

Minnesota Commercial Flower Growers Association Bulletin

Serving the Floriculture Industry in the Upper Midwest

IN THIS ISSUE

- 1 Factors Affecting Clematis Rooting
- 7 Recommended Calcium Levels
- 8 Calcium
- 9 Media Test Review
- 10 Land-Grant Universities Urged to Broaden Research Beyond Traditional Agricultural Mission
- 12 Cropping Systems for Greenhouse Tomatoes
- 14 Scheduling a Greenhouse Tomato Crop
- 15 Nutrition for Greenhouse Tomatoes
- 20 Managing Micronutrients in the Greenhouse
- 25 Minnesota Commercial Flower Growers 1992 Short Course
- 26 Whitefly Q & A for Bedding Plant Producers
- 29 Impact of the Floriculture Industry in Minnesota
- 37 Research Update

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FACTORS AFFECTING CLEMATIS ROOTING

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Introduction

Clematis production has increased significantly in Minnesota during the last 5 years. Although clematis have been propagated for decades, the method of propagation has essentially not changed. Traditionally, clematis are propagated in a washed sand based media without IBA application. Stuck cuttings are then placed in a humidity tent until rooting. Rooting generally takes 6 weeks.

We conducted a study to determine the influence of cultivar, media type, IBA and the node position from which a cutting is taken on clematis rooting.

Materials and Methods

Cuttings were taken from plants of *Clematis* cvs 'Jackmani', 'Contesse de Bouchard', 'Gypsy Queen' and *Clematis purpurea plena elegans* on March 5, 1991. Stock plants were composed of 5 nodes each. Node numbers were assigned from 1 at the base of the plant to 5 at the tip of the stem. Cuttings were treated with or without



Table 1. Summary of analysis of variance identifying the significance of medium, cultivar and node position on the time for clematis cuttings to root, root dry weight and primary root number after 8 weeks.

Term	Time to Root (days)	Root Dry Weight (grams)	Primary Root Number
Medium	***	***	***
Node Position	**	***	n.s.
Cultivar	***	***	***
Medium x Node Position	n.s.	**	n.s.
Medium x Cultivar	n.s.	***	n.s.
Node Position x Cultivar	n.s.	*	n.s.
Medium x Node Position x Cultivar	n.s.	n.s.	n.s.

Significant factors indicated by *(0.05), **(0.01), *** (0.001) or n.s. (non-significant) through Tukey's H.S.D.

Cultivars varied in their time of root initiation, primary root number and root dry weight.

0.1% IBA (indole-3-butyric acid) and placed in a humidity chamber in 1 of 5 different media:

- 1) 100% washed sand (**WS**),
- 2) 50% washed sand and 50% sphagnum peat (**WP**),
- 3) 50% sphagnum peat and 50% perlite (**SP**),
- 4) 100% perlite (**PT**), or
- 5) 50% sphagnum peat, 25% perlite and 25% vermiculite (**PV**)

Time of root initiation, root dry weight gain and primary root number were determined. Root dry weight and primary root number were collected after 8 weeks. The time of rooting was defined as when primary root length was equal to or exceeded 0.5 cm in length.

The experiment was organized as a 4 x 5 x 2 x 5 factorial with cultivar, medium, IBA treatment and node position assigned as main factors. There were 5 cuttings per treatment.

Results

Hormone Effects: IBA had no significant effect on clematis rooting.

Cultivar Effects: Cultivars varied in their time of root initiation, primary root number and root dry weight (Table 1 and 2; Figure 1). Both Gypsy Queen and *Clematis purpurea plena elegans* rooted after 38 days. In contrast, Jackmani rooted significantly later, i.e. 48 days (Table 2; Figure 1a).

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Table 2. The effect of medium type on time of rooting, root dry weight and primary root number, after 8 weeks, of *Clematis* cvs Jackmani, Contesse de Bouchard, Gypsy Queen and *Clematis purpurea plena elegans*. Numbers presented are treatment means across cultivar, IBA treatment and node position.

