in project HNS 56b will include field undercutting again, but will aim to minimise checks to subsequent shoot growth in the field through the use of irrigation post heading back.

The small differences in rate of new root and shoot development in the container, final size and flower numbers shown in this trial, may have been influenced as much by the weight of the plants potted between treatments, than a direct effect of the type of root system. For example, it might be expected that a dormant plant with a higher number of stronger shoots would have the vigour to develop taller new growth, and carry more flowers. The magnitude of the differences in growth and flower numbers was small when compared to the differences in numbers and thickness of shoots in the planting material (see 1994 - 1995 report for details). Perhaps this is not so surprising when one considers the ability of the rose to rapidly develop top growth from a small starting point. This is, of course, fully exploited in the production system where five or more strong shoot can develop from a single budded union within a season. In addition, flowering containerised patio roses can sometimes be produced almost as quickly from potting a first year field grown 'started eye', with a hard pruned mini-shoot framework, as from a second year field grown bush.

The effect of the shallow field undercutting treatment was to greatly reduce the amount of root pruning required before potting. This probably also meant that more active root tips were left intact to develop new roots more quickly after potting, than the heavily pruned root systems. Here, pruning wounds would have taken time to heal and form new lateral root initials before the new root system in the container could develop. This, in turn, may explain some of the differences observed in the time of bud break and leaf development. For Indian Summer, the non-undercut plants on 'Laxa' were the latest treatment to break bud, and these plants received the heaviest root pruning prior to potting. Conversely, the undercut Indian Summer on 'Inermis' were the earliest to break bud and these had received the least amount of root pruning. The same pattern occurred with cv. Amber Queen. One might have expected larger differences in times of early shoot development between undercutting x rootstock treatments for Baby Love and Silver Jubilee, based on the differences in root pruning required, especially as they showed some evidence of early root growth differences. However, differences in shoot numbers and thickness of the plants at potting were not as marked in these cultivars as with some of the others in the trial. The greater inherent vigour of Silver Jubilee than say Amber Queen, may also have had an overriding effect on the time of shoot development.

Final differences in root cover scores due to undercutting or rootstock treatments were small, but varied quite markedly between cultivars. There appeared to be some correlation here

between the amount of flower the plant was carrying, and the amount of white (new) root visible. Amber Queen and Indian Summer carried about 2.5 times as many flowers as Silver Jubilee, but showed evidence of more brown root present. The same trend was shown for the patios where Baby Love and Rosy Future were carrying some 70 flowers / plant compared to only 15 for Festival. It is possible that new root growth at that time was inhibited more strongly by the competitive demands from a heavier flower load on some cultivars.

The type of rootstock had little direct effect on final growth in the container. In the field, however, 'Inermis' was shown to generally have a finer root system than 'Laxa', with fewer deep thick roots, and was therefore influenced somewhat less by undercutting. 'Inermis' has been shown in previous work (under project HNS 6a) to be capable of giving improved field grade outs over 'Laxa', and be less susceptible to rust disease, but is unlikely to be widely adopted as a replacement for 'Laxa' because of the greater number of suckers it produces. So far the search for other rootstocks which display good rooting characteristics for containerising, and that combine the favourable features of 'Inermis' but without the suckering problem, have not yielded any alternatives.

The length of rootstock neck will make a difference to the amount of root pruning that is necessary when potting. In this project, 'Laxa' stocks of Dutch origin were used, which are known to have a longer 'neck', on average, English 'Laxa'. While budders may prefer working on Dutch stocks, inevitably they get budded rather high which means more root pruning at potting is required in order to bury the excess neck.

While the trend towards containerising more roses continues, producing root systems which require less pruning work prior to potting is likely to be worthwhile, even if subsequent growth benefits are not marked. The use of a shallow undercutting operation in the autumn of the budding year, as described in this project, should be a feasible option for many growers where roses will have been planted in a layout to facilitate final deep undercutting prior to lifting. The angled fixed blade Egedal machine borrowed for this project costs £2500 - £3000, and was capable of undercutting a wide double row of stocks 80 cm apart.

