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Effect of Growing Media Depth of Chrysanthemum (*Dendranthema grandiflora* Tzvelev) cv. Prof. Harris for Rooftop Gardening

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ABSTRACT

An experiment was conducted to study the effect of growing media depth of Chrysanthemum (Dendranthema grandiflora Tzvelev) cv. Prof. Harris for Rooftop Gardening during 2016. The experiment was laid out in two-factor completely randomised block design comprising of five growing medias having different components by volume at three different depths, viz. D_1:10 cm, D_2:20 cm and D_3: 30cm depths. The media compositions were G_1: soil + sand + coco peat + vermicompost (1:1:2:2), G_2: sand + coco peat + vermicompost (1:2:2), G_3: sand + coco peat + vermicompost + vermiculite (1:2:2:0.5), G_4: sand + coco peat + vermicompost + perlite (1:2:2:0.5) and G_5: sand + coco peat + vermicompost + vermiculite + perlite (1:2:2:0.25:0.25). Among the growing media and depth, G_5 and D_3 recorded the highest mean leaf area of 376.40 cm^2 and highest leaf area of 463.07cm^2 respectively. G_5 recorded the highest mean for root number(30.61), flower diameter (7.32cm), self life (36.69 days) and vase life (20.09 days) of flower. Media depth D_3 recorded the highest mean of 37.09 for root number. On the otherhand, D_3 found the maximum floral diameter (7.10cm), shelf life (38.86 days) and vase life (20.28 days) of the flower. Among the growing media and depth, the highest mean for fresh weight of flowers (5.29g) was recorded for G_5 and 5.14g in D_3. The highest mean for dry weight of flowers (4.27g) was recorded for G_5, at par with G_3 (4.09g). The highest chlorophyll content (3.09mg g^{-1} FW) was recorded for growing media G_5 and 3.37mg g^{-1} FW in D_3. G_5 (91.11%) and D_3 (90.36%) recorded the highest moisture content for growing media and media depth respectively.

Key words: *Dendranthema grandiflora T., rooftop gardening, Growing media, Media depth, Perlite, Vermiculite, Cocopeat, Vermicompost*

INTRODUCTION

Rooftops are places of fantasy and imagination. Roof gardens which are the precursors of contemporary green roofs have ancient roots. The earliest acknowledged roof gardens were the hanging gardens of Semiramis, the present day Syria, considered one of the seven wonders of the ancient world. Today, similar elaborate and modern roof-garden projects have been designed for high-profile international hotels, business centers, and private homes[5].

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Since forests, agricultural fields, and suburban and urban lands are replaced with impervious surfaces resulting from development, the necessity to recover green space is becoming increasingly critical to maintain environmental quality[4]. In an accessible rooftop garden, space becomes available for localized small-scale urban agriculture, a source of local food production. A rooftop garden can supplement the diets of the community it feeds with fresh and nutritious produce and provide a tangible tie to food production. Moreover rooftop agriculture allows for the retention of traditional or cultural gardening practices while local choice of plants can preserve heritage species and maintain diversity in diet. Rooftops are underutilized and rarely considered as urban space which otherwise could be utilized with potential for creative development. There are essentially three options for rooftop gardens. The first is container gardening, a less formal, cheaper form of roof gardening. In container gardening, few to no modifications are made to the existing roof-structure; containers like old bath tubs, tyres, wooden box, fish cartoons etc. are placed on a rooftop and filled with soil and plants. The second type of roof garden, in which the rooftop actually becomes a planting medium, involves more intensive investments. The third rooftop garden possibility is rooftop hydroponics, in which plants are grown in a soilless medium and fed a special nutrient solution. Rooftop hydroponics can be the lightest of the three options and may offer the possibility for faster plant growth and increased productivity.

