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EFFECT OF DIFFERENT POTTING MEDIA COMBINATIONS ON GROWTH AND VASE LIFE OF TUBEROSE (*POLIANTHES TUBEROSA* LINN.)

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The present study was carried out in the agro-metrological conditions of Rawalpindi, Pakistan. Different potting media were used in different combinations to check their effect on the morphological parameters as well as on the vase life of the tuberose. The different treatments included the combinations of FYM, poultry manure, sand, leaf compost and coconut coir in equivalent ratio. The data was analyzed statistically which showed significant effect of media combinations over control values. Maximum plant spread, number of leaves and vase life was recorded in sand+FYM. Coconut coir + FYM contributed to the maximum values of plant height, leaf area and spike length. Maximum plantlets were counted for sand+poultry manure. The highest values of floral diameter, number of flowers per spike and shelf life were observed in sand+leaf compost. These findings lead toward better quality cut flower production with maximum vase life.
Keywords: Tuberose, soil less media, growth characteristics, floral characteristics, potting media

INTRODUCTION

Flowers are an integral part of human life due to their diversity in beauty, form, texture, color and fragrance. Tuberose (*Polianthes tuberosa* Linn.) belongs to family Amaryllidaceae and is a perennial flowering plant popular worldwide as cut flower (Singh and Shanker, 2011). Tuberose is grown for garden decoration in pots, beds, borders for cut flower, loose flower and extraction of essential oil. Tuberose is popular among flower loving people because of its sweet and pleasant fragrance and also long keeping quality. The quality of tuberose flower is affected by various pre- and post-harvest factors such as temperature, relative humidity, frequency of irrigation, picking time and nutrition (Benschop, 1993).

Tuberose is cultivated in most of the tropical and subtropical countries of the world (Asif *et al*., 2001). In plains of Pakistan, it blooms profusely during the summer and flaunts its fragrance indoor and outdoor. Loamy and sandy loam soils with pH range of 6.5-7.5 are the best for its growth (Sharga and Sharma, 1994). It is also very sensitive to change in the temperature. Mostly tuberose is propagated through corms. The best suitable diameter of corm and planting depth for cut flower production ranges 2.5-3.5 cm and 6.0 cm, respectively (Hussain, 1999).

Growth medium is known to have effect on value of potted ornamental plants (Vendrame *et al*., 2005) and plays an important role in germination rate, and many other physiological parameters including plant height, number of leaves, spike length, number of florets per spike, spike diameter and yield etc (Vendrame *et al*., 2005). A best growing media should have proper aeration, water holding capacity and adequate nutrition supply; different manures provide good nutrition to plants when applied in combination with soil less substrates (Khobragade *et al*., 1997). Different vegetative and reproductive growth parameters produced best results favored by different soil less media are observed in rose (Ahmad, 1989), *Lagerstroemia speciosa* (Tahir *et al*., 1997), *Dieffenbechia* plant (Aquila and Pasini, 1989) and tuberose (Mahrose, 1999).

In order to regulate flower supply and extension in vase life of many kinds of flowers, the use of suitable wrapping materials and chemical treatments before storage has been made with varying success (Saeed *et al*., 1993). Vase life was increased three times by using solution containing 200 ppm silver nitrate ($AgNO_3$) and 4mM silver thiosulfate STS (Bakash *et al*., 1999). Similarly, tuberose flower held in de-ionized water (DIW) had a vase life of 13 days with floret opening of 63% (Hutchinson *et al*., 2003). Sudagar *et al*. (2010) obtained maximum vase life and flower diameter of tuberose cultivars when immersed in a solution containing sucrose 2% + 8 HQC (200 ppm) + $AgNO_3$ (50 ppm).

In Pakistan a limited research work on tuberose is carried out particularly regarding effect of different soil less growth media for good growth, and to obtain best quality tuberose cut flowers. Present research work was planned to investigate the best soil less media contributing to good plant growth, best flowering quality and maximum vase life of tuberose under agro-ecological conditions of Rawalpindi. Furthermore this research also emphasized upon shortening of flowering cycle for tuberose.

MATERIALS AND METHODS

The experiment was conducted in the agro-metrological conditions of Rawalpindi at the fields and postharvest laboratory of the Department of Horticulture, PMAS Arid Agriculture University. Rawalpindi region features a humid sub tropical climate with maximum temperature of 126^0F and minimum of 25^0F with annual average rainfall of 990 mm and consider good for cultivation of *Polianthes tuberosa.* The corms of the single variety of tuberose was sown in 9 inch pots by using poultry manure, leaf compost and farm yard manure (FYM) in combination with coconut coir and sand in 1:1 ratio. Table 1 shows the treatments used for growth of *Polianthes tuberosa*.

