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**Bulletin 410**
**August, 1984**

Published by the Colorado Greenhouse Growers' Assoc., Inc. in cooperation with Colorado State University

research bulletin

# ROSE ROOTING AND GRAFTING

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**Work on rose miniplant propagation, continued from Bulletin 371, showed that cultural conditions for rooting and grafting were more important than rootstock or hormone application. The slant graft was quicker and easier to make with the use of parafilm as a tie, while special precautions were necessary to prevent scion drying during the grafting process. Changes in cultural procedures gradually improved the technique to acceptable. The understock *odorata* usually performed the best. IBA, at 0.1% concentration as a ten second dip, appeared to be the best hormone treatment of those tested.**

### Introduction

Grueber's work on rose miniplant production was summarized in CGGA Bulletins 364 and 371. Based upon an index scale of 0 to 5 (best) for rating rooting and grafting, however, the majority of trials were not considered acceptable. Experiments were continued over the next 2 years to see if the process could be significantly improved. During this period, changes were made in procedures which gradually raised ratings to a point where we are now confident of consistently providing uniform and well grafted rooted miniplants under Colorado conditions (minimum acceptable index = 3.0). Portions of Bulletins 364 and 371 are duplicated in this report for purposes of illustration.

### Methods and Materials

With the exception of Experiment 20 (Table 1), containers were Speedling flats with 1 inch removed from the bottom to improve thermal contact with the heating cables. The rooting mixture was a 2:1 peatmoss-perlite to which 8 lbs $yd^{-3}$ $CaCO_3$ was added.

Each flat contained 6 cells across the width, and this was considered one replicate. Treatments within any experiment had at least 2 rows per treatment, and sometimes 4 (24 plants) randomized in the flat. Beginning in the experiments listed under "B" (Table 1), every other row in the flat was skipped in order to provide additional air circulation. Although Experiment 5 (Table 2) showed better grafting and rooting with 2 sets of leaves on understock and scion, experiments — with this one exception — invariably used one node with one 5-leaflet leaf, with the apex leaflet removed. Plants and flats were drenched once weekly with a Benlate-Dexon mixture (1.0 g $liter^{-1}$ each).

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### Cultural Changes

Throughout the period following Experiment 5 (Table 1), changes were made in the general procedure in order to improve rooting and grafting. The original grafting tool for producing a "V"-shaped notch in the understock and a corresponding match in the scion (cleft graft) wore rapidly, and a larger, improved version was constructed (Fig. 1). Observation showed, however, that failure to make a "slicing" cut resulted in considerable tissue damage which prevented close positioning of the cambial layers (Fig. 2). This problem suggested the switch to a simple "slant graft", which required no special tools other than a sharp knife, and with suitable binding to hold the scion and understock under constant pressure (Item F, Table 1). This gave what we felt to be a simple, rapid procedure, giving consistent results. Experiment 15 results (Table 3) suggested that, as long as pieces were not too "hard" to make a slant graft with undue effort, or too "soft" as to be easily damaged, grafting could be acceptable. A slant graft of 60° from the horizontal with a "slicing" cut seemed to give least tissue damage. The ability of the propagator to select appropriately matched wood and adequately secure the two pieces quickly and efficiently was most important.

A second observation was the fact that the scion could not be allowed to lose water. In fact, the propagator had to "grow" the scion during the grafting procedure. Any shrinkage, due to drying, caused the incipient union to break loose. Callus tissue seldom originated from the understock. Callus was always formed by the scion (Fig. 3). Turning the mist off at night, under Colorado conditions, resulted in scion drying, varying with the season. Beginning with Experiment 11 (Table 1), the cuttings were always tightly covered at night, and later the scion ends were waxed as a standard procedure to prevent fluid loss from the cut end. With these methods, scion sprouting was common during the grafting process (Fig. 4, bottom). By the time item "G" (Table 1) had been instituted, average grafting scores for

**Table 1:** Procedural changes in rose rooting and grafting over a three-year period of experimentation compared with total average rooting and grafting indices (scale of 0 to 5 [best]) for the particular experiment.

