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Effect of Different Potting Media on Growth and Foliage Yield of Water Spinach (*Ipomoea aquatic* Forsk.) under Container Gardening

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Abstract The experiment was conducted during 2015-16 to investigate the effect of different potting media on growth and foliage yield of water spinach (*Ipomoea aquatic* Forsk) under container gardening. Experiment was laid out in randomized block design replicated thrice. The treatment was consist of thirteen treatments viz., T_1 Coco-peat, T_2 Black Soil, T_3 Vermicompost (50%) + Coco-peat (50%), T_4 FYM (50%) + Coco-peat (25%) + Sand (25%), T_5 Coco-peat (50%) + Sand (25%) + Black Soil (25%), T_6 Vermicompost (50%) + Black Soil (50%), T_7 Black Soil (50%) + FYM (50%), T_8 Black Soil (50%) + Paddy husk (50%), T_9 Sand (50%) + FYM (25%) + Coco-peat (25%), T_{10} Black Soil (50%) + Vermicompost (25%) + Charcoal (25%), T_{11} Black Soil (50%) + FYM (25%) + Sand (25%), T_{12} Black Soil (50%) + Paddy husk (25%) + Vermicompost (25%), T_{13} Laterite soil (50%) + FYM (25%) + Coco peat (25%). The findings revealed that treatment T_8 recorded the highest, foliage yield, the next followed by T_9, T_{12} and T_{13}, whereas T_1 exhibited minimum yield.

Keywords Water spinach, Potting media, Container gardening, Growth, Foliage yield.

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Introduction

Water spinach (*Ipomoea aquatica* Forsk.) is an herbaceous aquatic or semi-aquatic perennial plant of the tropics or subtropics [1] belongs to family convolvulaceae. The leaves have a very pleasant, mild, sweet flavor and a slightly slippery texture, which contrast when cooked with the crispness of the stems. *Ipomoea aquatica* used as carminative agent and lessens inflammation and is useful in fever, jaundice, biliousness, bronchitis, liver complaints. *Ipomoea aquatica* is a rich source of vitamins, minerals, proteins, fibers, carotenes and flavanoids with many health benefits. It is an essential food item for people with anemia and pregnant women who need iron in their diets [2]. It is also rich in dietary fiber, protein, calcium, iron, vitamin A and vitamin C as indicated in the table below [3]. *Ipomoea aquatica* grows prostrate or floating [4] with shoots that are in contact

Table 1. Details of the different treatment.

Sl. No.	Treat-ments	Different media
1.	T_1	Coco-peat
2.	T_2	Black Soil
3.	T_3	Vermicompost (50%) + Coco-peat (50%)
4	T_4	FYM (50%) + Coco-peat (25%) + Sand (25%)
5.	T_5	Coco-peat (50%) + Sand (25%) + Black Soil (25%)
6.	T_6	Vermicompost (50%) + Black Soil (50%)
7.	T_7	Black Soil (50%) + FYM (50%)
8.	T_8	Black Soil (50%) + Paddy husk (50%)
9.	T_9	Sand (50%) + FYM (325%) + Coco-peat (25%)
10.	T_{10}	Black Soil (50%) + Vermicompost (25%) + Charcoal (25%)
11.	T_{11}	Black Soil (50%) + FYM (25%) + Sand (25%)
12.	T_{12}	Black Soil (50%) + Paddy husk (25%) + Vermicompost (25%)
13.	T_{13}	Laterite soil (50%) + FYM (25%) + Coco peat (25%)

with both water and air. It is cultivated in moist soil, small and big water courses, e.g. flooded soil, ditches, ponds, canals and rivers and it is harvest once a week under normal tropical conditions [5]. It has been found that water spinach has a high potential to convert nitrogen from bio-digester effluent into edible biomass with high protein content [6]. Water spinach requires fertile soils rich in organic matter. Overwatering can leached out readily available nutrients and will affect yield. So, there is need to find out the best organic potting media for water spinach. Therefore present investigation was conducted to study the effect of different potting media on growth and foliage yield of water spinach under container gardening.