Table 1. Treatment and composition of different media

Treatments	Composition
T_1	100% Sand
T_2	100% Coconut coir
T_3	Sand + FYM 1:1
T_4	Sand +Poultry manure 1:1
T_5	Sand +Leaf compost 1:1
T_6	Coconut coir + FYM 1:1
T_7	Coconut coir +Poultry manure 1:1
T_8	Coconut coir + Leaf compost 1:1

The treatments were replicated three times during the month of May. The physiological parameters including plant height (cm), number of plants, leaf area (cm^2), initiation time of spike, spike length (cm), spike weight (g), number of florets per spike, spike diameter (cm), flower diameter (cm) and vase life of flowers was observed in distilled water at 25°C. Completely Randomized Design was used to evaluate the results statistically and LSD (least significant difference) at 5% were calculated according to the method described by Steel *et al*. (1997).

RESULTS AND DISCUSSION

Growth characteristics:

***Plant height (cm)*:** It is observed from the Table 2 that the T_6 (coconut coir + FYM, 1:1) showed maximum plant height of 41.25 cm which is followed by T_5 (sand+ leaf compost, 1:1) by producing height of 38.13 cm in tuberose. The lowest plant height of 23.88 cm was contributed by T_4 (sand + poultry manure, 1:1). The results are in line with the work of Ahmad *et al*. (2004) and Turhan *et al*. (2007). They found that the best medium for the growth of saffron was mixture containing manure with its double application, above and below the corms. Our findings were in agreement with Yusef (1997) who reported that application of organic fertilizers had the best effects on growth of four annual flowers petunia (*Petunia hybrida* L.), snapdragon (*Antirrhinum majus* L.) and marigold (*Tagetes erecta* L.) and organic fertilizer increased plant height, flower diameter and number of flowers.

***Plant spread (cm)*:** It can be seen from the Table 2 that T_3 (sand + FYM, 1:1) produced maximum spread of 10.25 cm while the other treatments having T_4 (sand + poultry manure, 1:1), T_5 (sand +leaf manure, 1:1), T_6 (coconut coir + FYM, 1:1), T_7 (coconut coir +leaf manure, 1:1), T_1 100% sand and T_2 100% coconut coir produced spread of 7.25 cm, 7.5 cm, 8.28 cm, 4.63 cm, 4.75 cm, respectively, while the lowest spread of 3.75 cm was produced by T_7 (coconut coir + poultry manure, 1:1). The results are supported by the previous findings of Turhan *et al*. (2007) and El-Naggar and El-Nasharty (2009) who indicated that the different growing media had significant effect on the most of the vegetative growth characteristics, flowering parameters, bulbs productivity and leaf chemical composition parameters of *Hippeastrum vittatum* (Table 2).

***Number of leaves*:** Table 2 showed that the maximum number of leaves 36.09 were counted in treatment with (sand + FYM 1:1) followed by T_4 and T_5 by producing 23.17

Table 2. Effect of potting media on growth characteristics of *Polianthes tuberosa* L.

Treatment	Plant height (cm)	Plant spread (cm)	Number of leaves	Leaf Area (cm^2)	Number of plants	Spike Length (cm)	Spike Weight (g)
T_1	27.28 ^{D}	4.63 ^{CD}	17.28 ^{D}	8.95 ^{E}	0.50 ^{C}	0.00 ^{C}	0.00 ^{D}
T_2	25.95 ^{DE}	4.75 ^{CD}	10.09 ^{E}	13.10 ^{D}	0.00 ^{C}	19.10 ^{B}	19.10 ^{CD}
T_3	36.43 ^{BC}	10.25 ^{A}	36.09 ^{A}	23.93 ^{C}	0.00 ^{C}	69.20 ^{A}	34.30 ^{BC}
T_4	23.88 ^{E}	7.25 ^{B}	23.17 ^{B}	22.76 ^{C}	2.75 ^{A}	12.30 ^{BC}	8.30 ^{D}
T_5	38.13 ^{B}	7.50 ^{B}	24.34 ^{B}	21.55 ^{C}	0.00 ^{C}	72.40 ^{A}	50.20 ^{B}
T_6	41.25 ^{A}	8.25 ^{B}	20.38 ^{C}	50.55 ^{A}	0.00 ^{C}	70.40 ^{A}	32.50 ^{BC}
T_7	34.65 ^{C}	3.75 ^{D}	11.53 ^{E}	29.83 ^{B}	0.00^{C}	71.40 ^{A}	92.50 ^{A}
T_8	37.13 ^{BC}	5.13 ^{C}	16.97 ^{D}	30.20^{B}	1.25 ^{B}	19.40 ^{B}	7.80 ^{D}