Earlier rooting in the container from shallow undercut plants may be of particular benefit for roses lifted and potted in early autumn for dormant plant sales, where a rapidly formed new rootball is desirable. In this case, however, it would be important to minimise any check to top growth in the field as a result of the undercutting operation the previous autumn. Particular attention will be given to supplying extra irrigation, if required, during the critical early growth period in a future project in an attempt to alleviate this. Project HNS 56b will also be comparing module raised rootstocks with conventional bare root stocks to investigate how this might influence subsequent root systems.

CONCLUSIONS

The overall objective of the project was to examine potential techniques to improve the distribution and fibrousness of the root system formed in the field prior to lifting and potting roses, and to monitor these effects on subsequent growth in the container.

- A shallow undercut operation to a depth of about 150 mm in the early autumn of the budding year (eg. October) resulted in a more compact, and more fibrous root system with fewer long, deep roots. The effect was more marked on 'Laxa' rootstock than 'Inermis'.

- Other treatments such as the severity of root pruning the rootstocks at planting, or whether rootstocks are hand or machine planted had little effect on the nature of the root system by the time plants are lifted.

- Shallow undercutting produced a significant check to early shoot growth the following year, resulting in lighter weight plants at the end of the season. Further work needs to examine whether targeted irrigation in dry weather, will overcome this.

- These undercut plants required less root pruning prior to potting, particularly those on 'Laxa' stocks.

- Subsequent growth and flowering in the container the following spring and summer was relatively little affected by the undercutting treatment or rootstock, even where initial plant sizes differed quite significantly.

- The ability of roses to regenerate roots following quite severe root pruning, if conditions are good, was demonstrated in this project, following the good overall performance of plants after potting. It was not possible in this project to test whether the undercut plants would have been more robust and shown better establishment than normal plants, had growing-on conditions not been so good, and this needs to be explored in future work.

- There was some evidence that undercut plants developed new root faster when potted. This could be particularly useful for early potted plants destined for autumn sales, provided that any problems associated with lighter grade plants at this stage can be overcome.

APPENDICES

Layout Plan - HNS 56 - Influence of Undercutting, Rootstock etc. on Containerisation of Bush Roses
Growth and Flowering evaluation 1996

GLP 2030

N

(HNS 65 Trial B)

Bed 4

1	SJ	I U	Rep I
2	SJ	L U	
3	SJ	L N	
4	SJ	I N	
5	AQ	I N	
6	AQ	L N	
7	AQ	I U	
8	AQ	L U	
9	IS	I U	
10	IS	I N	
11	IS	L U	
12	IS	L N	

Bed 5

13	SJ	L U	Rep II
14	SJ	L N	
15	SJ	I N	
16	SJ	I U	
17	IS	I U	
18	IS	L U	
19	IS	I N	
20	IS	L N	
21	AQ	I U	
22	AQ	L U	
23	AQ	I N	
24	AQ	L N	
25	SJ	L N	Rep III
26	SJ	I U	
27	SJ	I N	
28	SJ	L U	
29	AQ	I U	
30	AQ	L N	
31	AQ	I N	
32	AQ	L U	
33	IS	L N	
34	IS	L U	
35	IS	I U	
36	IS	I N	
37	AQ	I N	Rep IV (part)
38	AQ	L U	
39	AQ	I U	
40	AQ	L N	

Bed 6

49	RF	I N	Rep I
50	RF	I U	
51	BL	I U	
52	BL	I N	
53	Fe	I U	
54	Fe	I N	
55	BL	I U	Rep II
56	BL	I N	
57	Fe	I N	
58	Fe	I U	
59	RF	I N	
60	RF	I U	
61	BL	I N	Rep III
62	BL	I U	
63	Fe	I N	
64	Fe	I U	
65	RF	I U	
66	RF	I N	
67	Fe	I N	Rep IV
68	Fe	I U	
69	BL	I N	
70	BL	I U	
71	RF	I N	
72	RF	I U	
41	SJ	I N	Rep IV (part)
42	SJ	I U	
43	SJ	L N	
44	SJ	L U	

Plot Size:
10 plants in 2 rows of 5 across bed

Spacing down bed:
300 mm

Spacing between rows across bed:
270 mm

Bed 8

45	IS	L U	Rep IV (part)
46	IS	I U	
47	IS	I N	
48	IS	L N	

Split plot design. But analysed as two separate trials for HT / FI cvs. and Patio cvs.