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Materials and Methods

The experiment was conducted during 2015-16 at center of excellence on protected cultivation and precision farming, Indira Gandhi Krishi Vishwavidyalaya,Raipur (CG) under randomized block design with seven treatments (Table 1) and three replications in each treatment. For filing the container, preparation of mixing different media was done by different sources and filling different amount of media in container and finally leveled with level equipment. The layout of prepared plot was done as per the experimental design. The plants were grown in container at the distance of 15 cm from row to row and 15 cm from plant to plant and the container size was 91.44.× 60.94 cm^2. Recommended dose of fertilizers and other cultural package of practices were adopted for better crop growth. Five competitive plants were selected randomly from each container to record observation on various parameters i.e. number of primary vine $plant^{-1}$, primary vine length (cm), leaf length (cm), leaf width (cm), number of nodes in primary vine, foliage yield cuttings-1 (kg) and total foliage yield (kg $container^{-1}$). The analysis of variance was carried out for each character separately as per method suggested by Gomez and Gomez [7].

Results and Discussion

The data on various parameters of water spinach at different duration of crop growth are presented in Tables 2 and 3.

No. of primary vine $plant^{-1}$

The results indicated that number of primary vine $plant^{-1}$ was significantly affected by different treatment at all the stage of crop growth. At 60 DAT, number of primary vine $plant^{-1}$ varied from 14.21 to 22.30. The maximum number of primary vine $plant^{-1}$ was recorded in treatment T_8 (22.30) which was significantly superior over other treatment but at par to treatment T_9 (21.14), T_{12} (20.69) and T_{13} (21.82). The minimum value of number of primary vine $plant^{-1}$ was recorded in treatment T_1 (14.21). At 90 DAT, maximum number of primary vine $plant^{-1}$ was recorded in treatment T_8 (24.95) which were significantly superior over other treatment but at par to treatment T_9 (23.74), T_{11} (22.29), T_{12} (22.34) and T_{13} (23.72). At 120 DAT, maximum number of primary vine $plant^{-1}$ was recorded in treat-

Table 2. Growth parameters of water spinach.

Treatments	Number of primary vine plant^{-1}			Primary vine length (cm)			Leaf length (cm)		
	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT
T_1	14.21	16.24	19.12	22.13	31.76	42.10	7.45	8.20	9.56
T_2	15.87	18.02	20.72	31.94	40.62	52.03	8.15	9.17	10.23
T_3	15.68	19.33	21.37	30.87	40.50	49.85	7.94	8.78	10.16
T_4	15.85	18.70	21.01	48.18	56.91	66.50	8.24	9.43	10.45
T_5	16.20	18.82	22.05	39.30	48.95	58.56	8.77	9.72	10.39
T_6	16.61	19.20	22.01	45.77	55.04	65.19	8.40	9.42	10.49
T_7	16.85	19.36	22.41	35.64	44.85	55.23	9.01	10.28	11.24
T_8	22.30	24.95	27.87	57.74	67.38	76.19	10.21	11.24	12.57
T_9	21.14	23.74	25.56	51.65	62.99	71.68	9.44	10.46	11.79
T_{10}	18.86	21.15	24.55	45.40	56.55	65.99	8.04	9.12	10.90
T_{11}	19.88	22.29	24.74	46.19	55.87	66.13	9.05	10.10	11.23
T_{12}	20.69	22.34	24.71	49.71	58.68	67.05	9.22	10.40	11.43
T_{13}	21.82	23.72	25.50	54.55	63.81	71.91	10.02	11.20	12.31
SEm±	0.55	1.30	1.30	1.39	1.45	1.35	0.35	0.47	0.50
CD (p=0.05)	1.61	3.79	3.80	4.06	4.24	3.95	1.02	1.38	1.46

ment T_8 (27.87) which was significantly superior over other treatment but at par to treatment T_9 (25.56), T_{10} (24.55 cm), T_{11} (24.74), (24.71) and T_{13} (25.50). These results supported by earlier findings of Chantal et al. [8] who reported that bio-organic fertilizers with EM significantly increased plant height of flue cured tobacco.

