STANDARDIZATION OF AGRO-TECHNIQUES FOR *Melaleuca bracteata* F. Muell

ABSTRACT

The experiment was conducted during the year 2019-21 at Horticulture Research Station, OUAT, Bhubaneswar laid out in Randomized Block Design (RBD) with 4 replications. The experiment was conducted in 6 modules. The growth parameters like plant height (75.36 cm and 133.52 cm), plant spread E-W (46.41 cm and 74.09 cm), plant spread N-S (39.98 cm and 70.72 cm), stem diameter (15.97 cm and 32.94 cm), length of branch (31.68 cm and 58.34 cm), number of primary branches (19.61 and 31.42), number of secondary branches (17.29 and 36.73) were recorded highest and significant with the adoption of Module VI (Spacing - 210cm X 210cm; Pit size - 60 cm^3; FYM - 25Kg/pit; Basal fertilizer dose - N:P_2O_5: K_2O @ 40:40:40 g /plant; Fertilizer-19:19:19@ 0.2% and BAP- 150 ppm) in two years respectively and internodal length (8.52 cm), number of tertiary branches (18.28), number of harvestable branches (63.41), foliage yield of plant (1.121 kg) also recorded highest in module –VI followed by Module –V. However, the yield per hectare (4.85 t/ha) was maximum in module-I because of maximum plant population.

Keywords: 6-Benzyl Amino Purine, Foliage yield, Pit size, Spacing, Water soluble fertilizers

Introduction:

Melaleuca bracteata is commonly known as Golden Bottle Brush, Black Tea-Tree, River Tea-Tree, or Mock Olive. The genus *Melaleuca* consists of 300 species and is the third-largest angiosperm genus in Australia after *Acacia* and *Eucalyptus* (Craven, 2009; Edwards *et al*., 2010). The species of the Myrtaceae family have well recognized economic importance and include many timber species, especially *Eucalyptus*, *Callistemon*, *Chamelaucium*, *Leptospermum* (tea tree), and *Myrtus* (myrtle). (Reynertson *et al.*, 2008).

Melaleuca bracteata is a large shrub to a medium tree usually up to 15 m tall, with small, narrow, and hairy leaves, (3-12 mm long) (Byrnes, 1986). Flowers are small bottlebrushes up to 20 mm long and occur near the end of the twigs. Their fruits are woody, small, cup-shaped capsules. *M. bracteata* the capsules are 2-3 mm long and 2.5-3 mm wide appearing on branches. Generally, *M. bracteata* can flower for the whole year, but more in spring and summer (Van *et al.*, 2002). Oil is used to increase the potency of some insecticides. *Melaleuca bracteata* is a medium-sized, shrub, or tree with fine scented foliage. Flowering occurs in winter/spring/summer with profuse white flowers. Plants respond to pruning and can be grown as

a hedge or screen. Some forms can get too large for small home gardens. The *Melaleuca* species are supposed to be used for reforestation ofbarren lands and lands deteriorated by floods (Barbosa *et al.* 2013).

Foliar application is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Plants are ready to absorb essential elements through their leaves. The absorption takes place through their stomata and epidermis. Foliar application results in crop growth better, either by stimulating more vigorous regrowth or maximizing the yield potential (Patil and Chetan 2018).

Lot of work done on *Melaleuca bracteata* related to their uses and chemical constituents but there is no work to growth and yield parameters, therefore we are going to standardize the agro techniques for *Melaleuca bracteata* for commercial cultivation.

Materials and methods:

The experiment was conducted during the year 2019-20 and 2020-21 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. Observations on plant height, plant spread, 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, yield per hectare (t/ha) and Stem water uptake were recorded.

