

Propagation of Geranium (*Perlagonium hortorum*) Using Different Rooting Medium Components

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Abstract: Geranium is one of the most important species in bedding plant business in the world. Optimisation of a rooting substrate for cutting production is dependent on the proper combination of water content, air content, drainage, nutrient balance, pH etc. The aim of the investigation was to determine the effects of different medium components on the rooting of geranium cuttings and to recommend the best medium component for commercial propagation purposes. The design of the experiment was randomised complete block design (RCBD). There were five treatments, i.e. garden soil, vermiculite, compost, sand and mixture of garden soil, compost and sand at the ratio of 1:1:1 (v/v). The treatments were replicated four times. A 100% rooting was obtained from cuttings stuck in garden soil, compost and mixture of garden soil, compost and sand. The highest number of roots per cutting (10.1) was obtained from the mixture of garden soil, compost and sand. Cuttings rooted in sand had the highest fresh mass (8.3 g) and dry mass (3.8 g). The highest shoot height (23.8 cm) and number of leaves per cutting (5.9) was obtained from geraniums rooted in the mixture of garden soil, compost and sand. For the commercial propagation of geranium, sand and mixture of garden soil, compost and sand should be utilised.

Key words: Geranium • Rooting media • Root length • Number of roots • Root mass

INTRODUCTION

Geranium (*Perlagonium hortorum*) belong to the Geraniaceae Family. It originated from the Republic of South Africa in the Mediterranean climate of Cape Province. In nature, the plant is found growing in dry, hot habitats, fissures of rocky outcrops, sandy soils and sand dunes [1]. It ranks number one in terms of units sold among potted flowering plants and number three in terms of wholesale value [2]. According to Behe *et al.* [3] geraniums are suited for wide variety of applications like for decorations, as gift plants (Mother's day), indoor potted plant, used in window boxes, patio boxes, porch boxes, as bedding plant, used in hanging basket etc [4].

Geraniums can be propagated by seed and cuttings. Tissue culture propagation is also possible but most geraniums are propagated by vegetative mean. Advantage of vegetative propagation include rapid multiplication of plants, efficient maintenance of genetic uniformity and rapid attainment of size, convenience, ease of propagation, combination of genotypes and reduction

of the juvenile period [4, 5]. The use of cuttings is one of the most common and simplest methods of asexual propagation of geraniums [6]. Geraniums are propagated by using herbaceous or softwood cuttings.

It is generally accepted that most of the perennial ornamental plants are propagated by vegetative means using cuttings, layering, grafting, budding etc. The success of rooting cuttings depends on physiological age, time of rooting, environmental conditions, i.e. light, temperature and humidity and use of plant growth regulators [7].

Commonly used media for rooting cuttings include peat moss, coir, rockwool, vermiculite, perlite, sand, shredded bark, garden soil, compost etc. Choice of medium component used depends on availability of materials, size and type of container used, method of watering etc. However, medium used should be free of disease pathogens, weeds, pests, nematodes, have good water holding capacity and good drainage. Soil-less media have become very popular with propagators because of their consistency, excellent aeration, reproducibility and

low bulk density, which reduce shipping and handling costs of the medium itself and of the finished plants [1]. The basic ingredients used in soil-less media include peat moss and vermiculite. Under ideal conditions and depending on cultivar, rooting of geraniums occurs within 12 to 18 days after sticking. Cuttings are ready for transplanting in three to four weeks [8]. Wherever possible, rooting of cuttings should be performed under misting to maintain high relative humidity. The purpose of this study was to determine the effectiveness of different medium components in the propagation of geraniums and to determine the best medium among the locally available and cheaper materials for commercial utilisation.

MATERIALS AND METHODS

Experimental Site: The investigations were carried out in the greenhouse in the Horticulture Department, Faculty of Agriculture, Luyengo Campus of the University of Swaziland. The site is located at Luyengo, Manzini Region in the Middleveld agro-ecological zone. Luyengo is 26° 34' S and 31° 12' E. The average altitude of this area is 750 m above sea level [9, 10].

Experimental Design: The experiments were laid out in a randomised complete block design (RCBD). Medium components used in the rooting of geranium included garden soil, vermiculite, compost, sand and a mixture of garden soil, compost and sand in the ratio of 1:1:1 (v/v). The garden soil was steam pasteurised for 30 minutes at 80°C. The rooting of cuttings was performed using 12-cm plastic pots, which were filled using the different medium components according to the objectives of the experiment. The treatments were replicated four times and each treatment consisted of 15 pots. The medium was irrigated until water started dripping from the bottom holes of the pots and a single geranium cutting stuck in each pot. Softwood stem cuttings were obtained from mature flowering plants. The pots were placed in a plastic tunnel to ensure high humidity in order to prevent drying of the cuttings.

Data Collection and Analysis: Data were collected at the end of the propagation period, i.e. four weeks after sticking. Five randomly selected plants were used in each replication and treatment. Data collected included: number of rooted cuttings, number of roots per cutting, length of root system, fresh mass of roots, dry mass of roots, shoot

height and number of leaves per cutting. Collected data were subjected to analysis of variance (ANOVA) using M Stat-C statistical package and Duncan's New Multiple Range Test (1955)(DNMRT) was used to separate means that were significant.