MATERIAL AND METHODS

The study was conducted in the rooftop of New Administrative Building, Assam Agricultural University, Jorhat during 2016. Cuttings of 5-7 cm from the terminal portion was taken on August 20th 2016 and planted in pro-trays having sand as rooting media for rooting. The rooted cuttings were then planted in the experimental box on 16th September 2016. The experimental boxes were thermacol box having a length and breadth of 60cm and 40 cm respectively. The plants were planted at a spacing of 30cm × 20cm thus four plants were accommodated in one box. NPK, 19 All @ 2g/l was sprayed twice a week to the plants and a combination of micronutrients was sprayed @ 2 g/ l once a week to the plants. The treatments were three depths of media along with five different compositions of media comprising of components mixed in various proportions by volume *viz.* D_1:10 cm, D_2:20 cm and D_3: 30cm depths. The media compositions were G_1: soil + sand + coco peat + vermicompost (1:1:2:2), G_2: sand + coco peat + vermicompost (1:2:2), G_3: sand + coco peat + vermicompost + vermiculite (1:2:2:0.5), G_4: sand + coco peat + vermicompost + perlite (1:2:2:0.5) and G_5: sand + coco peat + vermicompost + vermiculite + perlite (1:2:2:0.25:0.25). There were fifteen treatment combinations comprising of three level of depth of media and five different growing media. The experiment was designed based on two factor completely randomized block design with three replications. The average data were recorded on plant growth characters like leaf area, root number and flower characters like diameter of flower, self life, vase life, fresh weight of flower were recorded at maturity or at final growth stage. The experimental site was located at 26°47′N latitude, 94°12′E longitude and 86.8 m above the mean sea-level. Jorhat falls within Upper Brahmaputra Valley Agro Climatic Zone of Assam. The climatic condition of this zone is characterized by a subtropical humid climate having a hot humid summer and relatively dry and cool winter. The rainfall is about 2500 mm but unevenly distributed throughout the year. Normal rain starts from June and continues up to September with the pre-monsoon shower commencing from the mid-March. The intensity of rainfall is highest in monsoon season which normally begins from first week of June. Then the intensity of the rainfall decreases from October onwards reaching the minimum during December/January. In general the maximum temperature being around 34.36°C during summer and the minimum around 7°C during winter.

RESULTS AND DISCUSSIONS

Chrysanthemum is a shallow rooted crop, but the increase in media volume promoted the growth of feeder roots as evident from root volume. The increase of the plant growth characters might be attributed to the increased level of nutrient availability as the media content in the container increased with depth which corroborated report by Cantliffe[3]. The highest leaf area per plant of 376.40cm^2 in chrysanthemum were recorded in growing media G_5. The highest leaf area could be due to the higher number of leaves recorded in G_5 for leaf number (Table 4.2 and 4.22). With increase in the depth of growing media, the leaf (463.07cm^2 in chrysanthemum) of the plants increased as the leaf area of individual leaf increased for the plants grown in 30cm depth. The lowest leaf area in combination D_1G_1 could be attributed to less volume of growing media which restricted the nutrient supply. Similar result was reported by Iersel[1], in salvia. Root number of 40.43 for gerbera and chrysanthemum was recorded as highest in media G_5. The air porosity of the media might have provided ambient aeration for the roots as media aeration is an important factor for root development in plants. Among the media depths, D_3 i.e. 30cm recorded the highest root number for chrysanthemum because a depth of 30cm facilitated the growth of feeder roots which was comparatively restricted in case of 10cm and 20cm growing media depths. The treatment combination of D_3G_5 recorded the highest root number of 40.43in chrysanthemum. This might be due to the fact that there was less competition among the plants for space as the container size was bigger and the high porosity of the media facilitated vigorous growth.

The highest mean for diameter of flower (Table 4.11 and 4.31) was recorded in media G_5 which consisted of cocopeat, vermiculite and perlite among the media components. Higher performance of these characters might be due to the physico-chemical characteristics of G_5 in which the organic matter existence along with inorganic matter such as perlite improved the property of the media. Similar results were reported by Fakhri *et al.*[2], who obtained the largest flower on mixes of perlite. The diameter of flowers were highest in media depth 30cm. This might be due to increase in media volume which led to an increase in nutrient availability and less overlapping of the root zone. The treatment combination of D_3G_5 recorded the highest diameter of flowers. This might be due to the fact that the vegetative growth and root growth parameters were found to be the highest in this treatment. Self life and vase life of flower were found to be longest in growing media G_5 for chrysanthemum. This could be due to the better availability of P and K and also due to higher amount of reserve food material content in the flower. Likewise, the longest self and vase life observed in media depth D_3 could be attributed to the larger amount of available N, P and K with greater volume of the media. The combination D_3G_5 recorded the longest self life and vase life. This character might be due to the larger amount of N, P and K made available by the presence of vermiculite in the rhizosphere of the plant. Fresh and dry flower weight (Table 4.16, 4.17, 4.36 and 4.37) were found to be higher for growing media G_5.This might due to the larger leaf area which resulted in greater accumulation of photosynthates in the individual flowers. The highest fresh weight and dry weight of flower were found in media depth D_3 i.e. 30cm. This might be due to the vigorous growth of the plant which resulted in larger accumulation of photosynthates in the individual flowers.The treatment combination D_3G_5 recorded the highest fresh weight and dry weight of flowers which might be due to resultant highest shoot and root characters signifying accumulation of higher photosynthates in the individual flowers compared to other combinations. Longest duration of bloom for chrysanthemum was observed in growing media G_5 and the lowest was recorded in G_1.This might be due to the larger availability of nutrients in the media because of the presence of vermiculite which has high CEC and also prevents leaching of nutrients. The blooming period was significantly influenced by the depth of the growing media. The blooming period increased with the increase of media depth.