Table 1: The treatment details of the experiment

Cultural operations	Spacing	Pit size	FYM	Basal Fertilizer dose	Water soluble fertilizer 19:19:19 NPK Once a week	BAP (6-Benzylaminopurine)- once in a month
Module – I	90cm X 90cm	20cm x 20cm x 20cm	5Kg/pit	5:5:5 g $N:P_2O_5:K_2O$/ Plant	@0.1%	25 ppm

Module – II	120cm X 120cm	30cm x 30cm x 30cm	10Kg/pit	10:10:10 g $N:P_2O_5:K_2O$/ Plant	@0.1%	50 ppm
Module - III	150cm X 150cm	40cm x 40cm x 40cm	15Kg/pit	20:20:20 g $N:P_2O_5:K_2O$/ Plant	@0.2%	100 ppm
Module – IV	180cm X 120cm	50cm x 50cm x 50cm	20Kg/pit	30:30:30 g $N:P_2O_5:K_2O$/ Plant	@0.2%	150 ppm
Module – V	180cm X 180cm	50cm x 50cm x 50cm	20Kg/pit	30:30:30 g $N:P_2O_5:K_2O$/ Plant	@0.2%	150 ppm
Module - VI	210cm X 210cm	60cm x 60cm x 60cm	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, plant spread,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), yield (tn/ha) and relative water content varied significantly between the treatments.

Table 2: Effect of different modules on plant height, stem diameter, plant spread (E-W), plant spread (N-S), number of primary branches, number of secondary branches, length of branch of *Melaleuca bracteata* F. Muell

Modules	Plant Height		Stem Diameter		Plant spread (E-W)		Plant spread (N-S)		No. of Primary branches		No. of Secondary branches		Length of Branch	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
M_1	63.87	93.68	13.37	29.22	39.58	53.56	32.05	45.53	15.86	27.06	14.42	27.97	25.40	44.02
M_2	64.29	97.59	13.86	29.56	41.20	57.04	35.65	47.17	18.53	28.44	15.33	28.36	26.24	45.77
M_3	69.62	106.07	14.08	30.83	43.13	65.08	38.23	64.37	17.99	28.19	15.49	30.51	26.04	49.48

M_4	68.84	110.66	14.01	31.60	43.20	70.91	38.18	63.08	18.78	29.59	15.21	32.26	27.24	50.89
M_5	73.73	120.89	14.41	31.33	45.51	72.20	39.98	66.45	17.87	30.22	16.13	34.24	31.22	55.43
M_6	75.36	133.52	15.97	32.94	46.41	74.09	40.10	70.72	19.61	31.42	17.29	36.73	31.68	58.34
SE(m) ±	0.35	1.11	0.06	0.10	0.19	0.64	0.32	0.79	0.09	0.11	0.07	0.25	0.20	0.41
CD 5%	1.07	3.40	0.20	0.31	0.58	1.94	0.70	2.41	0.29	0.35	0.22	0.78	0.63	1.25
CV	1.02	2.20	0.94	0.67	0.89	1.95	1.23	2.66	1.05	0.80	0.93	1.62	1.48	1.63

M_6- Spacing - 210cm X 210cm; Pit size - 60 cm^3; FYM - 25Kg/pit; Basal fertilizer dose - N:P_2O_5: K_2O @ 40:40:40 g /plant; Fertilizer-19:19:19@ 0.2% and BAP- 150 ppm.

Table 3: Effect of different modules on tertiary branches, internodal length, No. of harvestable branches and relative water content of *Melaleuca bracteata* F. Muell

Modules	No. of Tertiary branches	Internodal length (cm) of primary branch	No. of Harvestable branches	Relative water content (%)	Yield per plant (kg)	Yield per Hectare (t/ha)
M_1	13.25 ^{e}	6.85 ^{d}	28.56 ^{f}	35.08 ^{e}	0.39 ^{f}	4.85 ^{a}
M_2	14.07 ^{d}	7.05 ^{d}	34.78 ^{e}	45.41 ^{d}	0.53 ^{e}	3.72 ^{c}
M_3	15.23 ^{c}	7.63 ^{bc}	39.39 ^{d}	45.49 ^{d}	0.63 ^{d}	2.80 ^{d}
M_4	16.36 ^{b}	7.44 ^{c}	47.48 ^{c}	46.78 ^{c}	0.75 ^{c}	2.33 ^{d}
M_5	16.86 ^{b}	7.81 ^{b}	51.31 ^{b}	52.90 ^{b}	0.91 ^{b}	4.22 ^{b}
M_6	18.28 ^{a}	8.52 ^{a}	63.41 ^{a}	57.36 ^{a}	1.12 ^{a}	2.54 ^{d}
SE(m) ±	0.15	0.03	0.94	0.59	0.01	0.07
CD 5%	0.48	0.10	2.84	1.86	0.05	0.25
CV	1.78	1.18	4.27	2.42	5.47	4.46

M_6- Spacing - 210cm X 210cm; Pit size - 60 cm^3; FYM - 25Kg/pit; Basal fertilizer dose - N:P_2O_5: K_2O @ 40:40:40 g /plant; Fertilizer-19:19:19@ 0.2% and BAP- 150 ppm.

