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Effect of Pit Size, Spacing, Growth Regulators and Fertilizers on Commercial Cultivation of Cut Foliages of *Murraya exotica*

Ruchita Panda[1*], Siddharth Kumar Palai[1], Sashikala Beura[1], Pradyumna Tripathy[2], Prasanna Kumar Samant[3] and K. Raja Babu[1]

[1]Department of Floriculture and Landscaping, College of Agriculture, OUAT, Bhubaneswar (Odisha) India.
[2]Department of Vegetable Science, College of Agriculture, OUAT, Bhubaneswar (Odisha) India.
[3]OIC, AICRP on LTFE, OUAT, Bhubaneswar (Odisha) India.

(Corresponding author: Ruchita Panda)*
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ABSTRACT: *Murraya exotica* is an important cut foliage, but no systematic work has been done to standardize agro-techniques for its commercial cultivation. Therefore, it is felt necessary to examine the effect of spacing, pit size, fertilizers and growth regulators on vegetative growth and foliage yield for commercial cultivation of *Murraya exotica*. The present investigation was conducted during the year 2019-2021 at Horticulture Research Station, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha. The experiment laid out in Randomized Block Design (RBD) with 4 replications. The experiment was conducted in 6 modules comprising of different spacing, pit size, FYM, basal fertilizer dose, water soluble fertilizers and growth regulator (BAP). Results revealed that, Module – VI (spacing - 210cm × 210cm; pit size - 60cm × 60cm × 60cm; FYM - 25Kg/pit; basal fertilizer dose - N: P_2O_5: K_2O @ 40:40:40 g/plant; foliar application of water soluble fertilizer- NPK 19:19:19 @ 0.2% and BAP- 150 ppm) recorded significant increase in vegetative growth parameters like plant height (126.76 cm),stem diameter (28.88 cm), length of branch (58.28 cm), number of primary branches (21.33), number of secondary branches (36.38), internodal length (4.70 cm), number of tertiary branches (68.20), number of harvestable branches (95.33) and foliage yield/plant (2.699 kg). However, the yield per hectare (6.12 t/ha) was reported maximum in module-I (spacing - 90cm × 90cm; pit size – 20cm × 20cm × 20cm; FYM - 5Kg/pit; basal fertilizer dose - N: P_2O_5: K_2O @ 5:5:5 g/plant; foliar application of water soluble fertilizer- NPK 19:19:19 @ 0.1% and BAP- 25 ppm).

Keywords: 6-Benzyl amino purine, module, spacing, pit size, water soluble fertilizer, foliage yield.

INTRODUCTION

Murraya is one of the 150 genera from the family Rutaceae. The genus Murraya was named after John Andrew Murray, a Swedish botanist and a professor of Medicine and Botany, in the University of Gottingen. *Murraya exotica* is geographically the most wide-spread species of section Murraya. This species grows from nearly sea level to an elevation of 1500 m and native to China, India, Sri Lanka, Northeastern Australia and Taiwan (Parrotta, 2001). *Murraya exotica* is commonly known as Orange Jasmine, Mock Orange, Satin Wood, Honey Bush, Kamini, China Box and Cafe de la India. It is distributed over the greater part of India and the Andaman Islands. This species has found wide medicinal value throughout the area of distribution.

Murraya exotica, an evergreen shrub, usually 2 to 3 m in height but reaching up to 7.5 m. The leaves are alternately arranged along the stems and borne on stalks. These leaves (6-11.5 cm long) are once-compound (*i.e.* pinnate) with 3-9 leaflets. The glossy leaflets (1.5-7 cm long and 1.2-3 cm wide) are narrowly elliptical to somewhat ovoid-shaped in outline. The fragrant flowers are borne in clusters, containing up to eight flowers, at the tips of the branches. Each flower has five green sepals and five white petals (10-18 mm long) that are curved backwards. Along with the fragrant flowers, cut foliages are also in demand throughout the year and comprise 10% of world floriculture trade with an annual growth rate of 4% (Nair *et al.,* 2017). Cut foliages are used as fillers along with flowers in bouquets, floral arrangements to create variability in colours, textures, shapes and forms. The plant can be pruned to make topiary and can also be grown as a hedge plant and cultivated as a bonsai (Gonzalez, 2002).

The main purpose of using the fertilizers is to replace the amount of nutrients that has been depleted in the soil profile because of continuously taken up by the plants

needed for their growth (Younis *et al*., 2013) whereas, organic manures generally improve the soil organic matter content, a basic indicator of soil health and resilience (Riaz *et al*., 2008; Tariq *et al*., 2012; Yasmeen *et al*., 2012). Foliar application is a technique of feeding plants by applying water soluble fertilizer directly to their leaves. Foliar application results in better crop growth, either by stimulating more vigorous growth or maximizing the yield potential (Patil and Chetan 2018). Cytokininsplay a major role in the developmental and physiological processes in plants, such as cell division, regulation of root and shoot growth, branching and chloroplast development (Seilaniantz *et al.*, 2007).