Main plot treatments - **Cultivars:**

AQ	Amber Queen (FI)
IS	Indian Summer (HT)
SJ	Silver Jubilee (HT)
BL	Baby Love (Pat)
RF	Rosy Future (Pat)
Fe	Festival (short FI)

Subplot treatments - **Undercutting in field x Rootstock (only one rootstock for BL, RF & Fe)**

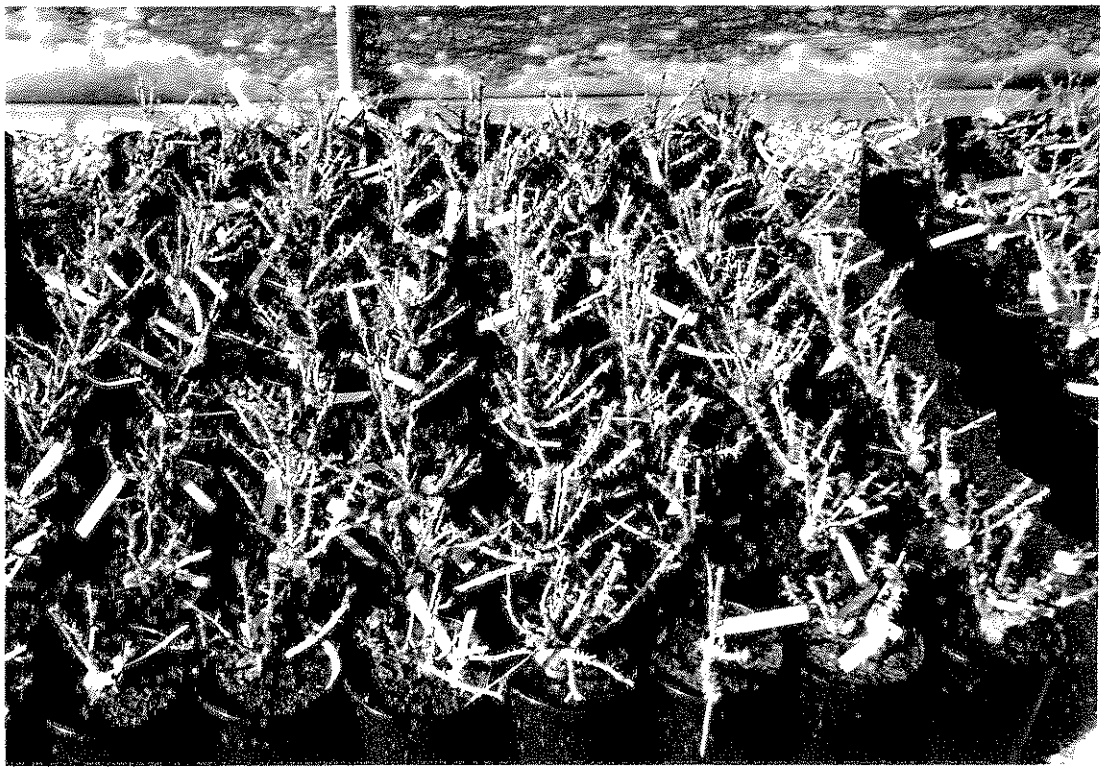
		Label Colour
I U	Inermis rootstock / Undercut	Purple / Blue
I N	Inermis rootstock / Not Undercut	Purple / White
L U	Laxa rootstock / Undercut	Red / Blue
L N	Laxa rootstock / Not Undercut	Red / White

Chris Burgess
Version A2 14/03/96

Appendix II Conversion table of day numbers to dates for a leap year (1996)

Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Month
Date													Date
1	1	32	61	92	122	153	183	214	245	275	306	336	1
2	2	33	62	93	123	154	184	215	246	276	307	337	2
3	3	34	63	94	124	155	185	216	247	277	308	338	3
4	4	35	64	95	125	156	186	217	248	278	309	339	4
5	5	36	65	96	126	157	187	218	249	279	310	340	5
6	6	37	66	97	127	158	188	219	250	280	311	341	6
7	7	38	67	98	128	159	189	220	251	281	312	342	7
8	8	39	68	99	129	160	190	221	252	282	313	343	8
9	9	40	69	100	130	161	191	222	253	283	314	344	9
10	10	41	70	101	131	162	192	223	254	284	315	345	10
11	11	42	71	102	132	163	193	224	255	285	316	346	11
12	12	43	72	103	133	164	194	225	256	286	317	347	12
13	13	44	73	104	134	165	195	226	257	287	318	348	13
14	14	45	74	105	135	166	196	227	258	288	319	349	14
15	15	46	75	106	136	167	197	228	259	289	320	350	15
16	16	47	76	107	137	168	198	229	260	290	321	351	16
17	17	48	77	108	138	169	199	230	261	291	322	352	17
18	18	49	78	109	139	170	200	231	262	292	323	353	18
19	19	50	79	110	140	171	201	232	263	293	324	354	19
20	20	51	80	111	141	172	202	233	264	294	325	355	20
21	21	52	81	112	142	173	203	234	265	295	326	356	21
22	22	53	82	113	143	174	204	235	266	296	327	357	22
23	23	54	83	114	144	175	205	236	267	297	328	358	23
24	24	55	84	115	145	176	206	237	268	298	329	359	24
25	25	56	85	116	146	177	207	238	269	299	330	360	25
26	26	57	86	117	147	178	208	239	270	300	331	361	26
27	27	58	87	118	148	179	209	240	271	301	332	362	27
28	28	59	88	119	149	180	210	241	272	302	333	363	28
29	29	60	89	120	150	181	211	242	273	303	334	364	29
30	30		90	121	151	182	212	243	274	304	335	365	30
31	31		91		152		213	244		305		366	31

Appendix III Plate 1 Amber Queen on rootstocks 'Laxa' (top) and 'Inermis' (bottom) 19/2/96, showing the lighter weight undercut plants (left 4 rows)