Primary vine length (cm)

At 60 and 90 DAT, maximum primary vine length (cm) was recorded in treatment T_8 (57.74 cm and 67.38 cm) which was significantly superior over other treatment but at par to treatment T_{13} (54.55 cm and 63.81 cm) respectively. At 120 DAT, T_8 exhibited maximum number of primary vine length (76.19 cm), where as minimum value for primary vine length (cm) was recorded in treatment T_1 (42.10 cm). Similar results were also reported by Tayama et al. [9], Barrett and Erwin [10], Khattak and Pearson [11] and Baloch et al. [12].

Leaf length (cm)

At 60 DAT, maximum leaf length (cm) showed by treatment T_8 (10.21 cm) which was at par to treatment T_9 (9.44 cm), T_{12} (9.22 cm) and T_{13} (10.02 cm). At 90 and 120 DAT, the maximum number of leaf length (cm) was recorded in treatment T_8 (11.24 cm and 12.57 cm respectively) which was significantly superior over other treatment but at par to treatment T_7 (10.28 cm, 11.24 cm), T_9 (10.46 cm, 11.79 cm), T_{11} (10.10 cm, 11.23 cm), T_{12} (10.46 cm, 11.43 cm) and T_{13} (11.20 cm, 12.31 cm). In both the cases (At 90 and 120 DAT) minimum value of leaf length (cm) was recorded in treatment T_1 (8.20 cm and 9.56 cm, respectively). Similar results were also reported by Mulder [13] who found that higher growth rate of leaf length was reached on the growth media soil + organic manure and soil + organic manure + inorganic manure. This finding is in agreement with findings who observed that organic seed of low molecular weight in organic matter help to increase leaf length. In addition, water soluble humic substances from organic manure had positive effect on the development of plant [14].

Leaf width (cm)

The findings indicated that leaf width (cm) was significantly affected by different treatment at all the stage of crop growth. At 60, 90 and 120 DAT, maximum leaf width (cm) was recorded in treatment T_8 (6.44 cm, 6.49 cm and 6.73 cm, respectively) and found at par with T_{13} in all the three cases, while the minimum value of leaf width (cm) was showed in treatment T_1 (4.51 cm, 4.89 cm and 5.21 cm) respectively. The results were in agreement with the findings of Pavlou et al. [15] in lettuce.

Table 3. Growth parameters of water spinach.

Treatments	Leaf width (cm)			Number of nodes in primary vine			Foliage yield cutting^{-1} (kg)			Total foliage yield per container (kg)		
	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT
T_1	4.51	4.89	5.21	20.34	22.43	24.39	1.13	1.65	2.00	4.78	4.78	4.78
T_2	4.59	4.93	5.27	23.34	25.56	27.98	1.23	1.82	2.32	5.37	5.37	5.37
T_3	4.99	5.29	5.62	26.30	28.56	32.14	1.31	1.79	2.33	5.43	5.43	5.43
T_4	5.04	5.53	5.80	29.09	32.60	36.10	1.44	1.92	2.38	5.74	5.74	5.74
T_5	5.66	5.98	6.11	30.80	34.11	36.90	1.47	1.96	2.40	5.81	5.81	5.81
T_6	4.71	5.13	5.33	23.15	27.78	31.11	1.48	2.01	2.47	5.96	5.96	5.96
T_7	5.29	5.64	5.94	24.99	27.87	31.40	1.32	1.82	2.34	5.48	5.48	5.48
T_8	6.44	6.49	6.73	34.60	37.60	40.96	2.02	2.35	2.67	7.04	7.04	7.04
T_9	5.79	6.12	6.46	30.81	33.35	36.00	1.71	2.10	2.42	6.23	6.23	6.23
T_{10}	5.62	5.93	6.21	28.50	31.59	34.72	1.48	1.97	2.40	5.85	5.85	5.85
T_{11}	5.33	5.68	5.98	22.06	24.71	27.20	1.45	1.93	2.29	5.67	5.67	5.67
T_{12}	5.60	5.88	6.35	26.89	26.89	30.26	1.71	2.07	2.38	6.16	6.16	6.16
T_{13}	6.07	6.41	6.67	31.04	32.59	35.88	1.93	2.19	2.49	6.61	6.61	6.61
SEm±	0.28	0.30	0.17	1.07	1.36	1.64	0.04	0.13	0.11	0.18	0.18	0.18
CD (p=0.05)	0.82	0.87	0.50	3.12	3.97	4.79	0.12	0.38	0.32	0.53	0.53	0.53