MATERIALS AND METHODS

The experiment was conducted during the year 2019-2021 at Horticultural Research Station, College of Agriculture, OUAT, Bhubaneswar, Odisha.

Geographically, the experimental site under the eleventh agro-climatic region of the country *i.e*. eastern coastal plain and sub-humid characterized by warm moist climate with mild winter and is located at an elevation of 44 M above mean sea level at the latitude of 20°15'56.3"N and longitude of 85°48'41.0"E. The experiment laid out in Randomized Block Design (RBD) with 4 replications. The experiment was conducted in 6 modules contains different spacing, pit size, FYM, basal fertilizer dose, water soluble fertilizers and growth regulator (BAP) was given in the table below. The observations on plant height, stem diameter, internodal length, length of branch, number of primary branches, number of secondary branches, number of tertiary branches, number of harvestable branches per plant per year, yield (fresh weight of harvested branches) kg/plant and yield per hectare (t/ha) were recorded.

Table 1: Treatment details of the experiment.

Cultural operations	Spacing	Pit size	FYM	Basal Fertilizer dose	NPK19:19:19 Once a week	BAP (6-Benzylaminopurine)-once in a month
Module - I	90cm × 90cm	20 cm^3	5Kg/pit	5:5:5 g $N:P_2O_5:K_2O$/plant	@0.1%	25 ppm
Module - II	120cm × 120cm	30 cm^3	10Kg/pit	10:10:10 g $N:P_2O_5:K_2O$/plant	@0.1%	50 ppm
Module - III	150cm × 150cm	40 cm^3	15Kg/pit	20:20:20 g $N:P_2O_5:K_2O$/plant	@0.2%	100 ppm
Module - IV	180cm × 120cm	50 cm^3	20Kg/pit	30:30:30 g $N:P_2O_5:K_2O$/plant	@0.2%	150 ppm
Module - V	180cm × 180cm	50 cm^3	20Kg/pit	30:30:30 g N $N:P_2O_5:K_2O$/plant	@0.2%	150 ppm
Module - VI	210cm × 210cm	60 cm^3	25Kg/pit	40:40:40 g $N:P_2O_5:K_2O$/plant	@0.2%	150 ppm

RESULTS

The growth and yield parameters like plant height, stem diameter, internodal length, length of branch, number of primary branches, number of secondary branches, number of tertiary branches, number of harvestable branches per plant, yield (Kg/plant) and yield (t/ha) varied significantly between the treatments.

The highest plant height was found in module VI (82.03 cm) followed by module V (80.57 cm) whereas module I (71.19 cm) recorded the lowest height in *Murraya exotica* at the end of first year, In the second year tallest plants were recorded in module VI (126.76 cm) followed by module V (124.03 cm) whereas lowest plant height was recorded in module I (98.76s cm).The maximum stem diameter was found in module VI (15.55 mm) followed by module V (14.82 mm) whereas, module I recorded the minimum stem diameter (13.62 mm) in *Murraya exotica* at the end of first year. In second year maximum stem diameter was recorded in module VI (28.88 mm) followed by module V (28.34 mm) whereas lowest stem diameter was recorded in module I (24.42 mm).

Maximum number of primary branches was found in module VI (9.34) followed by module V (7.80) whereas module I recorded the least number of branches (6.38) in *Murraya exotica* at the end of first year and in second year more number of branches were recorded in module VI (21.33) followed by module V (19.68) whereas least number of branches was recorded in module I (14.15). Maximum number of secondary branches was found in module VI (22.84) followed by module V (20.61) whereas, module I recorded the least number of branches (14.69) in *Murraya exotica* at the end of first year. In second year more number of branches was recorded in module VI (36.38) followed by module V (33.92) whereas least number of branches was recorded in module I (26.62). The longest branch was found in module VI (32.01 cm) followed by module V (30.82 cm) whereas module I (26.76 cm) recorded the smallest branch in *Murraya exotica* at first year and in second year longest branch was recorded in module VI (58.28 cm) followed by module V (55.81 cm) whereas smallest branch was recorded in module I (47.87 cm).

