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# Evaluation of Honey as a Rooting Aid for the Propagation of Rosa 'Red Cascade'

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## Summary

Previous research has shown that honey may prove beneficial to the plant propagation process. The objective of this research was to evaluate whether addition of honey to water-soluble auxin solutions increased root growth and uniformity compared to auxin solutions without honey on medial cuttings of *Rosa* 'Red Cascade'. The 4×5 factorial experiment consisted of four honey types (none, general multiflora, Manuka, or locally sourced honey), and five auxin levels (0, 250, 500, 750, or 1,000 ppm indole-3-butyric acid (IBA). Utilization of honey or auxin during propagation of 'Red Cascade' miniature rose did not increase percent rooting, number of roots, root length, shoot height, or root quality rating for cuttings. Additionally, honey type and auxin rate had no effect on net photosynthetic rate and stomatal conductance. Further research is being conducted with other woody ornamental plant species that vary in rooting difficulty to determine if addition of various honey types to water soluble IBA solutions enhances rooting responses.

## INTRODUCTION

Honey has a long history as a wound treatment, dating back to the writings of the Egyptians 5,000 years ago. In these earliest writings, honey was reportedly made into an ointment to treat skin and eye diseases - as well as applied as a dressing for burns and wounds (Israili, 2003). In the nursery industry, sugars (carbohydrates) are known to positively impact rooting of cuttings and are frequently used in tissue culture as an energy source for micro-cuttings (Davies et al., 2018). Clinical studies have confirmed the broad-spectrum antimicrobial properties of honey which are theorized to be due to naturally low pH, osmotic effect, high sugar concentration, and presence of bacteriostatic and bactericidal factors (Israili, 2003). Antibacterial properties are attributed to the super-saturated solution of sugar (Molan, 1992). A typical batch of honey has a 15-21% moisture content and a solid fraction containing a ratio of monosaccharides (glucose and fructose) which leaves very little free water available for growth of micro-organisms (Molan, 2001). Antimicrobial properties of manuka honey were determined by testing and the results used to calculate the unique Manuka factor (UMF) which ranges in potency from 1 -$70^{+}$ (Whalley, 2009).

Whalley (2009) of Taupo Native Plant Nursery in New Zealand conducted an on-nursery trial using honey as a stand-alone rooting hormone when their primary rooting hormone powder was discontinued. Whalley trialed Manuka honey (UMF 15+), a multiflora honey purchased from the supermarket, a commercially available root-promoting compound, and a nontreated control. These treatments were applied to cuttings of six New Zealand natives: *Brachyglottis* 'Sunshine', *Coprosma acerosa*, *Coprosma* x *kirkii* 'Kirkii', *Griselinia littoralis* 'Broadway Mint', *Myoporum laetum*, and *Olearia virgata* var. *lineata*. These plants were selected for various characteristics including ease of rooting (Whalley, 2009). Both varieties of honey were used to prepare solutions containing honey and hot water (1:2 v:v) and solutions were refrigerated for 24-h before use (Whalley, 2009). Cuttings were placed into solutions for 30 minutes before sticking and placed onto a mist bed with bottom heat (Whalley, 2009). Cuttings treated with solutions containing multiflora honey had the fewest unrooted cuttings across all four treatments and a high number of cuttings with a good (4+) and average (3 or less) root rating. Cuttings treated with Manuka honey had the lowest number of roots with a good (4+) rating and a higher number of unrooted cuttings among all four tested treatments (Whalley, 2009). Previous research has shown that honey may prove beneficial to the plant propagation process; however, further research is needed to quantify if honey proves beneficial in different scenarios of cutting treatment times. The objective of this research was to evaluate whether addition of honey to water-soluble auxin solutions increased root growth and uniformity compared to auxin solutions without honey.

## MATERIALS AND METHODS

Multi-node medial cuttings of *Rosa* 'Red Cascade' were harvested from containerized stock plants, trimmed to 2.5-in (6.4 cm). in length and stuck to a depth of 0.5-in. (1.3 cm) on 22 May 2020. Red Cascade rose was chosen as the model plant for preliminary studies since previous research has shown that it can be rooted successfully without using auxin although using an auxin-containing compound can result in an increased rooting response (Blythe et al., 2003). Propagation medium was 100% pine bark placed into 3.5-in. (8.3 cm) square production pots (T.O. Plastics, Inc., Clearwater, MN).

Cuttings were placed under intermittent mist applied for 6-sec/10-min during daylight hours. Treatments consisted of four honey types (none, general multiflora, Manuka, or locally sourced), and five auxin levels [0, 250, 500, 750, or 1,000 ppm indole-3-butyric acid (IBA) (Hortus Water Soluble Salts; Phytotronics Inc., Earth City, MO)]. Water soluble IBA solutions were created using deionized water. Honey treatments consisted of a 2:1 solution created by dissolving honey in either deionized water (when auxin level equaled 0 ppm) or the IBA solutions. Once the solutions were made, cuttings were treated with a 1-sec basal quick-dip in one of the twenty solutions before being stuck into production flats.

A completely randomized design with a 4×5 factorial treatment arrangement was utilized with 15 cuttings per treatment. Data collected after 42 days included rooting percentage, shoot height, total root number, average root length (three longest roots), and root quality (1-5, with 1=no roots and 5= ≥ 10 roots).