| | Procedure | Experiment number | Date started | Average score: Rooting | Average score: Grafting |
|---|---|---|---|---|---|
| A. | Speedling flat, cleft graft, no wrap or wax, uncovered at night. | 1 | 8/22/80 | 2.6 | — |
| | | 2 | 11/21/80 | 1.9 | 1.6 |
| | | 3 | 1/7/81 | 2.2 | 2.1 |
| | | 4 | 3/9/81 | 1.8 | 2.0 |
| | | 5 | 3/9/81 | 2.6 | 2.4 |
| | | 6 | 5/4/81 | 2.0 | 0.5 |
| B. | Grafting tool enlarged and built of heavier materials, otherwise procedure the same. Weekly drench with Benlate-Dexon. | 7 | 8/13/81 | 1.7 | 1.2 |
| | | 8 | 11/25/81 | 1.0 | 1.4 |
| | | 9 | 12/5/81 | 1.0 | 1.3 |
| | | 10 | 7/20/82 | 2.1 | 1.6 |
| C. | Cuttings covered at night with insulation when mist off. | 11 | 11/4/82 | 2.0 | 1.4 |
| D. | Grafting procedure changed from cleft to slant graft, wrapping required using various materials. | 12 | 11/9/82 | 3.2 | 2.8 |
| E. | Grafting wax placed on exposed scion cuts as standard procedure. | 13 | 1/4/83 | 1.9 | 1.6 |
| | | 14 | 1/5/83 | 1.7 | 0.9 |
| F. | Parafilm used as graft wrap | 15 | 2/2/83 | 1.4 | 3.0 |
| | | 16 | 2/7/83 | 1.0 | 3.1 |
| G. | Bottom heat improved for better uniformity | 17 | 3/29/83 | 2.5 | 3.4 |
| | | 18 | 4/14/83 | 2.2 | 3.4 |
| | | 19 | 4/23/84 | 2.1 | 2.3 |
| H. | Speedling flat discontinued, 1-inch "Cone-tainers" substituted, cuttings allowed to root before grafting. | 20 | 8/26/84 | 4.5 | 3.1 |

**Table 2:** Effect of number of nodes and leaves on rooting and grafting of 'Samantha' on *odorata* roses. Experiment 5. Rooting and grafting evaluated on a scale of 0 to 5 (best), rootone hormone to understock.

| Condition | Number of nodes | Number of 5 leaflet leaves | Rooting index | Grafting index |
|---|---|---|---|---|
| *odorata* on own root | 2 | 2 | 4.3 | Vertical line shows non-significance at 5% level. |
| | 2 | 1 | 1.6 \| | |
| | 1 | 1 | 1.5 \| | |
| | 2 | 0 | 0.5 | |
| | 1 | 0 | 0 | |
| 'Samantha' on *odorata* | Nodes and 5 leaflet leaves: Scion | Nodes and 5 leaflet leaves: Understock | | |
| | 2 | 2 | 3.6 | 2.7 |
| | 2 | 1 | 2.4 | 2.6 |
| | 1 | 2 | 2.4 | 2.2 |
| | 1 | 1 | 1.9 | 2.0 |
| | | | ns[a] | ns |

[a]ns – not statistically significant

an experiment were consistently higher. Rooting failed to improve as dramatically, however, until Experiment 20 where the cuttings were placed in a deeper container for 6 weeks as contrasted to the usual 4 weeks.

**Effect of Understock and Hormone**

As noted in Tables 4 and 5, there were not great differences as to rootstock performance with the exception of *manetti* (Table 4). We experienced considerable trouble from leaf drop with this understock under greenhouse conditions, and based upon results in Experiment 1, we eliminated *manetti* from all subsequent experiments. Generally, the understock *odorata* performed well, with inconsistent differences between 'Dr. Huey' and 'goman'. 'Dr. Huey', 'goman' and *odorata* all rooted satisfactorily when stuck in "Cone-tainers" and given 6 weeks. All other experiments were evaluated at the end of 4 weeks. Graft union improved significantly between Experiments 6 and 15, indicating the efficacy of the various cultural changes outlined in Table 1.