Medium Type	Time to Root (days)	Root Dry Weight (grams)	Primary Root Number
WS	36.2 a	.068 a	7.3 a
WP	44.7 b	.020 bc	4.2 bcd
SP	46.0 bc	.016 c	4.3 cd
PT	38.4 a	.086 a	6.3 ab
PV	41.6 ab	.056 a	5.3 b

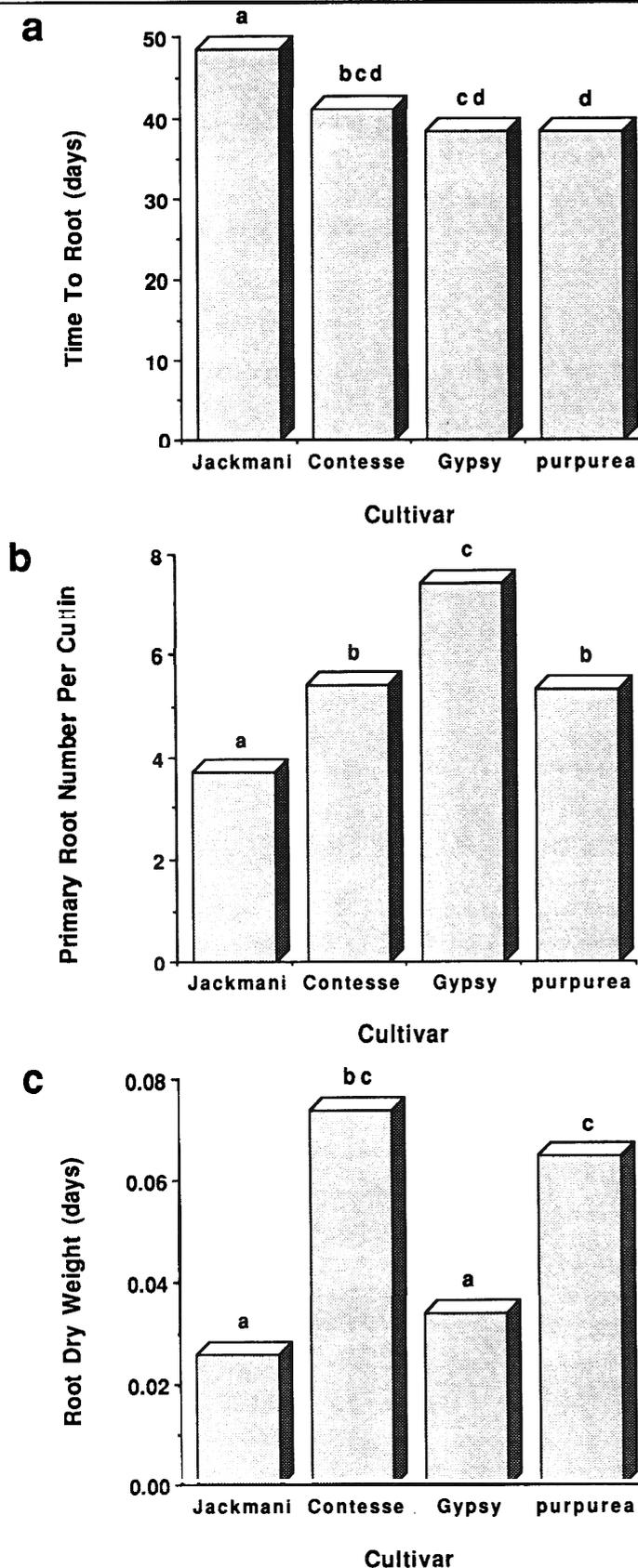


Figure 1. Variation in rooting time (a), primary root number per cutting (b) and root dry weight (c) of *Clematis* cv Jackmani, Contesse de Bouchard, Gypsy Queen and *Clematis purpurea plena elegans*.

