

# 由單節扦插苗，芽接扦插苗和微體扦插 苗生產迷你玫瑰盆花<sup>(1)</sup>

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關鍵字：盆花，迷你玫瑰，繁殖

## 摘 要

本文比較經由單節扦插、芽接後扦插和微體扦插繁殖所產生之迷你玫瑰的盆花品質。

Royal Sunblaze 品種，每盆栽植一株芽接扦插苗或微體扦插苗一株或三株單節扦插苗，在扦插後 16 週其盆花的高度與樹冠直徑的比值都可達到標準比值 1.5。栽植 Royal Sunblaze 的芽接扦插苗，其盆花植株高度較栽植微體扦插苗長成的盆花植株高。而且芽接扦插苗發育較多基部芽、花朵以及較大的樹冠陰影面積。Red Sunblaze 品種，每盆栽植一株單節扦插苗或微體扦插苗，在扦插 24 週後都可發育成具商品價值的盆花。芽接扦插苗，由於植株過於高大反而未能發育成具商品價值的盆花。雖然，其樹冠陰影面積與單節扦插苗或微體扦插苗的樹冠陰影面積並無差異。

## Introduction

In the United States and Canada, miniature roses have been propagated by single-node cuttings, which was developed for potted roses by Dr. R. Moe in 1973. However, budded miniatures have predominated in Britain, because the British climate makes growth from cuttings difficult<sup>(9)</sup>.

Miniature roses budded onto wild stock are more vigorous than those growing on their own roots<sup>(9)</sup>, however, the quality of budded miniatures is not always satisfactory for pot roses, because the extensive root system requires a relatively large pot. In addition, the dominant rootstock (*Rosa multiflora*) used in budding results in elongated and voluminous plants and inhibits scion bud break and shoot growth<sup>(10)</sup>. Recently, researchers suggested using grafted-cuttings<sup>(11,14)</sup> and budded-cuttings<sup>(11)</sup> to replace traditional budded roses, since they possessed the vigorous growth of budded roses, yet lacked the aforementioned disadvantages.

Miniature rose production through micropropagation has been investigated, because micropropagated miniatures were more compact in appearance than those produced by cuttings<sup>(5,8)</sup>. However, the success of the micropropagation industry

depends on the reduction of production costs without any decrease in product quality<sup>(3)</sup>. Rooting ex-vitro combined rooting and hardening-off at the same time<sup>(15)</sup> and saved the costs of labor and facilities to harden-off plants<sup>(4)</sup>.

Since greenhouse maintenance costs are an important factor in the pot plant industry<sup>(7)</sup>, the growth rate of plantlets produced by different propagation methods should be determined in addition to comparing rooting. The growth rate of plants is very dependent upon propagation techniques and plant materials. For example, the growth rate and eventual height of budded/grafted plants are affected by rootstock<sup>(8)</sup>. Furthermore, Dubois et al, found the growth rate of in-vitro-propagated rose plants was twice that of cuttings<sup>(6)</sup>. Therefore, the following studies not only compared the growth of single-node-cuttings, budded-cuttings and micropropagated shoots, but also the pot quality from each propagation method.

### Materials and Methods

**Plant materials.** Four-month-old miniature roses of 'Royal Sunblaze' and 'Red Sunblaze' were cultured in 10-cm pots in a greenhouse and were used as stock plants for single-node cuttings and scions for budded-cutting propagation. One-year-old stock plants of *Rosa multiflora* were grown in 30-cm pots for budded-cutting propagation.

**One-node cutting propagation.** Shoots (1.5-3 mm diam.) were collected when the flower bud achieved full color. Single-node cuttings of 1-3 cm in length with a 5-leaflet leaf were taken 1 mm above lateral buds. The base of these cuttings then were dipped in an indole-3-butyric acid (IBA) solution, at a concentration of 2000 mg l<sup>-1</sup>, for one second.