Growth parameters

The highest plant height was found in module VI (75.36 cm) followed by module V (73.73 cm) whereas module I (63.87 cm) recorded the lowest height in *Melaleuca* bracteata F. Muell at the end of first year, In the second year tallest plants were recorded in module VI (133.52 cm) followed by module V (120.89 cm) whereas lowest plant height was recorded in module I (93.68 cm). The maximum stem diameter was found in module VI (15.97 mm) followed by module V (14.41 mm) whereas, module I recorded the minimum stem diameter (13.37 mm) in *Melaleuca* bracteata F. Muell at the end of first year. In second year maximum

stem diameter was recorded in module VI (32.94 mm) followed by module V (31.33 mm) whereas lowest stem diameter was recorded in module I (29.22 mm).

The plant spread (E-W) varied significantly between the treatments. The maximum plant spread was found in module VI (46.41 cm) followed by module V (45.51cm) whereas module I recorded the minimum plant spread (39.58 cm) in *Melaleuca* bracteata F. Muell at the end of first year, In second year maximum plant spread was recorded in module VI (74.09 cm) followed by module V (72.20 cm) whereas minimum plant spread (53.56 cm) was recorded in module I. The maximum plant spread (N-S) was found in module VI (40.10 cm) followed by module V (39.98 cm) whereas module I (32.05 cm) recorded the minimum plant spread in *Melaleuca* bracteata F. Muell at first year and in second year maximum plant spread was recorded in module VI (70.72 cm) followed by module V (66.45 cm) whereas minimum plant spread was recorded in module I (45.53 cm).

Maximum number of primary branches was found in module VI (19.61) followed by module IV (18.78) whereas module I recorded the least number of branches (15.86) in *Melaleuca* bracteata F. Muell at the end of first year and in second year more number of branches were recorded in module VI (31.42) followed by module V (30.22) whereas least number of branches was recorded in module I (27.06). Maximum number of secondary branches was found in module VI (17.29) followed by module V (16.13) whereas, module I recorded the least number of branches (14.42) in *Melaleuca* bracteata F. Muell at the end of first year, In second year more number of branches was recorded in module VI (36.73) followed by module V (34.24) whereas least number of branches was recorded in module I (27.97).

The longest branch was found in module VI (31.68 cm) followed by module V (31.22 cm) whereas module I (25.40 cm) recorded the smallest branch in *Melaleuca* bracteata F. Muell at first year and in second year longest branch was recorded in module VI (58.34 cm) followed by module V (55.43 cm) whereas smallest branch was recorded in module I (44.02 cm). The highest number of tertiary branches, internodal length, number of harvestable branches and relative water content was found in module VI (18.28, 8.52 cm, 63.41 and 57.36% respectively) followed by module V (16.86, 7.81 cm, 51.31 and 52.90% respectively) and lowest in module I (13.25, 6.85 cm, 28.56 and 35.08% respectively) in *Melaleuca* bracteata F. Muell.

Yield

The highest yield per plant was found in module VI (1.121 kg) followed by module V (0.913 kg) whereas lowest yield per plant was recorded in module I (0.393 kg) in *Melaleuca* bracteata F. Muell. The highest yield per hectare was found in module I (4.85 t/ha) followed by module V (4.22 t/ha) whereas lowest yield per hectare was recorded in module IV (2.33 t/ha) in *Melaleuca bracteata* F. Muell.

Discussion:

The results showed that application of NPK fertilizers as foliar spray is having impact on growth and yield of *Melaleuca bracteata*. The numbers of branches were higher in the treatments with highest NPK doses, because of more photosynthesis and food accumulation occurred, possibly resulting in better growth and conversion of vegetative growth in early stages. Foliar application is a technique where liquid fertilizers are applied directly to their leaves. Foliar application results in crop growth better, either by stimulating more vigorous regrowth 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. The number of leaves also increased with the application of BAP by Eid and Abou-Leila (2006) on croton. Moreover, increasing plant growth as a result of combined growth hormones with nutrient may be owing to physiological role of hormones and nutrient in synthesis of the plant phytochemicals through the action of various enzymes activity and protein synthesis (Tandel *et al.* 2018).