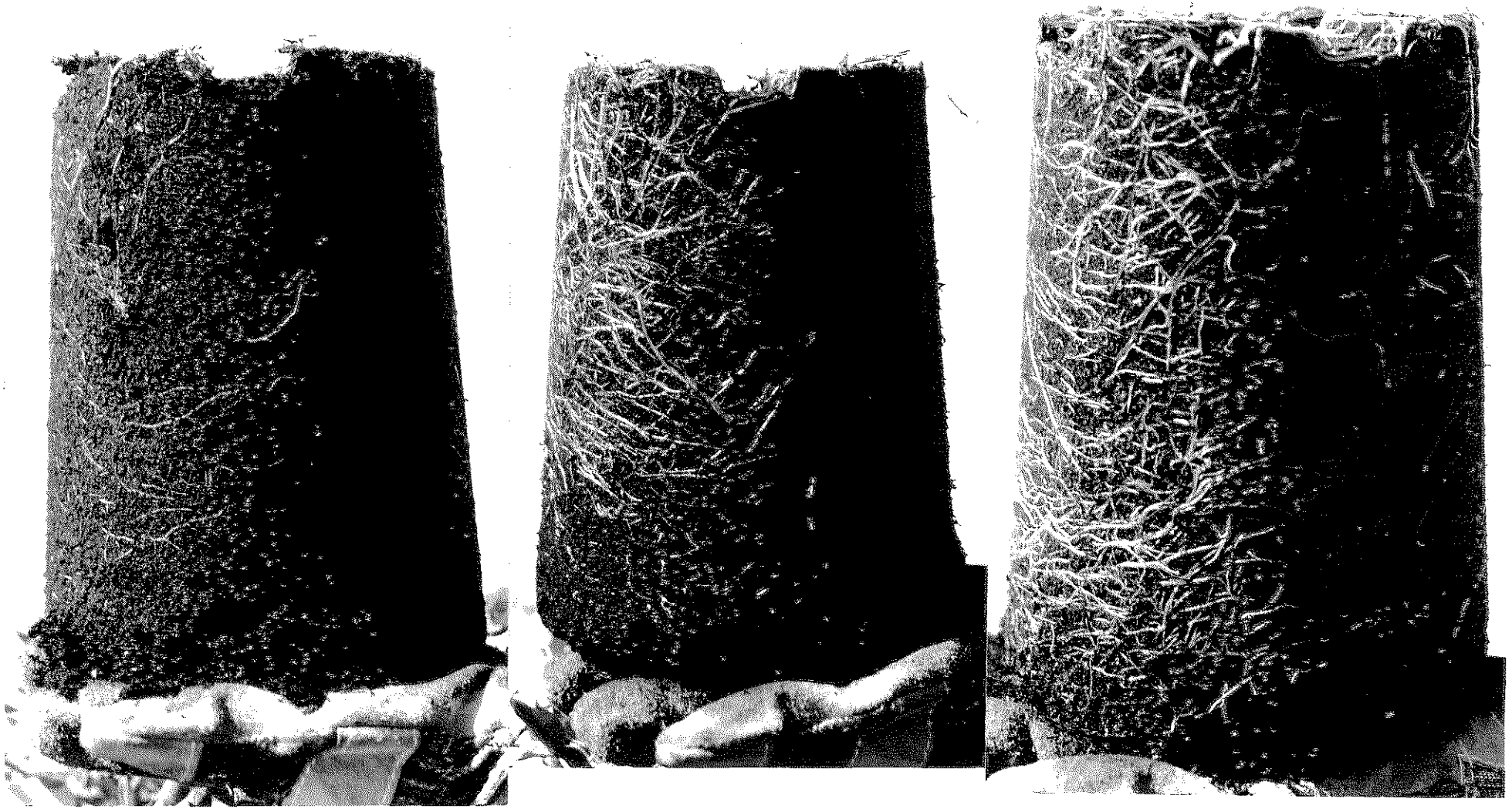
Appendix III Plate 2 **Plants given overwinter protection under side vented tunnel (left). Layout on growing on bed, 10/4/96, prior to installation of pot drip irrigation (right).**

COMMERCIAL – IN CONFIDENCE

Appendix III Plate 3 Early root growth assessment in late March 1996. Root cover scores 1 (left) and 5 (right).

COMMERCIAL – IN CONFIDENCE

Appendix III Plate 4 Marketing stage root growth assessment mid June 1996. Root cover scores 1, 3, 5 (left to right).



COMMERCIAL – IN CONFIDENCE

Appendix III Plate 5 Silver Jubilee (top); Festival and Baby Love (bottom), 18/6/96.

Appendix III Plate 6 **Indian Summer (top) and Silver Jubilee (bottom), 13/6/96. Left to right: 'Inermis' x u/cut, 'Laxa x u/cut, 'Laxa' x not u/cut, 'Inermis' x not u/cut.**

Appendix III Plate 7 Rosy Future (top) and Festival (bottom), 13/6/96. Undercut (left) and not undercut (right); all on 'Inermis'.

Appendix IV Contract

Contract between HRI (hereinafter called the "Contractor") and the Horticultural Development Council (hereinafter called the "Council") for a research/development project.

1. TITLE OF PROJECT

Contract No: HNS 56
Contract Date: 19.08.95

THE INFLUENCE OF PRUNING, ROOTSTOCK TYPE, AND PLANTING METHOD ON THE CONTAINERISATION OF BUSH ROSES

2. BACKGROUND AND COMMERCIAL OBJECTIVES

The number of field grown roses produced in England and Wales is about 22.5 million annually, worth some £24 million farm gate value (1993 estimate) compared to a container grown nursery stock fgv of £127 million. It is not clear from the statistics whether the roses containerised before sale from nurseries are included in the fgv for container grown stock or not, but the trend is clear; the proportion of roses containerised or container grown continues to increase. Typically 25-30% of plants are now containerised before sale, with well over 50% on some nurseries. Garden centre sales are largely responsible for this increase in containerisation, but increasingly landscape and amenity markets are buying their plants in pots. Roses for patios are also an expanding market and ideal for container sales.