Depth of 30cm recorded the highest blooming period of 62.37 days for chrysanthemum. This might be attributed to the increase in nutrient availability due to larger media volume. The combination of D_3G_5 showed significantly high blooming period of 64.76 days for chrysanthemum. This might be due to the complimentary effect of depth of media and growing media which recorded highest for all other characters. Highest mean chlorophyll content of 3.09mg g^{-1} FW in chrysanthemum were observed in growing media G_5. This might be due to the high availability of N in the media. The chlorophyll content was highest in media depth 30cm which might be due to the increase in media volume resulting in an increase in N availability. Chlorophyll content in the combination D_3G_5 was recorded highest. This might be due to the high CEC of vermiculite present in the media which made N available to the plant. Growing media G_5 recorded the highest moisture content. This might be due to the perlite present in the media which have microspores to hold water and make it available to the plants constantly. With the increase of media depth the moisture content also increased with the highest in D_3. This might be due to the increase in media volume that made more water available for the plant. D_3G_5 exhibited highest moisture content in plants due to better water holding capacity of perlite and vermiculite and increased depth of the media.

CONCLUSION

From the experimentation, it may be concluded that the media G_5 (sand + cocopeat + vermicompost + vermiculite + perlite, 1:2:2:0.25:0.25 v/v) along with media depth D_3 i.e. 30cm was considered as the best for rooftop gardening of chrysanthemum. This media composition can be considered also recommended for rooftop gardening under Assam condition.

Table 1: Effect of media depth and composition on plant characters

Treatment	Leaf Area (cm^2)	Root number	Diameter of flower (cm)	Self life (days)	Vase life (days)	Fresh weight of flower (g)	Dry weight of flower	Chlorophyll Content (mg g^{-1} FW)	Moisture content (%)
D_1	233.14	17.69	6.66	31.21	17.55	4.76	3.84	2.47	89.48
D_2	315.86	26.91	6.94	35.46	19.78	4.98	3.92	2.98	90.26
D_3	463.07	37.09	7.10	38.86	20.28	5.14	3.78	3.37	90.36
SEd(±)	2.272	0.042	0.024	0.408	0.366	0.043	0.110	0.012	0.006
CD (5%)	4.654	0.086	0.050	0.836	0.749	0.089	0.224	0.025	0.012
G_1	307.04	23.94	6.15	34.08	18.97	4.40	3.39	2.80	89.24
G_2	314.84	26.27	6.90	34.58	18.71	4.92	3.72	2.85	89.60
G_3	354.98	27.42	7.17	34.44	19.44	5.16	4.09	3.02	90.52
G_4	333.53	27.91	6.96	35.97	18.81	5.02	3.77	2.92	89.70
G_5	376.40	30.61	7.32	36.69	20.09	5.29	4.27	3.09	91.11
SEd(±)	2.933	0.054	0.032	0.527	0.472	0.056	NS	0.016	0.008
CD (5%)	6.009	0.111	0.065	1.080	0.967	0.115	NS	0.032	0.016
$D_1 G_1$	198.51	14.67	5.51	30.02	16.69	3.88	3.03	2.32	88.48
$D_1 G_2$	199.89	17.66	6.80	31.04	17.01	4.77	3.99	2.42	89.28
$D_1 G_3$	261.63	16.73	6.98	30.79	18.67	5.00	4.00	2.52	89.38
$D_1 G_4$	230.24	18.68	6.88	32.07	16.87	4.97	3.95	2.48	89.45
$D_1 G_5$	275.44	20.68	7.13	32.11	18.50	5.18	4.25	2.60	90.81
$D_2 G_1$	286.32	22.79	6.46	34.67	19.40	4.72	3.73	2.83	89.56
$D_2 G_2$	302.21	24.90	7.00	34.95	19.76	5.04	3.76	2.87	89.69
$D_2 G_3$	326.59	27.73	7.05	34.19	19.89	5.01	4.10	3.09	91.11
$D_2 G_4$	317.20	28.42	7.04	36.28	19.73	4.99	3.80	2.92	89.72
$D_2 G_5$	346.99	30.72	7.15	37.86	20.12	5.12	4.20	3.17	91.23
$D_3 G_1$	436.29	34.34	6.47	37.55	20.81	4.60	3.41	3.25	89.69
$D_3 G_2$	442.40	36.26	6.88	37.76	19.37	4.96	3.42	3.27	89.83
$D_3 G_3$	476.72	37.80	7.48	38.33	19.75	5.46	4.15	3.46	91.07
$D_3 G_4$	453.15	36.62	6.98	39.57	19.81	5.09	3.57	3.36	89.92
$D_3 G_5$	506.77	40.43	7.70	40.10	21.64	5.58	4.37	3.49	91.29
SEd(±)	5.081	0.094	0.055	NS	NS	NS	NS	0.027	91.29
CD (5%)	10.408	0.192	0.112	NS	NS	NS	NS	0.055	0.027

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