Mean values denoted by the same letters are not significantly different at p=0.05 levels

and 24.34 and were statistically at par. Leaves for treatment T_6 (coconut coir+ FYM, 1:1), (coconut coir+ compost, 1:1), T_7 (coconut coir + poultry manure, 1:1), T_1 (100% sand) were counted as 20.38, 16.97, 17.28 and 11.53, respectively. The least number of leaves (10.09) were produced by treatment containing 100% coconut coir. This results were supported by the findings of Raiz *et al*. (2008). They counted maximum number of leaves in leaf compost mixture. The possible reason was nutritional contribution of the treatment that produced maximum number of leaves.

***Leaf area (cm^2)*:** The data on the leaf area was seen in Table 1 that the growing media significantly affected the leaf area as, T_6 had produced maximum leaf area of 50.55 cm^2 followed by T_7 (coconut coir + poultry manure, 1:1) and T_8 (coconut coir + leaf compost, 1:1) by producing leaf area of 29.83 cm^2 and 16.97 cm^{2,} respectively and was statistically at par with each other. Treatments with sand +FYM (1:1), sand + poultry manure (1:1), coconut coir + poultry manure (1:1) and coconut coir + leaf manure (1:1) produced leaf area of 23.93 cm^2, 22.76 cm^2, 20.38 cm^2 and 30.20 cm^2, respectively, which was statistically at par while T_1 and T_2 produced the leaf area of 13.1 cm^2 and 8.95 cm^2, respectively. The results are in agreement with those of Pal and Biswas (2005) who revealed that NPK fertilization significantly increased the leaf area in *Polianthes tuberosa.*

***Number of plantlets per plant*:** Table 1 shows that T_4 (sand + poultry manure, 1:1) produced maximum number of plantlets per plant (2.75) followed by T_8 (coconut coir + leaf manure, 1:1) by producing 1.25 plantlets/plant. The other six treatments T_1, T_2, T_3, T_5, T_6, T_7 with 100% sand, 100% coconut coir, sand + FYM (1:1), and sand + leaf compost (1:1), Coconut coir + FYM (1:1), coconut coir + poultry manure (1:1) produced no plantlets.

***Spike length (cm)*:** It was found that maximum spike length of 72.4 cm was obtained in T_7 (coconut coir + poultry manure, 1:1) followed by T_3 (sand + FYM, 1:1), T_5 (sand + leaf compost, 1:1), T_6 (coconut coir +FYM, 1:1) by producing spike length of 69.2 cm,72 cm, 70.4 cm, respectively and were statistically at par (Table 2). The rest of the treatments including T_8 (coconut coir + leaf compost, 1:1) T_2 (100% coconut coir) and T_4 (sand + poultry manure, 1:1) produced spike length of 19.40 cm, 19.1 cm and 12.3 cm, respectively while T_1 (100% sand) failed to produce any spike. These results were confirmed by the findings of Kariuki and Kako (1999) who observed increase in length of spike with increasing bulb size in *Ornithogalum saundersiae*.

***Spike weight (g)*:** As far as spike weight is concerned T_7 (coconut coir + poultry manure, 1:1) produced the heaviest spike of 92.5 g. The other treatments, i.e. T_2 (100% coconut coir), T_4 (sand + poultry manure, 1:1), T_5 (sand + leaf compost, 1:1), T_6 (coconut coir + FYM, 1:1), T_8 (coconut coir + leaf manure, 1:1) produced spikes with weight of 19.1 g, 34.3 g, 8.3 g, 5.02 g 30.25 g and 7.8 g, respectively and 100% sand did not produce any spike.

***Spike diameter (cm)*:** The data regarding spike diameter showed significant results for all treatments (Table 3). Maximum diameter of 0.6 cm was contributed by T_7 (coconut coir + poultry manure, 1:1) followed by T_5 (0.5) and T_3 (0.4) followed by diameter of 0.2 cm, 0.2 cm and 0.1 cm was observed in T_8 (coconut coir + leaf manure, 1:1), T_2 (100% coconut coir), T_4 (sand + poultry manure, 1:1), respectively.