Rosa 'Laxa' rootstocks typically produce long tap roots with relatively little fibrous root. A 2 yr old finished plant from the field usually requires extensive root pruning in order to containerise it centrally and deeply enough into an acceptable sized (typically 4 litre) pot. Early potting in autumn is usually recommended in order to encourage active new root growth before plants become dormant to ensure strong growth the following spring. Root pruning of either the rootstock plants prior to planting, or undercutting the root system in the field part way through the production cycle, may encourage a more fibrous root system before potting which is both physically easier to containerise neatly, and which offers more sites from which new root can develop. This, together with its influence on the need for root pruning at the point of containerisation, requires investigation. The effect of treatments on the rate of establishment and subsequent development in the container will also need to be monitored.

3. POTENTIAL FINANCIAL BENEFIT TO THE INDUSTRY

Containerisation can be a cost effective means of 'adding value' and increasing profitability of the rose crop, but it needs to be done well to avoid giving the product a poor reputation. Improvements in the quality of containerised or container grown roses should be reflected in the improved confidence of customers in the product, which in turn will lead to increased sales and a secured share in this expanding sector of the market.

Specific to this project, benefits to the nurseryman should include improved survival of rose bushes after potting, stronger growth and better grade-out leading to a maintenance of good prices and returns. There should also be fewer returned plants requiring refunds / replacements from garden centres and other outlets

which will also help to maintain good trading relations. It may be possible for the nurseryman to use smaller size or at least standard size containers (consistent with maintaining vigorous growth and quality through to the final point of sale). Also, a better root system may help to extend the recommended potting season if improved root regeneration is encouraged. This would be an advantage over the present tight potting window in October / November and would also help smooth the labour use profile.

4. SCIENTIFIC / TECHNICAL TARGET OF THE WORK

A greater understanding of how machine vs. hand planting affects rootstock form (and subsequent ease of potting such as being able to centralise a plant in the container) will be achieved. A measure of the severity of pruning that rootstocks are able to withstand at planting, and also whether subsequent undercutting operations in the field production phase affects survival will also be gained. The influence of rootstock pruning and field undercutting operations on the fibrousness and form of the root system at lifting will be observed, as will the influence of any subsequent root pruning required at potting on the survival, growth and performance. The effect and possible interaction of rootstock (*Rosa* 'Laxa' or *R. canina* 'Inermis') on the considerations outlined above will also be determined, as will any interactions with different scion cultivars (HT, floribunda, patio types) on their performance, or indeed influences scion cultivars may have on root growth.

5. CLOSELY RELATED WORK - COMPLETED OR IN PROGRESS

Project proposal HNS 65 is aimed at developing scheduling techniques for containerised bush roses for successional spring and summer sales. Treatments include the manipulation of development using different holding and growing environments such as cold stores, polythene tunnels and cold glass for containerised plants of both 'dormant eye' and finished maiden bushes.

Project HNS 54 is examining aspects of standard stem rose containerisation, but is concentrating more on stem production systems suitable for containerised marketing. However, some of the problems highlighted in the containerisation of field grown stems are common to bush roses.

6. DESCRIPTION OF THE WORK

Five HT and floribunda cultivars will be budded in 1994 onto rootstocks of both Laxa (coarse root system), and Inermis (finer root system). Machine vs hand planting and normal vs severe root pruning treatments will be imposed onto the rootstocks at planting. Half of this material received a further undercutting in autumn 1994 and half was left.

Four patio cultivars and one dwarf floribunda will also be budded in 1994 onto Inermis rootstock. These will receive the same range of planting method and pruning treatments as the 'Laxa' and 'Inermis' above, and will receive undercutting as for the HT and floribunda cultivars.