RESULTS AND DISCUSSION

Root Formation: A 100% rooting was observed in geranium cuttings that were rooted in garden soil, compost and mixture of garden soil, compost and sand (Table 1). The lowest rooting was observed from cuttings rooted in vermiculite. In order for cuttings to form a new root system, they must have a ready moisture supply at the cut surface [11]. The high root formation observed with cuttings rooted in garden soil, compost and mixture of garden soil, compost and sand could be attributed probable to high water holding capacity and good aeration of the media.

Number of Roots per Cutting: The highest number of roots per cutting (10.1) was obtained from geraniums rooted in mixture of garden soil, compost and sand, while the lowest number of roots per cutting (5.0) was observed in plants rooted using garden soil (Table 1). There was no significance difference ($P < 0.05$) in the number of roots per cutting in geraniums rooted using sand and mixture of garden soil, compost and sand. Rooting geraniums in the mixture of garden soil, compost and sand resulted in formation of more than double the number of roots per cutting as compared to using garden soil alone. El-Naggar and El-Nasharty [12] reported that potting media as well as nutritional requirements are the most important factors affecting growth of ornamental plants. Khayyat *et al.* [13] observed that, the type of rooting media and their characteristics are of utmost importance for the quality of rooted cuttings. They also attributed the improved root formation and growth in *Epipremnum aureum* cuttings rooted in medium mixtures containing leaf mould and sand to better aeration, drainage and water holding capacity. The highest root formation observed in this investigation in the mixture of garden soil, compost and sand, can also be attributed to the same factors.

Length of Root System: The highest length of root system (6.8 cm) was obtained from geranium cuttings rooted using compost, while Garden soil induced the lowest length of root system (3.7 cm) (Table 1). The length of root system formed in geranium cuttings rooted in compost was almost double that obtained from cuttings

Table 1: Effects of growing medium components on root formation, shoot height, number of leaves, number of roots per cutting, length of root system and root fresh and dry mass of geraniums

Parameters	Rooting medium component				
	Garden soil	compost	vermiculite	sand	garden soil + compost + sand
Root formation (%)	100.0a*	100.0a	85.5b	95.0a	100.0a
Number of roots per cutting	5.0b	5.7b	5.5b	9.3a	10.1a
Length of root system (cm)	3.7d	6.8a	4.4cd	5.9b	4.7c
Root fresh mass (g)	1.3c	2.3bc	3.0b	8.3a	3.7b
Root dry mass (g)	1.0c	1.1bc	0.9c	3.8a	2.0b
Shoot height (cm)	23.6a	18.7b	20.7b	18.3b	23.8a
Number of leaves per cutting	5.6a	4.4b	5.3a	4.1b	5.9a

*Means followed by same letter along rows not significantly different. Mean separation by DNMRT, $P = 0.05$.

rooted in garden soil. The highest root length in geranium cuttings rooted in compost could probably be attributed to higher water holding capacity of the medium. Aeration also plays a very significant role in root elongation in cuttings [14]. This explains the observed low length of root systems obtained from geraniums rooted in garden soil.

Fresh and Dry Mass of Roots: The highest fresh mass of roots (8.3 g) was obtained from geranium cuttings rooted using sand, while the lowest root fresh mass (1.3 g) was observed in cuttings rooted in garden soil (Table 1). The fresh mass of roots formed by cuttings rooted in sand was more than 6x that obtained from cuttings rooted in garden soil. Similarly, the highest dry mass of roots per cutting (3.8 g) was obtained from geraniums rooted in sand and the lowest root dry mass (1.0 g) in cuttings rooted in garden soil (Table 1). The dry mass of roots per cutting was more than 3x in geraniums rooted in sand as compared to those rooted in garden soil. There was no significant difference ($P < 0.05$) in root dry mass per cutting in geraniums rooted in garden soil, compost and vermiculite. Khayyat *et al.* [13] reported that mechanical impedance and reduced porosity can reduce formation, growth and development of roots in cuttings. Higher root fresh and dry mass in geraniums rooted in sand was observed in this investigation could, therefore, be attributed to reduced impedance to root spread and better porosity of the medium.

Shoot Height: The highest shoot height (23.8 cm) was obtained from geranium cuttings rooted in the mixture of garden soil, compost and sand, while the lowest shoot height (18.3 cm) was observed in cuttings rooted in sand (Table 1). There was no significant difference ($P < 0.05$) in shoot height for the cuttings rooted in compost, vermiculite and sand. The high shoot height obtained in geraniums rooted in the mixture of garden soil, compost

and sand could probably be attributed to high water and nutrient holding capacity of the medium. The low shoot height was observed in cuttings rooted in sand could probably be attributed to low water holding capacity of the medium.

Number of Leaves: The highest number of leaves per cutting (5.9) was observed in geranium rooted in the mixture of garden soil, compost and sand, while the lowest number of leaves (4.1) was observed in cuttings rooted in sand (Table 1). According to Govinden-Soulange *et al.* [5], the number of leaves produced per cutting is determined by type of cutting used, plant growth regulators utilized, temperature, dry matter content of the cuttings before sticking in the medium and health status of the plant. Since all cuttings used in this investigation were uniform, the highest number of leaves per cutting observed in geraniums rooted in the mixture of garden soil, compost and sand could be attributed to other medium characteristics like porosity, water holding capacity and nutrient content. In conclusion, sand was found to be superior in the propagation of geranium when compared to the other medium components in most root parameters determined. The mixture of garden soil, compost and sand gave the next best results in most of the parameters. Sand and mixture of garden soil, compost and sand are, therefore, recommended for use in commercial propagation of geraniums under similar conditions.

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