Number of nodes in primary vine

At 60 and 90 DAT the data recorded for number of nodes in primary vine respectively, showed that treatment T_8 (37.60), exhibited maximum number of nodes in primary vine while minimum value of number of nodes in primary vine was recorded in treatment T_1 (20.34 and 22.43). At 90 DAT, number of nodes in primary vine varied from 22.43 to 37.60. At 120 DAT, number of nodes in primary vine varied from 24.39 to 40.96. The maximum number of nodes in primary vine was recorded in treatment T_8 (40.96) which was significantly superior over other treatment but at par to treatment T_5 (36.90). The result obtained is similar to Seripong [16] in soyabean.

Foliage yield cuttings^{-1} (kg cutting^{-1} container^{-1})

The findings indicated that foliage yield cuttings^{-1} (kg cutting^{-1} container^{-1}) was significantly affected by different treatment at all the stage of crop growth. At 60 DAT, foliage yield cuttings^{-1} (kg cutting^{-1} container^{-1}) varied from 1.13 kg to 2.02 kg. The maximum foliage yield cuttings^{-1} (kg cutting^{-1} container^{-1}) was recorded in treatment T_8 (2.02 kg) which was at par to treatment T_{13} (1.93 kg) and significantly superior over other treatments while, the minimum value of foliage yield cuttings^{-1} (kg cutting^{-1} container^{-1}) recorded in treatment T_1 (1.13 kg). At 90 and 120 DAT, T_8 (2.35 kg and 2.67 kg respectively) exhibited maximum foliage yield cuttings^{-1} (kg cutting^{-1} container^{-1}), while at par to treatment T_6- (2.10 kg, 2.47 kg), T_{10} (1.97 kg, 2.40 kg), T_{12} (2.07 kg, 2.38 kg) and T_{13} (2.19 kg, 2.49 kg). In both cases (At 90 and 120 DAT) minimum foliage yield cuttings^{-1} (kg cutting^{-1} container^{-1}) was recorded in T_1 (1.65 kg, 2.0 kg, respectively). Similar results were also reported by Okon et al. [17] and Kaur et al. [18] on tomato plants.

Total foliage yield container^{-1} (kg)

The total foliage yield (kg container^{-1}) varied from 4.78 kg to 7.04 kg. The maximum total foliage yield (kg container^{-1}) was recorded in treatment T_8 (7.04 kg) which was significantly superior over other treatment but at par to treatment T_{13} (6.61 kg). The minimum value of total foliage yield (kg container^{-1}) was recorded in treatment T_1 (4.78 kg). Similar results were also reported by Karaki [19] and Gupta and Sengar [20] on tomato plant who mentioned that increasing vegetative growth is due to rice husk increasing potassium fertilizer levels.

Conclusion

The findings revealed that among the treatment, T_8- Black Soil (50%) + Paddy husk (50%) found best for foliage yield followed by T_9, T_{12} and T_{13}, whereas T_1 exhibited minimum yield. From this study can be concluded that organic media was the best option for water spinach growth. The uses of media are effective response in yield of water spinach and increasing the leaf yield.

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