**Budded-cutting propagation.** A scion with a dormant bud and a 5-leaflet leaf was taken from a flowering stem similar to that used for one-node cuttings. The rootstock stem (3-6 mm diam.) was cut into 2-5-cm-long pieces consisting of a single internode without any bud. The budding techniques followed those used for hybrid tea roses<sup>(1)</sup>.

**Micropropagation.** Multiple shoot clusters of 'Red Sunblaze' and 'Royal Sunblaze' from the fourth subculture in vitro<sup>(2)</sup> were separated into 1-2-cm-long units under non-sterile conditions and the basal parts of these microcuttings were dipped into a 1000 mg l<sup>-1</sup> concentrated solution of IBA for one second.

All cuttings from different propagation methods were inserted into a sterilized mixture of peat, perlite and vermiculite (1:1:1;v/v/v) and were put under an intermittent mist regime of 10 seconds on and four minutes off from 8:00 AM to 8:00 PM. After 4 weeks, one or three ('Royal Sunblaze') rooted plantlets from one-node cuttings were transplanted into each 10-cm pot and grown in a greenhouse. At each flower flush stage, the height (pot plus plant) and the canopy shading area

(CSA) were measured, and flowers with two upper lateral buds with 5-leaflet leaf were cut off until the canopy met the requirement of a standard commercial pot flower.

Canopy shading area was calculated by viewing potted roses from overhead with a Sony AVC-D1 CCD video camera and a 28-85 mm Tokina lens. Aperture was set between f/11 and f/16, and the distance from camera to stage was about 90cm. The light source consisted of two round-shaped fluorescent lamps (General Electric, FC12T-CW9 and FC16T-CW9) which were hung 50 cm below the camera (Fig. 1). The resulting video image was captured, digitized and analysed with an Imaging Technology (Woburn, MA) FG-100-AT digitizer housed in an IBM PC/AT microcomputer and operated with Image Pro software (Media Cybernetics, Silver Spring, MD)<sup>(13)</sup>.

According to Sachs et al., the ratio of the height (plant plus pot) (H) to the diameter of a flowering plant (D) should be 1.5 to 1.7<sup>(12)</sup>; our theoretical standard canopy shading area (TSCSA) for a commercial pot rose was determined as:  $\geq [(H \div 1.5) \div 2]^2 \times 3.14$ . When the potted miniature roses were of marketable quality, the number of basal shoots, flowers were counted, and height of pot plant were measured.

Table 1. The impact of different propagation methods on the quality of potted 'Royal Sunblaze' roses, 16 weeks after propagation.

表一 不同繁殖方法對繁殖16週後盆栽玫瑰「Royal Sunblaze」品質的影響

Parameter 盆花品質性狀	Single-node cutting 單節扦插		Microcutting 微體扦插	Budded cutting* 芽接後扦插
	1 plant/pot 1株/盆	1 plants/pot 1株/盆	1 plant/pot 1株/盆	1 plant/pot 1株/盆
Height(cm/pot) 高度(公分/盆)	22.0ab**	21.4ab	18.3b	24.9a
No. of basal shoots per pot 每盆主幹枝數	1.6b	3.1ab	2.7ab	3.4a
No. of flowers per pot 每盆花朵數	2.4b	3.8ab	2.7b	4.8a
CSA(cm <sup>2</sup> /pot) 樹冠正投影面積	149.8b	184.1b	147.9b	266.5a
TSCSA(cm <sup>2</sup> /pot)*** 樹冠正投影面積理論標準值	168.9	159.8	116.8	216.3

\* *Rosa multiflora* used as rootstock. 根砧為 *Rosa multiflora*。

\*\* Means within a row separated by LSD test at 5% level. 同列平均值經由LSD (5%水準) 測驗, 區分其顯著性。

\*\*\* Theoretic standard of canopy shading area (TSCSA) was calculated from height of potted roses. 樹冠正投影面積之理論標準值由盆栽玫瑰高度計算之。

$$TSCSA = [(H \div 1.5) \div 2]^2 \times 3.14.$$

Table 2. The impact of different propagation methods on the quality of potted 'Red Sunblaze' roses, 24 weeks after propagation.