***Days to start wither*:** Days to start wither are showed in Table 3. Four treatments T_7 (coconut coir + poultry manure, 1:1), T_5 (sand + leaf compost, 1:1), T_3(sand + FYM, 1:1), T_6 (coco nut coir + FYM, 1:1) took 4 days to start wither while T_2 (100% coconut coir), T_4 (sand + poultry manure, 1:1), T_8 (coconut coir + leaf compost, 1:1) took 1.3, 0.5 and 1 day to start wither, respectively.

Floral characteristics:

***Number of florets per spike*:** Table 3 shows that maximum number of florets 27.3 were produced by T_5 (sand + leaf compost, 1:1) followed by T_6 (26.8) and T_7 (23.3). The T_3 (sand + FYM, 1:1), T_8 (coconut coir + leaf compost, 1:1), T_2 (100% coconut coir), T_4 (sand + poultry manure, 1:1) were able to produce 18.6, 8.6, 5.5 and 2.81 floret, respectively while T_1 (100% sand) did notproduce any spike. The above

Table 3. Effect of potting media on floral characteristics of *Polianthes tuberosa* L.

Treatment	Spike Diameter (cm)	Days to start Wither	Floral Diameter (cm)	Number of flowers per spike	Shelf life
T_1	0.00 ^{F}	0.00 ^{C}	0.00 ^{D}	0.00 ^{F}	0.00 ^{D}
T_2	0.20 ^{D}	1.30 ^{B}	1.00 ^{C}	8.00 ^{D}	2.70 ^{C}
T_3	0.40 ^{C}	4.00 ^{A}	2.20 ^{B}	18.60 ^{C}	8.90 ^{B}
T_4	0.10 ^{C}	0.50 ^{BC}	0.80 ^{C}	2.81 ^{EF}	2.00 ^{CD}
T_5	0.40 ^{C}	3.30 ^{A}	3.40 ^{A}	27.30 ^{A}	12.30 ^{A}
T_6	0.50 ^{B}	3.30 ^{A}	3.10 ^{A}	23.30 ^{B}	11.00 ^{AB}
T_7	0.60 ^{A}	4.00 ^{A}	3.10 ^{A}	26.80 ^{AB}	12.00 ^{A}
T_8	0.20 ^{D}	1.00 ^{BC}	0.70 ^{C}	6.50 ^{DE}	2.80 ^{C}

Mean values denoted by the same letters are not significantly different at p=0.05 level

mentioned results are fully supported by Riaz *et al*. (2008) who found that maximum number of flower per plant were produced by a mixture containing leaf manure. Similar results were obtained by (Singh, 2000) who observed that larger corms produced more florets in gladiolus.

***Floral diameter (cm)*:** Floral diameter presented in Table 3 shows maximum floret diameter of 3.4 cm in T_5 (sand + leaf compost) followed by T_6 (coconut coir + FYM) and T_7 (coconut coir + poultry manure) by producing spike diameter of 3.1 cm and was statistically at par with T_5. While rest of the treatments including T_3 (sand + FYM), T_4 (sand + poultry manure), T_2 (100% coconut coir) and T_8 (coconut coir + leaf manure) contributed to floral diameter of 2.2 cm, 0.8 cm.0.7 cm and 1 cm, respectively. These results are supported by Awang and Ismail (1997) who reported that growth mixture with leaf manure produced the second largest flower size.

***Shelf life*:** From the data showed in Table 3 it is clear that maximum shelf life of 12.3 days was observed in T_5 (sand + leaf manure, 1:1) followed by T_7 (coconut coir + poultry, manure 1:1) with shelf life of 12 days and are statistically significant with each other. The treatments like T_6 (coconut coir + FYM), T_3 (sand + FYM), T_2 (100% coconut coir), T_8 (coconut coir + leaf compost) and T_4 (sand + poultry manure) contributed to shelf life of 11, 8.9, 2.7 2.8, and 2 days, respectively.

CONCLUSION

The growth characteristics of *Polianthes tuberosa* were significantly affected by the mixture of coconut coir and FYM because. It is rich in minerals that are required for the efficient growth for crop plant. The maximum contribution to the floral characters was observed in the potting mixture containing sand and poultry manure because poultry manure is well decomposed and all the required nutrients were readily available to the plant.

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