Additionally, net photosynthetic rate (A) and stomatal conductance ($gs_w$) values were sampled from five cuttings per treatment, for a total of 100 cuttings, between the hours of 7:30 A.M. and 11:30 A.M., using the LiCOR® 6800 Portable Photosynthesis System (LI-COR Biosciences; Lincoln, NE). Data were analyzed using linear mixed models and generalized linear mixed models with the GLIMMIX procedure of SAS (ver. 9.4; SAS Institute Inc., Cary, N.C.)

## RESULTS AND DISCUSSION

There was no interaction between honey type and auxin rate therefore only main effects are presented (Table 1). Utilization of honey or auxin during propagation of 'Red Cascade' miniature rose did not increase percent rooting, number of roots, average length of three longest roots, shoot height, or root quality rating for cuttings (Table 1). Additionally, the interaction between honey type and auxin rate was non-significant for net photosynthetic rate and stomatal conductance (Table 2). Use of honey or auxin during the propagation process does not increase the rate of gas exchange during the rooting process and, as a result, the assimilation of $CO_2$ into dry matter is unaffected. The data taken from the LI-COR platform further confirms that our tested rooting parameters as well as subsequent shoot growth is neither helped nor hindered by the addition of honey to water-soluble IBA solutions.

Table 1: Results of three different honey sources on rooting percentage, root number, average root length, root quality, and growth of medial stem cuttings of a miniature climbing rose (*Rosa* 'Red Cascade').

| | Rooting (%) | Roots (no.) | Avg. Length of three longest roots (cm) | Shoot Height (cm) | Root Quality Rating[z] |
|---|---|---|---|---|---|
| **Honey Type:** | | | | | |
| No Honey | 83.3 | 1.4ab | 9.7a | 3.4a | 2.9a |
| Local Honey | 100 | 1.4ab | 8.6a | 2.9a | 2.8a |
| Manuka Honey | 100 | 1.3b | 9.5a | 3.8a | 2.6a |
| Multiflora Honey | 100 | 1.6a | 8.8a | 3.4a | 2.9a |
| **Auxin Rate:** | | | | | |
| 0 ppm IBA | 83.3 | 1.5a | 8.6a | 3.4a | 2.8a |
| 250 ppm IBA | 100 | 1.5a | 7.8a | 2.6a | 2.6a |
| 500 ppm IBA | 100 | 1.4a | 9.6a | 3.5a | 2.8a |
| 750 ppm IBA | 93.3 | 1.4a | 9.9a | 3.6a | 2.7a |
| 1,000 ppm IBA | 100 | 1.5a | 9.8a | 3.8a | 2.8a |
| **Significance[x]:** | | | | | |
| Honey Type | NS | NS | NS | NS | NS |
| Auxin Rate | NS | NS | NS | NS | NS |
| Honey Type × Auxin Rate | NS | NS | NS | NS | NS |

[z]Root Quality (1-5, with 1 = no roots and 5 = ≥ 10 roots)
[y]Means within a column followed by the same letter were not different at α = 0.05 or 0.10.
[x] Significant at the $P \leq 0.1$ (*) or 0.05 (**) level. NS= Not significant

Our results differ from Whalley (Whalley, 2009). In their experiments, using a Manuka or a multiflora honey enhanced rooting, including a healthier or higher quality root system, when compared to a commercial root-promoting compound. Our results showed that honey type did not impact our tested rooting parameters. Our results differ from previous experiments on the effects of IBA rate on the rooting of Red Cascade miniature rose (Blythe et al., 2003). In their experiment, they found that rooting response of 'Red Cascade' rose increased with increasing auxin concentration. Our results showed that regardless of auxin concentration, our tested rooting parameters are not impacted by increasing auxin rate. Cuttings treated with 1,000 ppm IBA rooted similarly to those cuttings not receiving IBA at the time of treatment initiation.

Further research is currently ongoing to examine other woody ornamental plant species that vary in rooting difficulty to determine if addition of various honey types to water soluble IBA solutions enhances rooting responses. Cuttings that require longer propagation times may benefit from the addition of honey to auxin solutions as longer propagation time can allow for an extended period for soil pathogens to impact cutting health.

Table 2: Results of three different honey sources on assimilation rate and stomatal conductance values of medial stem cuttings of a miniature climbing rose (*Rosa* 'Red Cascade').

| | Assimilation Rate (A) ($\mu mol \cdot m^{-2} \cdot s^{-1}$) | Stomatal Conductance ($gs_w$) ($mol \cdot m^{-2} \cdot s^{-1}$) |
|---|---|---|
| **Honey Type:** | | |
| No Honey | 7.1a[z] | 0.19a |
| Local Honey | 8.7a | 0.19a |
| Manuka Honey | 7.4a | 0.16a |
| Multiflora Honey | 8.6a | 0.18a |
| **Auxin Rate:** | | |
| 0 ppm IBA | 8.4a | 0.16a |
| 250 ppm IBA | 9.0a | 0.18a |
| 500 ppm IBA | 8.4a | 0.19a |
| 750 ppm IBA | 6.8a | 0.15a |
| 1,000 ppm IBA | 7.2a | 0.20a |
| **Significance[x]:** | | |
| Honey Type | NS | NS |
| Auxin Rate | NS | NS |
| Honey Type × Auxin Rate | NS | NS |

[z]Means within a column followed by the same letter were not different at $\alpha = 0.05$ or 0.10.

[y] Significant at the $P \leq 0.1$(*) or 0.05 (**) level. NS= Not significant

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