表二 不同繁殖方法對繁殖24週後盆栽玫瑰「Red Sunblaze」品質的影響

Parameter 盆花品質性狀	Single-node Cutting 單節扦插	Microcutting 微體扦插	Budded cutting* 芽接後扦插
Height(cm/pot) 高度(公分/盆)	23.8b**	23.8b	27.7a
No. of basal shoots per pot 每盆主幹枝數	1.7a	2.5a	2.5a
No. of flowers per pot 每盆花朵數	3.6a	4.4a	3.5a
CSA(cm <sup>2</sup> /pot) 樹冠正投影面積	212.6a	203.6a	246.3a
TSCSA(cm <sup>2</sup> /pot)*** 樹冠正投影面積理論標準值	197.6	197.6	276.7

\* One plant each pot. *Rosa multiflora* used as rootstock. 每盆一株。芽接砧木為 *Rosa multiflora*。

\*\* Means within a row separated by LSD test at 5% level. 同列平均值經由LSD (5%水準) 測驗，區分其顯著性。

\*\*\* Theoretic standard of canopy shading area (TSCSA) was calculated from height of potted roses. 樹冠正投影之理論標準值，由盆栽玫瑰高度計算之。

$$TSCSA = [(H \div 1.5) \div 2]^2 \times 3.14.$$

## Results

'Royal Sunblaze' roses from budded and single-node cutting were taller than those from microcuttings. Sixteen weeks after cutting, budded cuttings developed more basal shoots, flowers and CSA than microcuttings and single-node cuttings. Budded cuttings and microcuttings developed into commercial grade roses as determined by the TSCSA. However, pot roses propagated by microcuttings were too short to be of commercial grade. Although one single-node cutting per pot did not develop into a commercial pot rose, three single-node cuttings per pot met the TSCSA of miniatures in 16 weeks (Table 1, Fig. 2).

Budded-cuttings of 'Red Sunblaze' developed into taller roses compared to microcuttings or one-node cuttings. The number of leaves and total leaf area of budded-cuttings and microcuttings was greater than that from single-node-cuttings. Nevertheless, there were no significant differences in the length of stems, and the number of basal shoots and flowers between all three propagation methods. Twenty-four weeks after cutting, microcuttings and single-node cuttings had a greater CSA than the TSCSA of commercial miniatures. Budded-cuttings did not meet the requirements for commercial standard pot roses ( $TSCSA = [(H \div 1.5) \div 2]^2 \times 3.14$ )

although their CSA was the same as that of single-node cuttings or microcuttings (Table 2).

