

PROPAGATION OF SELECTED *CLEMATIS* L. CULTIVARS BY SOFTWOOD CUTTINGS

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Abstract. The goal of the experiments carried out was to compare the rooting ability of two types of softwood cuttings. Nodal softwood cuttings with two leaves were used and bud cuttings with one leaf. *Clematis* 'Madame Baron Veillard' and *Clematis tangutica* 'Golden Tiara' were chosen as model plants. Nodal softwood cuttings were 40 to 50 mm in length. Their base was wounded and stimulated by auxins. The leaf area was reduced. Bud softwood cuttings were created by a longitudinal cut and dividing of 15 mm long nodal cutting. All the wound was stimulated by auxins. In addition the leaf area was reduced. The regeneration of the root system was managed under controlled conditions. Nodal softwood cuttings and bud softwood cuttings of *Clematis* 'Madame Baron Veillard' and *Clematis tangutica* 'Golden Tiara' rooted on average from 84% to 92%. Statistical evaluation showed fairly insignificant differences in the rooting ability of the tested types of cuttings.

Key words: *Clematis* L., propagation, cuttings, rooting, regeneration

Abbreviations: NAA (Naphtalene Acetic Acid), IBA (Indole -3- Butyric Acid), IAA (Indole Acetic Acid)

INTRODUCTION

The genus *Clematis* L. includes approximately 250 species and numerous garden hybrids. It is a varied genus, made up of mostly woody, deciduous climbing plants, though a few are evergreen and a few herbaceous. There is a great variety in the flower form, color, bloom season, foliage effect and plant height. Leaves are opposite on the stem and mostly compound with three to five leaflets MARTIN (2007). Due to their many decorative features, the *Clematis* L. species and cultivars are a much appreciated species. They are often used in gardens.

The propagation technologies of *Clematis* L. species and cultivars have changed in the last few decades. Technologies of generative propagation were used (BÄRTELS, 1988) and different autovegetative and heterovegetative propagation technologies were used too (WALTER, 1997; HARTMANN ET AL. 1997). The technology used most is the propagation by soft wood cuttings at present (WALTER, 1997, URL 1). Double leaf bud cuttings are used most often (URL 2) or internodal cuttings. If there is a lack of plant material to use one leaf bud cuttings are possible.

To root optimally *Clematis* cuttings need special conditions during regeneration. The temperature should not be higher than 30°C. The substrate has to be porous. Air humidity necessary for *Clematis* species is lower than what is necessary for other ornamental plants. The *Clematis* species and cultivars react negatively to high air and substrate humidity. Their leaves and stems often decay.

The base of cuttings is stimulated by exogenous auxins. The concentration of applied exogenous auxins can depend on cultivars (OBDRŽÁLEK A PINC, 1997). In optimal conditions for example, by using a bottom heat of 23°C, roots should form within 14 days (URL 3). Well rooted cuttings need from four to six weeks to develop.

MATERIAL AND METHOD

The experiments have carried out over the two years. The goal of the experiments was to compare the rooting ability of two types of softwood cuttings. It took eight weeks from when the cuttings were taken to the formation of roots and the evaluation of the results. The regeneration ability of the cuttings was evaluated by cultivars *Clematis* 'Madame Baron Veillard' and *Clematis tangutica* 'Golden Tiara'.

Cuttings were taken in the period where the rapid growth of shoots occurred from the end of May to July. Cuttings were taken before the experiments were performed in the morning hours. Softwood cuttings of two types were used in order to represent experimental variants. In the first variant double leaf nodal cuttings were used. There were two buds on the cutting. The leaf area had been reduced by one third. Cuttings were from fifty to sixty mm long. The terminal cut was five mm above the buds. The nodal cut was about forty mm under the buds. A ten mm long lengthwise section had been made at the base of the cutting. Then the base of the cutting was simulated by the application of exogenous auxins. As a rooting stimulator STIMULAX (0,06% NAA, 0,06% IBA, 0,05% IAA) was used. Variant consisted of minimum sixty cuttings divided to three replications.

In the second variant bud cuttings were used. Fifteen mm long nodal cuttings were used followed by a vertical cut to produce two equally sized bud cuttings. Cutting consisted of one bud and one leaf. Leaf area was reduced by two thirds. Next the bud cutting was submerged in the auxin stimulator STIMULAX. Variant was replicated three times.