Gypsy Queen had the greatest primary root number, 7.4 per cutting (Table 2; Figure 1b). Contesse de Bouchard and *Clematis purpurea plena elegans* had intermediate levels of primary root number. In contrast, Jackmani had the lowest primary root number with only 1/2 the primary root number (3.7 primary roots per cutting) as Gypsy Queen (Table 2; Figure 1b).

Contesse de Bouchard and *Clematis purpurea plena elegans* had a significantly greater root dry weight after 8 weeks compared to Jackmani and Gypsy Queen (Table 2; Figure 1c). Contesse de Bouchard had the greatest root dry weight (0.074 g) and Jackmani had the lowest root dry weight (0.026 g) (Table 2; Figure 1c).

Medium Effects: Medium significantly affected time to root, primary root number and root dry weight (Table 1). WS, PT and PV resulted in significantly earlier rooting than either WP or SP across cultivar, IBA treatment and node position (Figure 2). 'Sticking' cuttings into WS resulted in the earliest rooting, 36 days (Table 3; Figure 2a). In contrast, sticking cuttings in SP resulted in the slowest rooting, 46 days (Table 3; Figure 2a).

Rooting cuttings in WS or PT resulted in the greatest primary root number. In contrast, rooting cuttings in WP, SP or PV reduced primary root number. WS resulted in the greatest

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Root dry weight after 8 weeks was greatest when cuttings were placed in WS, PT or PV.