Up through Experiment 12 (Table 6), IBA at 0.1% concentration for a 10 second dip generally provided the best rooting, with the possibility of a significant effect on grafting. In Experiment 14, however (Table 7), NAA at 0.05% for 10

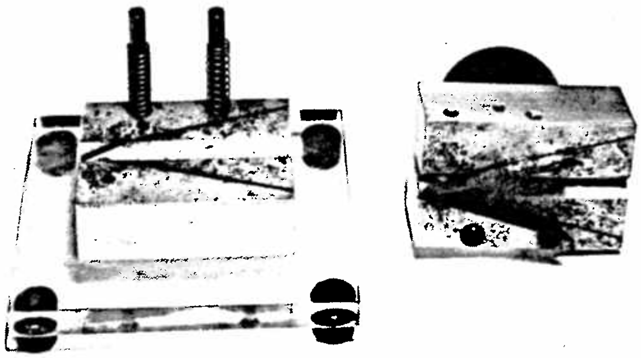


**Fig. 1:** Improved cutting tool for making a "cleft" graft on roses. Despite sharp blades, the method of making the cut appeared to result in excessive damage to woody tissue.

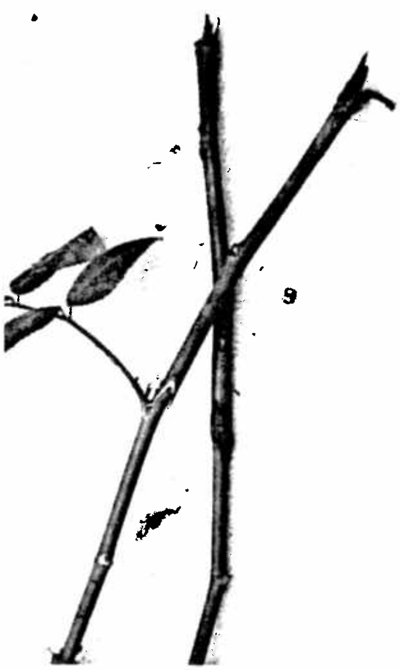


**Fig. 2:** Failure of a rose "cleft" graft. Unavoidable tissue damage in cutting the graft seemed to increase graft failure with this type of tool as shown in Fig. 1.

seconds had the highest mean index although not significantly different from IBA for 10 seconds. On the other hand, NAA at .05% was significantly better than IAA when rooting and grafting scores were combined, regardless of dipping time (Table 8). There was a statistically significant interaction between hormone and dipping time when rooting and grafting scores were combined, with NAA for 5 seconds giving the highest mean rating of 3.4 and an excellent grafting index of 4.1. A large part of the variability in results could be attributed to changes in cultural procedures between experiments. We suggest that IBA at 0.1% for 10 seconds is a reasonable treatment of understock for rooting, although better combinations could probably be found.

**Table 3:** Effect of relative position of cutting on stock from "hard" and "soft" wood on rooting and grafting of 'Royalty' on 'goman'. Experiment 15, hormone treatment to understock 0.1% NAA for 10 s. Rooting and grafting indices based on a scale of 0 to 5 (best). Rating of "hard" versus "soft" entirely subjective.

| Relative position from which taken | Rooting index | Grafting index | Mean index |
|---|---|---|---|
| "Hard" wood | | | |
| Position 1 (tip) | 1.0 | 3.5 | 2.3 |
| Position 2 | 0.3 | 2.1 | 1.2 |
| Position 3 (base) | 0.4 | 3.1 | 1.8 |
| HSD (5%) mean index | — | — | 0.6 |
| "Soft" wood | | | |
| Position 1 (tip) | 1.6 | 3.0 | 2.3 |
| Position 2 | 1.7 | 3.1 | 2.4 |
| Position 3 | 2.1 | 3.9 | 3.0 |
| Position 4 | 0.9 | 3.1 | 2.0 |
| Position 5 (base) | 1.2 | 3.5 | 2.4 |
| | ns | ns | ns |

**Table 4:** Rooting of various combinations of rose rootstock and scions in Speedling flats containing 2:1 peatmoss-perlite, dipped in Rootone rooting hormone. Experiment 1, vertical lines show those rooting indices not significantly different from each other at the 5% level. Rooting scale on an index of 0 to 5 (best). Duplicated from Bulletin 364.