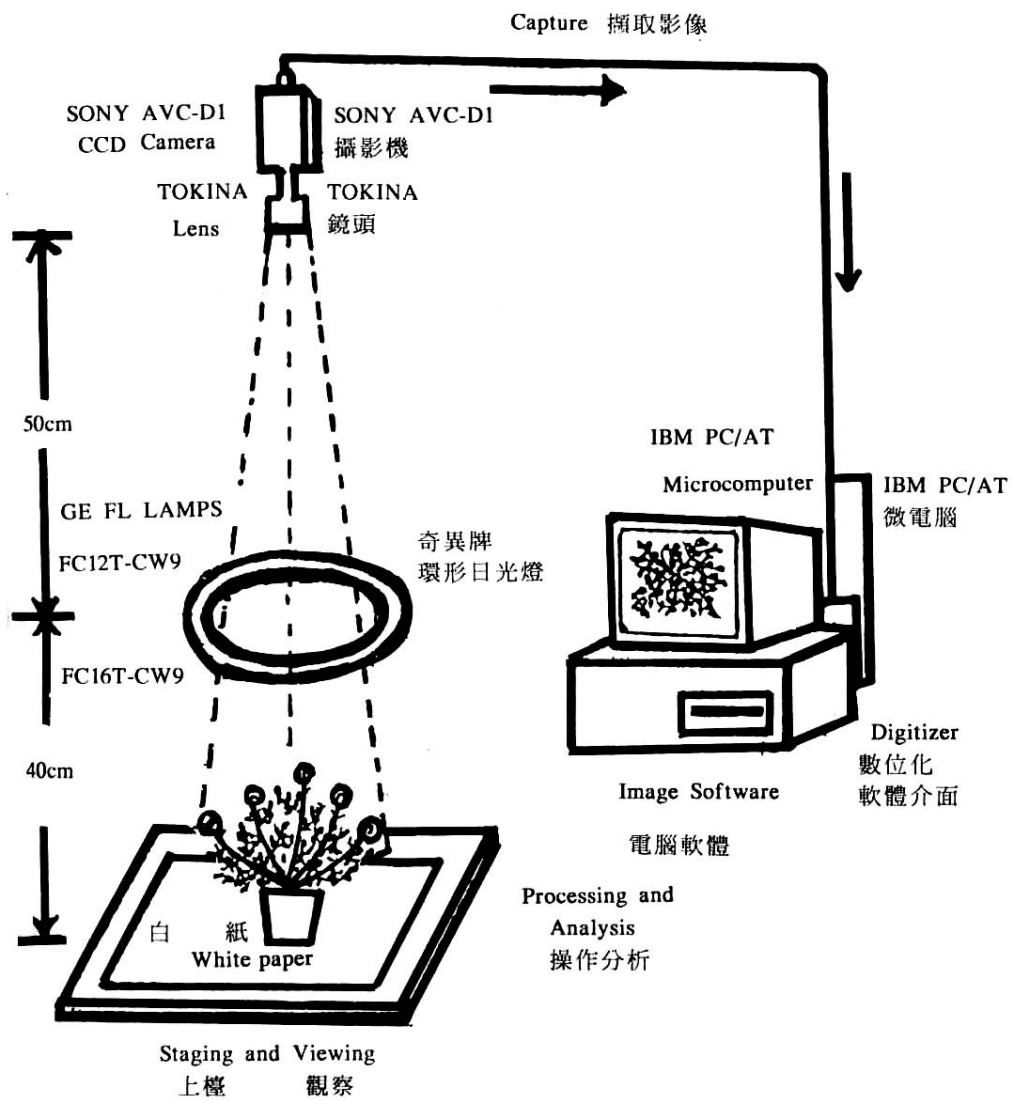


Figure 1. Overview of canopy shading area measurement system.

圖一 樹體正投影面積度量系統



Figure 2. A sideview of 'Royal Sunblaze' roses from three different propagation methods, 16 weeks after propagation. The two middle pots include one cutting and three cuttings per pot.

