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Interactive Effect of Calcium and Magnesium on Rooting of *Schefflera arbolicola* Cuttings

Bakht baidar[1], Gohar Ayub[1], Javid Rehman[2], Nadia Bostan[1], Fazal Rabi[1], Asif Ali[1] and Imtiaz Ahmad[1]
1. Department of horticulture, The University of Agriculture, Peshawar.
2. Agriculture Research Institute (North) Mingora Swat
*Corresponding author's email: Fazal Rabi <fazal_rabi10@yahoo.com>

Abstract
An experiment ''Interactive effect of calcium and magnesium on rooting of *Schefflera arboricola* cuttings'' was conducted at Ornamental Nursery Farm, Department of Horticulture, The University of Agriculture Peshawar during 2012-13. Calcium and magnesium each at 0, 5, 10, 15, and 20% were used alone and in combination. Calcium at the rate of 20% caused highest number of roots (11.07), root weight (2.65g) and root length (23.97cm) whereas magnesium alone at the rate of 10% resulted in better root length (24.21cm) and root weight (2.17g). Cutting treated with calcium and magnesium at the rate of 20% and 10% respectively produced highest root length (28.53cm) and root weight (2.93g), whereas highest number of roots (12.67) were observed in cuttings treated with 20% calcium and no magnesium respectively. Hence 20% calcium and 10% magnesium each alone and in combination respectively are recommended for the good quality root growth of S*chefflera arboricola* propagation through cuttings.

INTRODUCTION

Schefflera arboricola is an ornamental evergreen shrub belongs to family Araliaceae, native to China. It is commonly known as "Dwarf umbrella tree". It is foliage plant, normally growing three to four meter in height. Several cultivars have been developed for variation in leaf color and configurations, frequently variegated with centers or creamy white to yellow edges. (Edward, 1999). *Schefflera arboricola* is used, as landscape plants, as foliage plant (specimen plant), as cut flower, as filler and can be grown in containers as an indoor plant. Besides, it can also be used as medicinal plant. Being an important ornamental foliage plant, it has great potential in the market. Hence we need to propagate it in enormous amount to satisfy the market demand. Schefflera is generally propagated by two methods i.e. sexual and asexual propagation. Asexual propagation includes micro propagation, air layering and cutting. Cutting propagation is often the preferred method for plant propagation because it is the easiest and least expensive way to produce a clone of a particular parent plant while other methods i.e. grafting, layering and micro propagation are more difficult as these methods need skillful labor and more expenses. *Shefflera arboriola* is hard to root by propagation through cuttings which means, it may be auxotrophic in nature. Different rooting hormones are using for initiating roots in cuttings but they are expensive enough that nurserymen cannot use it on commercial scale. Besides hormones, calcium and magnesium also play a pivotal role in root initiation. Magnesium is important nutrient for being its role in root formation, chlorophyll and photosynthesis (Cakmak and Yazici, 2010). Calcium is an important element for root functioning and development (Zekri and Obreza, 2009). Both these nutrients are comparatively cheaper than hormones. Hence this project was planned to investigate effective and inexpensive macronutrients to replace plant growth regulators as far as rooting is concerned to achieve the following objectives;

- To study the optimum level of calcium and magnesium for optimal rooting.
- To explore an optimum interaction of Calcium and magnesium for rooting and the resultant growth.

MATERIALS AND METHODS

An investigation to find out the "Interactive effect of calcium and magnesium on rooting and growth of *Schefflera arboricola* cuttings" was conducted at Ornamental Nursery farm, Department of Horticulture, The University of Agriculture Peshawar, during the year 2012-13.

EXPERIMENTAL DESIGN

The experiment was design as randomized complete block design (RCBD) with two factors factorial arrangement and treatments were replicated three times.

Details of the experiment

The plastic bags (5x7 inches) were filled with farm yard manure, silt and sand at 1:1:1 and were settled according to the experimental design at the ornamental nursery. About 3 inches long cuttings containing at least three buds were used in the experiment. The cuttings were treated with calcium and magnesium each at the rate of O%, 5%, 10%, 15% and 20% alone and in combination. Lightly irrigation were carried out just before planting the cuttings and all the cultural operations like weeding, irrigation were practiced at appropriate time and regular interval throughout the experiment. The cuttings were planted on 28 May, 2012 and were uprooted

on 29 November, 2012

DATA COLLECTION

The data was noted on selected parameters at different vegetative growth at particular time. For noting various observations three plants in each treatment of every replication was labeled and was used for noting the chosen parameters.

PARAMETERS OBSERVED

The following parameters were studied during the experiment.

Number of roots plant^{-1}

Root weight plant^{-1} (g)

Root length plant^{-1} (cm)

STATISTICAL ANALYSIS

The noted data were statistically analyzed according to the technique related to randomize complete block design (RCBD) with two factors experiment through using a statistical package Statistics.

RESULTS AND DISCUSSION

Data recorded on the above parameters are presented in Tables 1-3. The results are briefly described as under.