| Combination | Rooting index |
|---|---|
| 1. *odorata* own root | 4.2 |
| 2. 'Cara Mia' on *odorata* | 3.9 |
| 3. 'Samantha' on *odorata* | 3.8 |
| 4. 'Cara Mia' on *indica* 'Major' | 3.7 |
| 5. *indica* 'Major' own root | 3.2 |
| 6. 'Samantha' on *indica* 'Major' | 3.1 |
| 7. 'Samantha' on 'Dr. Huey' | 2.7 |
| 8. 'Dr. Huey' own root | 2.5 |
| 9. 'Samantha' own root | 2.5 |
| 10. 'Cara Ma' on 'Dr. Huey' | 2.2 |
| 11. 'Cara Mia' own root | 2.0 |
| 12. 'Samantha' on *manetti* | 1.1 |
| 13. 'Cara Mia' on *manetti* | 1.0 |
| 14. *manetti* own root | 0.6 |

**Table 5:** Effect of understock on rooting and grafting index. See Table 4 for rooting of *manetti* under 'Samantha' and 'Cara Mia'. Experiments in this table used 'Royalty' as the scion. Index rating based on a scale of 0 to 5 (best). Hormonal treatment varied between experiments.

| Rooting or grafting | Understock | Experiment 6 | 15 | 17 | 20 |
|---|---|---|---|---|---|
| Rooting | *odorata* | 2.6 | 2.3 | 2.9 | 4.7 |
| | 'goman' | 1.4 | 1.3 | 3.3 | 4.1 |
| | 'Dr. Huey' | 2.1 | 0.6 | 1.4 | 4.7 |
| | *indica* 'Major' | 1.9 | | | |
| Grafting | *odorata* | 0.4 | 3.1 | 2.7 | 3.5 |
| | 'goman' | 0.8 | 2.9 | 2.9 | 2.5 |
| | 'Dr. Huey' | 0.3 | 2.9 | 3.5 | 3.4 |
| | *indica* 'Major' | 0.3 | | | |

**Fig. 3:** "Slant" graft of roses, showing the growth of tissue callus by the scion on the understock (top, right). Understock seldom showed any sign of callus at the junction. The graft often united even though the understock failed to root (bottom-right).

**Table 6:** Effect of hormone on rooting and grafting of the rose 'Royalty' on various understocks. Index rating based on a scale of 0 to 5 (best). Concentrations and times varied between experiments.

| Rating or grafting | Hormone[1] | Experiment 6 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| Rooting | IAA | 1.9 | 0.8 | | | |
| | NAA | 1.7 | 0.7 | | | 2.3 |
| | IBA | 2.4 | 1.3 | 2.7 | | 4.3 |
| | IBA/IAA | | | 1.8 | 2.0 | 3.2 |
| | IBA/NAA | | | 2.7 | | |
| | IAA/NAA | | | 1.8 | 2.2 | 2.9 |
| | Rootone | | | 1.4 | | |
| Grafting | IAA | 0.5 | 1.6 | | | |
| | NAA | 0.4 | 1.1 | | | 2.7 |
| | IBA | 0.6 | 1.3 | 1.6 | | 3.8 |
| | IBA/NAA | | | 1.4 | 1.3 | 2.3 |
| | IBA/NAA | | | 1.3 | | |
| | IAA/NAA | | | 1.9 | 1.7 | 2.5 |
| | Rootone | | | 1.7 | | |

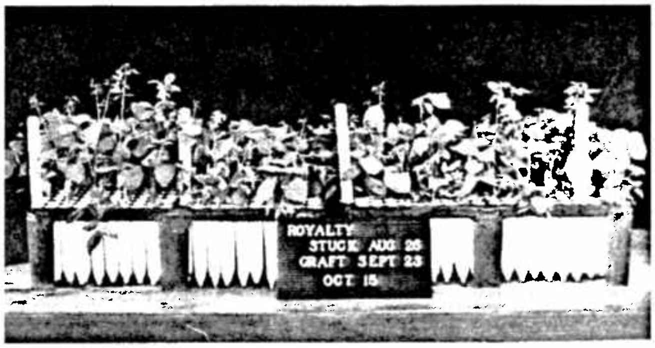
[1]IAA – indole acetic acid
IBA – indole butryic acid
NAA – napthalene acetic acid

**Table 7:** Effect of hormone and application treatment to understock on rooting and grafting of rose 'Royalty' on 'goman'. Experiment 14, hormone concentration in all treatments 0.05%. Rooting and grafting indices based upon a scale of 0 to 5 (best).