Table 2: Effect of different modules on plant height, stem diameter, number of primary branches, number of secondary branches and length of branch of *Murraya exotica.*

Modules	Plant height		Stem diameter		No. of primary branches		No. of secondary branches		Length of branches	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
M_1	71.19	98.76	13.62	24.42	6.38	14.15	14.69	26.62	26.76	47.87
M_2	72.76	108.93	13.70	25.21	6.87	15.12	17.51	28.03	27.20	48.46
M_3	76.47	117.57	14.14	26.07	7.16	16.11	17.83	30.16	28.16	50.55
M_4	77.04	118.48	14.21	27.28	7.63	17.89	19.54	31.93	29.12	52.98
M_5	80.57	124.03	14.82	28.34	7.80	19.68	20.61	33.92	30.82	55.81
M_6	82.03	126.76	15.55	28.88	9.34	21.33	22.84	36.38	32.01	58.28
SE(m) ±	0.42	0.82	0.10	0.15	0.07	0.20	0.22	0.29	0.15	0.32
CD (5%)	1.28	2.49	0.32	0.43	0.23	0.61	0.62	0.88	0.46	0.97
CV	0.973	1.282	8.082	7.930	8.034	8.289	10.075	10.824	10.060	10.415

Table 3: Effect of different modules on no. of tertiary branches, internodal length (cm) of primary branch, number of harvestable branches, yield per plant (kg) and yield per hectare (t/ha) of *Murraya exotica.*

Modules	No. of Tertiary branches	Internodal length (cm) of primary branch	No. of Harvestable branches	Yield per plant (kg)	Yield per Hectare (t/ha)
M_1	62.80	4.10	51.89	1.662	20.51
M_2	64.32	4.52	68.44	1.715	11.9
M_3	64.37	4.67	75.25	1.803	8.01
M_4	66.52	4.67	83.45	1.963	6.05
M_5	67.99	4.54	91.72	2.185	10.09
M_6	68.20	4.70	95.33	2.699	6.12
SE(m) ±	0.167	0.017	1.211	0.029	0.408
CD (5%)	0.507	0.024	1.713	0.089	1.242
CV	1.508	1.747	3.119	2.924	7.817

Results found that the highest number of tertiary branches, internodal length and number of harvestable branches was found in module VI (68.20, 4.70 cm and 95.33 respectively) followed by module V (67.99, 4.54 cm, 91.72 respectively) and lowest in module I (62.80, 4.10 cm, 51.89 respectively) in *Murraya exotica*. The highest yield per plant was found in module VI (2.699 kg) followed by module V (2.185 kg) whereas lowest yield per plant was recorded in module I (1.662 kg) in *Murraya exotica*. The highest yield per hectare was found in module I (20.51 t/ha) followed by module II (11.9 t/ha) whereas lowest yield per hectare was recorded in module IV (6.05 t/ha) in *Murraya exotica*.

DISCUSSIONS

The results showed that effect of pit size, spacing, growth regulators and fertilizers and application of NPK fertilizers as foliar spray has a significant impact on growth and yield of *Murraya exotica*. Wider spacing produced significant increase in plant height, leaf length and number of leaves. However, high yield per hectare was observed in closer spacing, due to the more plant population. Effect of pit size might be attributed to the fact that, larger sized pits conserve and provide more moisture and nutrients to the growing plants in the initial stages of crop growth when the roots are tender. The increase in fertilizer dose caused a parallel increase in plant height. Literature indicated a positive correlation between plant height and fertilizer application rate in different crops, like *Dahlia* (Bhattacharjee and Mukherjee 1983), *Viola* (John *et al*., 1984), *Chrysanthemum* (Barman and Pal 1999) and *Zinnia* (Kashif, 2001). Reports regarding increase in the number of branches per plant by increasing the amount of NPK fertilizer are also consistent (Baboo and Sharma 1997; Gurav *et al*., 2002; John *et al.*, 1984; Katsoulas *et al*., 2006; Palai *et al.*, 2002; Obreza *et al*., 2008).

Foliar application results into better crop growth, either by stimulating more vigorous growth or maximizing the yield potential (Patil and Chetan, 2018). Similar results were found by Ashour *et al.* (2020) in *Dracaena marginata* and Gurjar *et al.* (2012) in *Anthurium andreanum*. Cytokinins play a major role in many developmental and physiological processes in plants, such as cell division, regulation of root and shoot growth and branching, chloroplast development (Seilaniantz *et al.*, 2007). The role of 6-benzyl amino purine (BAP) is to stimulate xylem differentiation and vascular strand development, consequently more absorption of water and nutrients from the soil, which reflected more growth. Moreover, increasing plant growth as a result of combined growth hormones with nutrient may be due to physiological role of hormones and nutrient in synthesis of the plant phytochemicals through the action of various enzymes and protein synthesis (Tandel *et al.*, 2018).

CONCLUSION

From the present study, it can be concluded that spacing, pit size, application of inorganic (N: P_2O_5: K_2O), organic (FYM), water soluble fertilizers (NPK 19:19:19) and growth regulator (BAP) play significant role in improving the growth and quality of *Murraya exotica*. Vegetative growth and foliage yield per plant was maximum in Module-VI but, yield per hectare was

maximum in Module-I because of highest plant population per hectare. Adoption of Module-I is recommended for commercial cultivation of cut foliages.

FUTURE SCOPE

Need to study the response of other modules having high density planting, different spacings, pit size and application of any other fertilizers and growth regulators for commercial cultivation of cut foliages of *Murraya exotica*.

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Conflict of Interest. None.

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