All plants will be lifted as finished bushes and containerised in autumn 1995 and observed for fibrousness of root present, ease of potting, and final assessments on subsequent establishment and growth completed in spring / summer 1996.

Treatments

Trial 1 outline:

2 Rootstock selections x 2 Planting methods x 2 Initial root pruning treatments = 8 initial treatments

All initial treatments budded with 5 flowering cultivars x 2 Undercutting treatments in autumn

Trial 2 outline:

1 Rootstock selection x 2 Planting methods x 2 Initial root pruning treatments = 4 initial treatments

All initial treatments budded with 5 flowering cultivars x 2 Undercutting treatments in autumn

Plot sizes in field are about 26 - 30 plants (ie per lowest level sub-treatment). Technical difficulties with plant spacings mean that identical plot sizes between machine and hand planted treatments will not be possible, however there will be sufficient plants of each treatment available for recording at lifting, potting and monitoring through for subsequent performance.

The complexity and range of treatments used in this first experiment mean that plots can not be replicated in the field. However potted plants taken through for final assessments will be arranged in a replicated trial design.

Details of treatments

Rootstock selections:	L	*Rosa dumetorum* 'Laxa'
	I	*Rosa canina* 'Inermis' ('Inermis' only for Trial 2)
Planting methods:	H	By hand
	M	By Super Prefer planting machine
Initial root pruning:	RP1	Normal pruning leaving about 150 - 180 mm of root measured from top of root collar
	RP2	Severe pruning leaving about 100 mm of root measured from top of root collar

Flowering cultivars:

Trial 1

Royal William	HT	Deep Crimson
Silver Jubilee	HT	Pink
Margaret Merril	FL	Pearly White
Indian Summer	HT	Creamy Orange
Amber Queen	FL	Amber

Trial 2

Festival	Patio	Scarlet
Rosy Future	Patio	Bright Pink
Sweet Dream	Patio	Apricot
Trumpeter	Dwarf FL	Scarlet
Baby Love	Patio	Yellow

Undercutting:

UC0 Not undercut

UC1 Undercut to about 150 mm depth with Egedal angled fixed blade undercutter in mid October 1994

Plants will be potted into a standard peat based growing media with controlled release fertiliser into deep 4 litre containers (eg Optipot 17RX) and held under some form of protection to prevent waterlogging occurring overwinter. Growing on to flower will be on a Mypex based standing out ground with drip and/or overhead irrigation.

Records

To include:

a Survival and establishment of rootstocks in field in summer 1994

b Budtake by spring 1995

c Grade of individual bushes at lifting based on Grade 1, 2 and waste according to shoot numbers and diameters.

d Score of fibrousness and spatial distribution of root at lifting in autumn 1995

e Quantity of root pruning required for potting

f Time of shoot development and flowering spring / summer 1996 based on key growth stages as used for project HNS 65

g Overall visual appearance grading score of plants in spring / summer 1996 at point of sale appropriate to the individual cultivars

h Development and score of rootball in container prior to sale (% visible root cover over pot ball)

i Photographs at rootstock planting, lifting, pruning, potting, during growing on and at point of marketing as required

j Crop Diary, to include details of routine operations such as spraying, weeding etc, as well as key operations related to treatments.

7. COMMENCEMENT DATE AND DURATION

Start date: 01.04.94, duration 2¾ years.

The pruning and planting method treatments will be applied to rootstocks in Spring 1994 followed by budding in August. The experimental work will be completed by July 1996.

An interim report will be produced after lifting in December 1995 and the final report will be produced by November 1996.

8. STAFF RESPONSIBILITIES

Mr C M Burgess

9. LOCATION

HRI Efford

TERMS AND CONDITIONS

The Council's standard terms and conditions of contract shall apply.

Signed for the Contractor(s)

Signature.....

Position.....

Date.....

Signed for the Contractor(s)

Signature.....

Position.....

Date.....

Signed for the Council

Signature.....

Position.....

Date.....