Number of roots plant^{-1}:

Data regarding number of roots plant^{-1} is presented in Table-1. According to the analysis of variance number of roots is significantly affected by calcium and its interaction with magnesium while not by magnesium alone. The mean values regarding calcium shows that maximum number of roots (11.07) plant^{-1} was noted in cuttings treated with calcium at the rate of 20%, followed by 15% (9.13) roots plant^{-1} whereas minimum number of roots (7.47) plant^{-1} was observed in cuttings treated with no calcium. Regarding the mean values concerning magnesium more roots (9.07) were counted in cuttings treated with 0 and 5% magnesium, followed by (8.53) roots, in cutting treated with 5% magnesium while lowest number of roots (8.33) were observed in cuttings treated with 20 and 15% magnesium respectively. From the mean value regarding interaction between calcium and magnesium, it is cleared that the cuttings treated with calcium and magnesium at the rate of 20 and 0% caused more number of roots (12.67) plant^{-1}, followed by (11.67) roots numbers in cuttings treated with 20 and 5% calcium and magnesium whereas lowest roots number (6.00) plant^{-1} were observed in cutting treated with calcium and magnesium at the rate of 5% and 0% respectively. The increase in roots numbers might be due to calcium and magnesium application as calcium assists the cell division and cell enlargement while magnesium is involved in the enhancement of photosynthesis. These findings are in confirmation with the findings of Bellamine *et al*., (1998) who observed that increase in calcium concentration in the medium, increase the rooting proportion.

Table 1: Number of roots of *Schefflera arboricola,* as treated with different levels of calcium and magnesium.

Magnesium (%)	Calcium (%)					
	0	5	10	15	20	Means
0	8.00	6.00	9.00	9.67	12.67	9.07
5	7.33	8.67	7.67	10.00	11.67	9.07
10	8.33	7.67	8.00	8.00	10.67	8.53
15	7.00	8.00	7.33	9.33	10.00	8.33
20	6.67	8.67	7.33	8.67	10.33	8.33
Mean	7.47c	7.80c	7.87c	9.13b	11.07a	

LSD value for calcium = 0.81

LSD for Magnesium = 0.81

LSD for Calcium x magnesium = 1.81

Root length (cm):

Mean values regarding root length is displayed in Table-2. According to the analysis of variance root length is affected significantly by calcium, magnesium while non-significantly by their interaction. Mean values concerning calcium showed that largest roots (25.89cm) were noted in cuttings treated with calcium at the rate of 15%, followed by 20% calcium (23.84cm) root length, whereas smallest root (13.74cm) was observed in cuttings treated with no calcium. Mean values regarding magnesium showed that largest root (24.21cm) was observed in cuttings treated with magnesium at the rate of 10% followed by 15% magnesium (21.29cm) root length, whereas the smallest roots (16.20cm) were noted in cuttings treated with no magnesium. The largest root length might be due to calcium and magnesium treatment with the cuttings as calcium helps in enlargement of cells and magnesium provide photosynthates to the roots, from the upper part of the plant. These findings are in closely related to the finding of Attia *et al.* (2004) who reported that root length of *Ficus benjumina* increased when

treated with calcium. Calcium is of cause cell growth, both at the plant terminal and at the root tips. Calcium deficiency results in poorly developed root systems and relatively little fruit of poor quality, Steven, (2003).

Table 2: Root length (cm) of *Schefflera arboricola,* as treated with different levels of calcium and magnesium.

Magnesium (%)	Calcium (%)					
	0	5	10	15	20	Mean
0	9.33	12.77	16.63	22.73	19.53	16.20e
5	12.10	13.43	18.47	21.37	22.33	17.54d
10	18.07	21.10	24.83	28.53	28.53	24.21a
15	15.53	17.40	20.97	27.30	25.27	21.29b
20	13.67	14.10	18.53	25.50	24.20	19.20c
Mean	13.74d	15.76c	19.89b	25.09a	23.97a	

LSD value for calcium =0.94
LSD value for magnesium = 0.94

Root weight (g):

Data regarding root weight is displayed in Table-3. According to the analysis of variance root weight is significantly affected by calcium, magnesium and their interaction. The highest root weight (2.65g) was noted in cuttings treated with calcium at the rate of 20%, followed by 15% calcium (2.39g, while lowest root weight (0.73g) was noted in cuttings treated with no calcium. Mean value documented for magnesium showed that highest root weight (2.17g) was noted in cuttings treated with magnesium at the rate of 10%, followed by 15% magnesium (2.07g) whereas lowest root weight (1.55g) was observed in cuttings treated with no magnesium. According the mean values of interaction between calcium and magnesium, highest root weight (2.93g) was noted in cuttings, treated with calcium and magnesium at the rate of 20% and 10% whereas lowest root weight (0.50g) was noted in cuttings treated with no calcium and magnesium. The improvement in root weight might be due to calcium and magnesium because calcium is actively involved in cell division and cell elongation in roots hence increased the root biomass. These finding pertaining to root weight are in similarity to the finding of Attia *et al*., (2004) who reported that calcium treated plants gave maximum root biomass.

Table 3: Root weight (g) of *Schefflera arboricola*, as treated with different levels of calcium and magnesium.

Magnesium (%)	Calcium (%)					
	0	5	10	15	20	Mean
0	0.5	1.23	1.7	2	2.33	1.55e
5	0.6	1.23	1.73	2.3	2.53	1.68d
10	1.17	2.07	2.37	2.33	2.93	2.17a
15	0.8	1.8	2.2	2.8	2.77	2.07b
20	0.6	1.5	2.07	2.5	2.7	1.87c
Mean	0.73e	1.57d	2.01c	2.39b	2.65a	

LSD value for calcium = 0.10
LSD value for magnesium = 0.10
LSD value for Ca*Mg = 0.22

CONCLUSION AND RECOMMENDATION

From the above experiment it is concluded that cutting treated with 20% calcium and 10% magnesium showed best results regarding root length, number of roots and root weight, so on the basis of these conclusions it is recommended that calcium and Magnesium at the rate of 20% and 10% respectively, are recommended for the production of quality plants of schefflera propagated through cuttings.

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