Cuttings were stick in rooting medium after stimulation. The depth of nodal cuttings sticking was thirty mm. They were sticking vertically to the rooting medium. Bud cuttings were sticking to the rooting medium little aslant. The section had to be all in the rooting medium. As a rooting medium sterile perlite was used. Roots regenerated in a foil house under controlled conditions. The lowest temperature was 18 °C. To reduce illumination shadowing textile was used. Cuttings were watered with a 2% concentration of Previcur (effective constituent: 607 g/l propamocarb) every fourteen days.

Rooting formation was first checked four weeks after the establishment of the experiments. All the results were evaluated after eight weeks. An analysis of variance and an LSD test of statistical significance in differences between the average values in statistical evaluation was used. On the basis of visual evaluation the qualitative side of regeneration could be noted. A comparison between the regenerated roots of the two types of cuttings could be made. The results were evaluated for two vegetation seasons.

RESULTS AND DISCUSSION

Results obtained for two years were statistically analysed. Not significant differences in root regeneration were noticed for tested taxa influenced by factors of the year. Significant level α was for cuttings of *Clematis* 'Madame Baron Veillard' 0,5695 and for cuttings of

Clematis tangutica 'Golden Tiara' it was 0,5109. Rooting ability for both cultivars differed only 3% between years.

On the base of analysis of variance no significant difference in the root regeneration of nodal and bud *Clematis* L. cuttings were found. The findings apply for both *Clematis* 'Madame Baron Veillard' and *Clematis tangutica* 'Golden Tiara' cuttings (Table 1).

Table 1

Analysis of variance of *Clematis* L. cultivars root regeneration influenced by the type of cutting

<i>Clematis</i>	Source of variation	Sum of Squares	DF	Mean square	F-ratio	Significant level α
'Madame Baron Veillard'	Type of cutting	154,80	1	154,80	4,56	0,0583
	Residual	338,98	10	33,89		
	Total	493,78	11			
tangutica 'Golden Tiara'	Type of cutting	8,84	1	8,84	0,48	0,5109
	Residual	183,72	10	18,37		
	Total	192,56	11			

The average number of rooted bud cuttings of *Clematis* 'Madame Baron Veillard' was 84%. From nodal cuttings of the same *Clematis* L. cultivar 91% rooted. The regeneration ability of the bud and nodal cuttings of *Clematis tangutica* 'Golden Tiara' was very similar. 92% of bud cuttings regenerated roots and 94% of nodal cuttings regenerated roots.

On the basis of the information mentioned above it is apparent that the propagation technology used does not have a significant influence on the rooting ability of *Clematis* 'Madame Baron Veillard' and *Clematis tangutica* 'Golden Tiara' cuttings. The percentage of rooted cuttings was by both types of cuttings statistically uniform. A notable difference was in the quality of the rooting. Nodal cuttings had roots of better quality than bud cuttings.

The time necessary for optimal roots formation concurred with the conclusions reached by other authors (WALTER, 1997; HARTMANN ET AL. 1997). The major influence of the type of heating used was confirmed on roots regeneration. As URL 3 mentioned by using a minimum heat of 23°C, roots should form within two weeks. In our experiments an air heating system was used which probably did not heat the rooting medium optimally. Roots formation was induced within four weeks.

CONCLUSIONS

Conclusions reached from the results obtained:

1. Softwood nodal and bud cuttings of *Clematis* 'Madame Baron Veillard' and *Clematis tangutica* 'Golden Tiara' rooted during the second month after the establishment of the experiment.
2. The type of *Clematis* L. cutting used does not have a significant influence on the number of new regenerated plants. Softwood nodal and bud cuttings rooted uniformly.

3. Regenerated roots of nodal softwood cuttings were of better quality.
4. The use of bud cuttings is possible in cases where there is a lack of mother plants. In comparison to technology using nodal cuttings, double the amount of cuttings can be produced. On the other hand, due to the lower number of regenerated roots, the further growth of rooted cuttings could be problematic.

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Fig. 1 - Softwood bud cutting

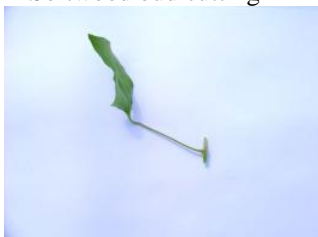


Fig. 2 - Softwood nodal cutting



Fig. 3 - Roots regeneration of softwood bud cutting



Fig. 4 - Roots regeneration of softwood nodal cutting