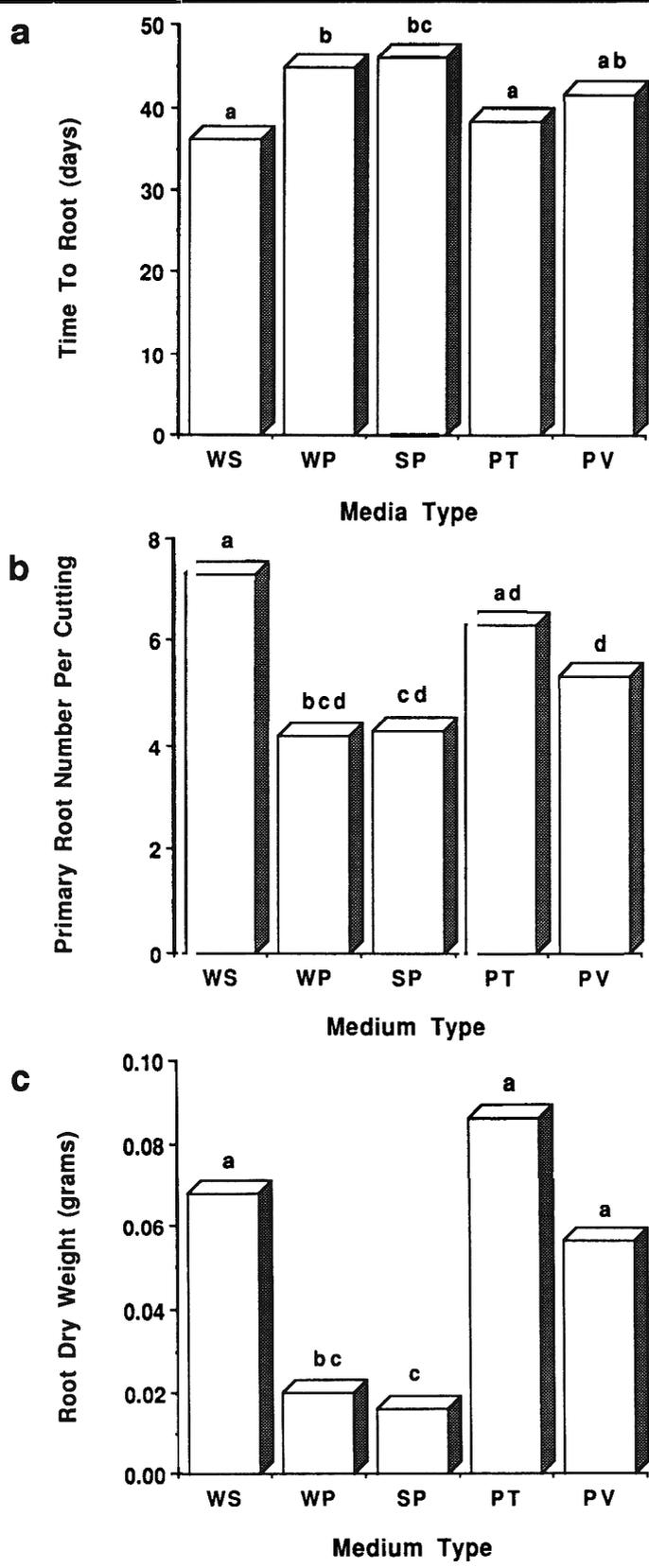


Figure 2. Effect of medium on time to root (a), primary root number per cutting (b) and root dry weight (c) of *Clematis* cv Jackmani, Contesse de Bouchard, Gypsy Queen and *Clematis purpurea plena elegans*.

primary root number (7.3 per cutting) across cultivar, IBA treatment and node position (Table 3; Figure 2b). In contrast, rooting cuttings in WP resulted in the lowest primary root number (4.2 per cutting) across cultivar, IBA treatment and node position (Table 3; Figure 2b).

Root dry weight after 8 weeks was greatest when cuttings were placed in WS, PT or PV. Root dry weight was significantly reduced when cuttings were placed in WP or SP. Root dry weight across cultivars and node positions was greatest when cuttings were placed in PT, 0.086 g (Table 3; Figure 2c). In contrast, root dry weight across cultivars and node positions was the lowest when cuttings were placed in SP, 0.016 g (Table 3; Figure 2c).

Node Position Effects: Node position had a significant effect on time to root and root dry weight after 8 weeks; node position did not have a significant effect on primary root number (Table 1). The time of rooting of a cutting decreased as cutting position increased from 1 to 2 then increased as node position increased from 2 to 5 across cultivars and media (Figure 3a). In contrast, root dry weight after 8 weeks increased slightly as node position increased from 1 to 2 then decreased as node position became more distal (Figure 3b).

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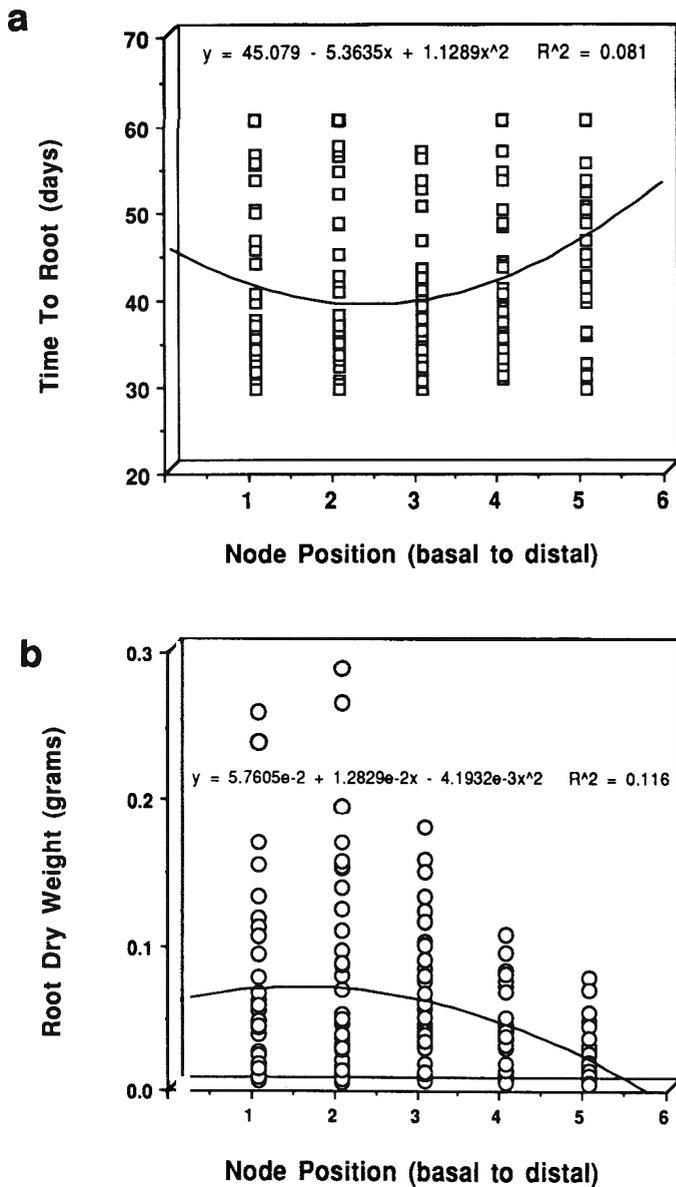