圖二 經由三種不同繁殖方法的「Royal Sunblaze」玫瑰，在繁殖16週後的生長側面像。中間兩盆左邊為每盆種一株扦插苗右邊則為每盆種3株扦插苗。

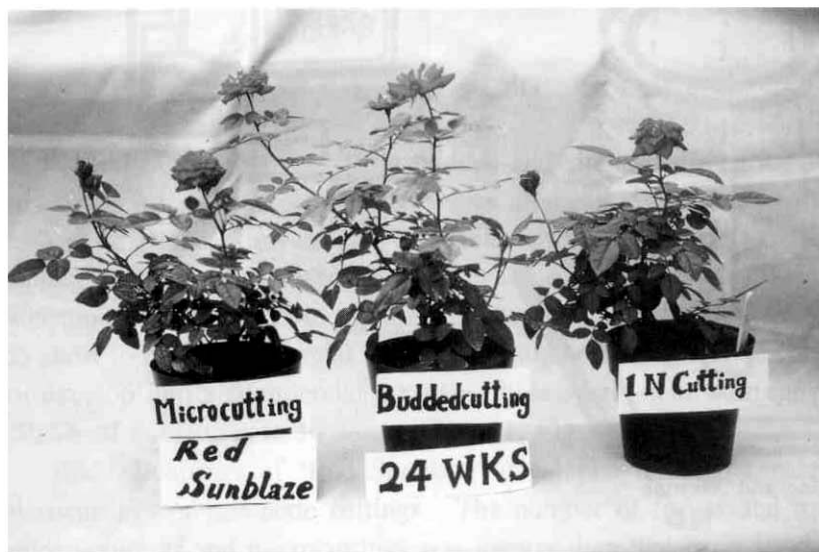


Figure 3. A sideview of 'Red Sunblaze' roses from three different propagation methods, 24 week after propagation.

圖三 經由三種不同繁殖方法繁殖的「Red Sunblaze」玫瑰，在繁殖24週後的生長情形側面像。

## Discussion

Sachs et al. suggested that the ratio of plant plus pot height (H) to plant diameter (D) was an important quality index of a pot plant, and it should be 1.5 to 1.7<sup>(12)</sup>. Since miniature roses are shrubs and their canopy usually is not a round shape, particularly in the case of several plantlets per pot (Fig. 1), the determination of plant diameter is very difficult. In addition, the diameter does not indicate entire canopy area. Video image analysis has been used as a biological quantitative research tool. Through this system, plant surface area has been quantified easily and precisely<sup>(13)</sup>. In our experiments, the canopy image taken from overhead (the image area is equal to CSA) was indicative of the quality of the pot rose plant. Furthermore, the image measurement was more reliable than diameter in verifying the quality.

According to growth habits, roses cultivars have been classified as to (1) canopy constructed by basal shoots, and (2) canopy constructed by lateral shoots. Roses of the first group develop basal shoots in the spring and fall. Yet during summer and winter, since plants possess a strong apical dominance, new lateral shoots develop from the upper section of shoots after pruning. In contrast, roses of the second group do not have a significant growing flush of basal shoots, however, some basal shoots and lateral shoots grow from the lower section of basal shoots throughout the year. After two-years of observation, we found that the canopy of 'Royal Sunblaze' was dependent on basal shoot formation. For 'Red Sunblaze', the canopy was constructed by lateral shoots as well as basal shoots.

Our results (Tables 1 and 2) were in agreement with previous reports<sup>(9,10)</sup> in that budded cuttings were more vigorous than own-root plants (single-node cuttings and microcuttings). The vigorous growth of 'Royal Sunblaze' resulted in formation of basal shoots. Consequently, this cultivar achieved the TSCSA earlier than own-root plants (Table 1). In contrast, with 'Red Sunblaze', the vigorous growth produced long and thick shoots instead of an increased number of basal or lateral shoots. Consequently, in comparing with own-root plants, budded plants obtained a larger CSA, but were not commercially acceptable due to too large a TSCSA (Table 2). Therefore, if the budded-cutting method is used, only cultivars constructed by basal shoots are recommended. However, the success rate of propagation by budded cuttings was too low (50%) in our studies to be considered for commercial production (unpublished). Additional studies would be necessary to promote rooting from the rootstocks instead of scions.

In considering the quality of potted roses, budded 'Royal Sunblaze' grew into a larger canopy than that of single-node cuttings or microcuttings. Furthermore, the height, basal shoot number, and flower number from budded-cuttings were greater than either single-node cuttings or microcuttings. Nevertheless, except for CSA, the quality of three single-node cuttings planted in one pot was comparable to one budded

plant. In contrast, the highest quality of 'Red Sunblaze' roses were attained by micropropagation because of their compact appearance (Table 2).

### Acknowledgement

The authors wish to acknowledge De Vor Nurseries, Inc. for donations of rootstock cuttings.

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