The result indicates that spacing is the primary agro technique for improving the growth of the plant, directly responsible for higher growth and yield. Wider spacing produced significant increase in plant height, leaf length and number of leaves. High yield per hectare was observed in closer spacing, due to the more plant population. Results are similar with Nayak *et al.* (2022) in *Eucalyptus camaldulensis and* Mohammad *et al.* (2021) in *Gmelina arborea* and *Dalbergia latifolia* forest species.

Any reference with respect to regarding influence of pit size could not be traced out, however, this might be attributed to the fact that, large 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.

Conclusion:

The results of the present study revealed that Vegetative growth and foliage yield per plant was maximum in Module-VI (spacing - 210cm X 210cm; Pit size - 60 cm^3; FYM - 25Kg/pit; Basal fertilizer dose - N: P_2O_5: K_2O @ 40:40:40 g /plant; Fertilizer-19:19:19@ 0.2% and BAP- 150 ppm), but yield per hectare was maximum in Module-I because of highest plant population per hectare.

References:

Ashour HA, El- Attar AB, Abdel WMM. Combined effects of NPK fertilizer with foliar application of benzyladenine or gibberellic acid on *Dracaena marginata* 'Bicolor' grown in different potting media. *Ornamental Horticulture*, 2020; 10: 23-28

Barbosa LCA, Silva CJ, Teixeira RR, Meira RM, Pinheiro AL. Chemistry and biological activities of essential oils from *Melaleuca* L. species. *Agriculturae Conspectus Scientificus*, 2013; 78(1): 11-23.

Byrnes N, A revision of *Melaleuca* (Myrtaceae) in northern and eastern Australia, *Austrobaileya*, 1986; 254-273.

Craven LA, Melaleuca (Myrtaceae) from Australia. *Novon: A Journal for Botanical Nomenclature*, 2009; 19(4): 444-453.

Edwards RD, Craven LA, Crisp MD, Cook LG. *Melaleuca* revisited: cpDNA and morphological data confirm that *Melaleuca* L. (Myrtaceae) is not monophyletic. *Taxonomy*, 2010; 59(3): 744-754.

Eid RA, Abou-Leila BH. The response of croton plants to gibberellic acid, benzyl adenine, and ascorbic acid application. *Journal of Agricultural Sciences*, 2006; 2(2): 174-179.

Gurjar RA, Dhaduk BK, Chawla SL, Singh A. Standardization of foliar nutrients (NPK) spray in Anthurium cv. Flame, *Indian Journal of Horticulture*, 2012; 69(3): 390-394.

Mohammad N, Rajkumar M, Singh K, Nain NPS, Singh S, Rao, GR, Prakasham U. Spacing, pit size and irrigation influence early growth performances of forest tree species. *Journal of Tropical Forest Science*, 2021; 33(1): 69-76.

Nayak MR, Mishra PJ, Sahoo B, Murmu LK, Paramguru S. Effect of spacing on growth and yield of *Eucalyptus camaldulensis* in Eastern Ghat high land zone of Odisha, *The Pharma Innovation Journal,* 2022; 11(7): 1851-1854.

Patil B, Chetan HT. Foliar fertilization of Nutrients, Kisaan E- Patrika, *marumegh*, 2018; 3(1): 49-53

Reynertson KA, Yang H, Jiang B, Basile MJ, Kennelly EJ. Quantitative analysis of antiradical phenolic constituents from fourteen edible Myrtaceae fruits. *Food Chemistry*, 2008; 109(4): 883-890.

Seilaniantz RA, Navarro L, Rajendra B, Jones JDG. Pathological hormone imbalances. *Current Opinion in Plant Biology,* 2007; 10: 372-379

Tandel MH, Animasaun DA, Krishnamurthy, R. Growth and phytochemical composition of *Adhatoda zeylanica* in response to foliar application of growth hormones and urea. *Journal of Soil Science and Plant Nutrition,* 2018; 18(3): 881- 892.

Van T, Rayachhetry M, Center T, Pratt P. Litter dynamics and phenology of *Melaleuca quinquenervia* in south Florida. *Journal of aquatic plant management,* 2002; 40: 22-27.