Figure 3. Variation in rooting time (a) and root dry weight (b) of *Clematis* cv Jackmani, Contesse de Bouchard, Gypsy Queen and *Clematis purpurea plena elegans* propagated from cuttings originating from different node positions on stock plants.

Discussion

Clematis varied greatly in their ability to root among cultivars and species (Table 2). Of the cultivars which were difficult to root, such as Jackmani, media type plays a greater role as evidenced by the significant medium x cultivar interaction on root dry weight (Table 1).

Typically, better rooting is achieved in peat based medium compared to sand based media in other plant species. Therefore, better and/or earlier rooting may be achieved in clematis if a peat-based media is used which is pH adjusted to 7.0-8.0.

Although there were significant effects of node position on time of rooting and

The traditional method of rooting cuttings in WS resulted in earlier and greater rooting than any of the other medium types other than PT. IBA had no effect on rooting and appeared to be unnecessary.

Interestingly, the degree of clematis rooting did not seem to be related to media structure; rooting was similar between media with very different structures such as WS and PT. Instead, time of rooting and the earliness of rooting appeared to be related to the pH of the medium; both WS and PT had the highest pH values of the medium types, 8.2 and 8.6, respectively, compared to SP and PV, 4.6 and 4.4, respectively.

When time of rooting, primary root number and root dry weight were regressed against media pH a significant relationship was found in all cases. Time of rooting decreased as pH increased (Figure 4a). Primary root number and root dry weight after 8 weeks increased as pH increased (Figures 4b and 4c).

Conclusions

Clematis appears to have a relatively high optimal pH for earliness of rooting and root development.

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Therefore, better and/or earlier rooting may be achieved in clematis if a peat-based media is used which is pH adjusted to 7.0-8.0.