| Treatment | Rooting index | Grafting index | Mean index |
|---|---|---|---|
| 1. 10 s dip in NAA | 2.4 | 1.4 | 1.9 |
| 2. 20 s dip in NAA | 2.2 | 1.4 | 1.8 |
| 3. 40 s dip in NAA | 1.7 | 1.1 | 1.4 |
| 4. 10 s dip in IBA | 1.9 | 0.9 | 1.4 |
| 5. 10 s dip in IAA | 1.9 | 0.7 | 1.3 |
| 6. 20 s dip in NAA/IAA | 1.3 | 0.7 | 1.0 |
| 7. 20 s dip in NAA/IBA | 1.1 | 0.6 | 0.8 |
| 8. 20 s dip in IAA/IBA | 1.3 | 0.4 | 0.8 |
| HSD (5%) | — | — | 0.8 |

**Table 8:** Effect of treatment time and hormone applied to understock of 'Royalty' grafted on 'goman'. Experiment 18, hormone concentration 0.05%. Rooting and grafting indices based upon a scale of 0 to 5 (best).

| Hormone | Dipping time | Rooting index | Grafting index | Mean index | Mean (hormone) |
|---|---|---|---|---|---|
| NAA | 5 s | 2.7 | 4.1 | 3.4 | |
| | 10 s | 2.0 | 3.2 | 2.8 | |
| | 15 s | 2.7 | 3.5 | 3.1 | |
| | 40 s | 1.6 | 3.7 | 2.6 | |
| | | | | | 3.0 |
| IAA | 5 s | 2.3 | 3.3 | 2.8 | |
| | 10 s | 1.6 | 3.3 | 2.4 | |
| | | | | | 2.6 |
| | 15 s | 2.7 | 3.1 | 2.9 | |
| | 40 s | 2.4 | 2.3 | 2.3 | |
| | Mean | 2.2 | 3.4 | | |
| HSD(5%) Time versus hormone | | | | 1.0 | |
| HSD(5%) Hormone | | | | | 0.3 |


## Summary

Not all experimental results were reported here for the sake of brevity. However, simultaneous rooting and grafting imposes very high cultural requirements for success. Although other grafting techniques may provide better results (e.g. Paz et al's patented procedure), we were much more satisfied with the simplifications made by going to a slant graft with a good tie. As pointed out, grafting remains a horticultural technique where art on the part of the propagator is required. We were also pleased with the "Cone-tainers" except that the ones utilized in Experiment 20 were too small. The deeper tubes, combined with interior ridges to prevent root spiraling, seemed to provide better moisture and aeration relationships — although we have no data to substantiate this.

**Fig. 4:** "Speedling" (top) and "Cone-tainer pine-cells" used for rose rooting and grafting. The Speedling flat had one inch removed from the bottom.

# NEW GREENHOUSE FOREMAN ON BOARD

Charlie Christensen, started as CSU's first full-time greenhouse foreman at PERC last fall as a Research Associate. This is the first time that the research range has had a relatively permanent individual to oversee the general operation of the greenhouse facility. Charlie received his B.S. degree from CSU two years ago, and after spending a short time with Watanabe's in Hawaii, returned to Fort Collins to take his present position. A former submariner, Charlie is married with one daughter, and an avid skier, backpacker and general outdoorsman. His presence has certainly relieved the three staff of the day-to-day nick-picking details that it takes to run a first-class operation. CGGA partially supports the position with a yearly grant to the research fund through the Research and Education Committee.

# CSU GRADUATES AN ALL-FEMALE CLASS

*Janelle Catalano*

*Connie Smith*

*Michelle Koppish*

*Regina Lang*

*Nancy Baker*

These students graduated this spring from CSU. All have been active with special projects, supported by CGGA, and worked part-time at the research range during their academic careers.

Janelle is a former track team member at CSU, native to the San Luis Valley where her parents farm. She has taken a position with Long's Peak Greenhouses. Regina Lang comes from Texas, an accomplished horsewoman, is now at Berthoud Rose Farm. Nancy Baker did a good job on our sales program last year, and has started work at Anthony Euser's Greenhouses as a rose grower, while Connie Smith, who took care of the Bay Farm this year, coming from Pennsylvania, is down at Lottito's.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