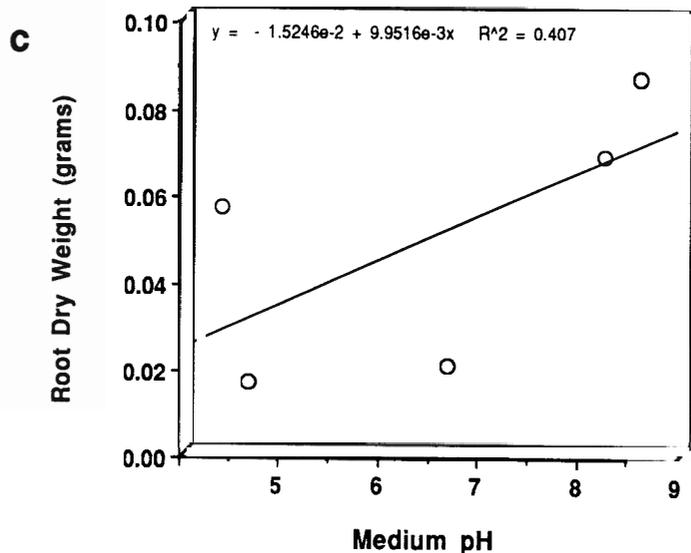
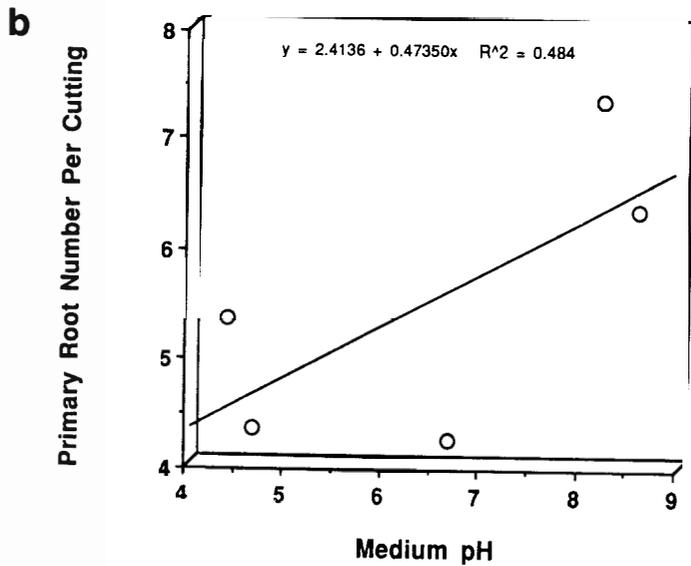
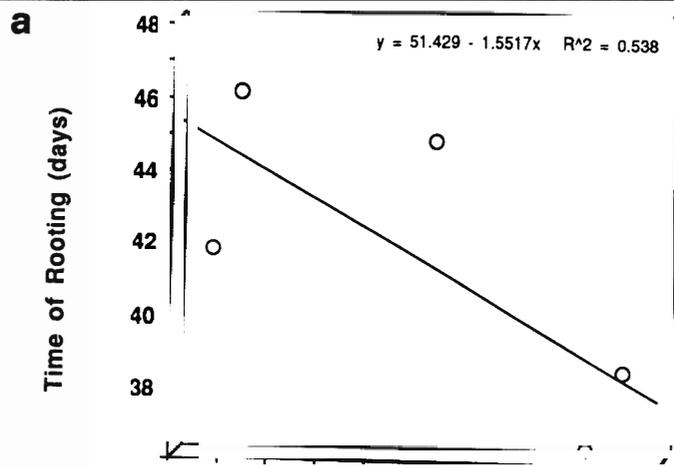


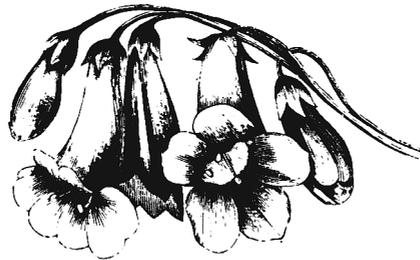
Figure 4. The effect of medium pH on time to root (a), primary root number (b) and root dry weight after 21 days (c) of *Clematis*. Data presented are means across cultivars and stock plant node positions.

root dry weight, they were not great. However, the data suggest that the 2 most distal cuttings do not have as great a potential for rooting as nodes lower down on the stem.



Table 3. The effect of cultivar on time of rooting, root dry weight and primary root number of *Clematis* cvs Jackmani, Contesse de Bouchard, Gypsy Queen and *Clematis purpurea plena elegans*. Numbers presented are treatment means across medium and nodes.

Cultivar	Time to Root (days)	Root Dry Weight (grams)	Primary Root Number
Jackmani	48.4 a	.026 a	3.7 a
Contesse de Bouchard	41.3 bcd	.074 bc	5.4 b
Gypsy Queen	38.4 cd	0.34 a	7.4 c
<i>Clematis purpurea plena elegans</i>	38.4 d	0.65 c	5.3 b



RECOMMENDED CALCIUM LEVELS

Gary W. Hickman

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For optimum greenhouse vegetable production, adequate nutrient solution or soil concentration of essential elements is necessary. Many published recommendations exist for calcium levels and are summarized below.

Calcium

Nutrient Solution Concentration - 136-300 ppm

Soil Nutrient Level - 200-1000 ppm

Leaf Tissue

Cucumber - 1-3%

Tomato - 2-3%

Lettuce - 1-2%

Pepper - 3%