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Standardization of Growing Media for Palak (*Beta vulgaris* var. *bengalensis*) var. Arka Anupama under Shade Net Conditions

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ABSTRACT

A field experiment was conducted to find out the effect of different growing media on the growth and yield of palak var. Arka Anupama under shade nut conditions at RVS Agricultural College, Thanjavur. The experiment was laid out in a completely randomized design with eight treatments and three replication. The treatments are T_1: Digested coir compost + FYM (1:1 ratio), T_2: Digested coir compost + Vermicompost (1:1 ratio), T_3: Digested coir compost + Red Soil (1:1 ratio), T_4: Digested coir compost + Red soil + FYM (2:1:1 ratio), T_5: Digested coir compost + Red soil + Vermicompost (2:1:1 ratio), T_6: Digested coir compost + FYM + Vermicompost (2:1:1 ratio), T_7 : Digested coir compost + Red soil + FYM + Vermicompost (1:1:1:1 ratio) and T_8: Digested coir compost (control). The results of the experiment revealed that the highest plant height, highest number of leaves per plant, highest leaf length and highest length of root at the time of harvest was recorded in the treatment T_6. The yield characters the highest yield per plant and highest yield per bag at the time of harvest was recorded in the treatment T_6. However, the treatment T_8 registered the lowest yield per plant and per bag.

Key words : *Growing media, Palak, Shade net, Coir compost, FYM.*

Introduction

Palak (*Beta vulgaris* var. *bengalensis*) belongs to the chenopodiaceae family. It is a popular cool season leafy vegetable in tropical and subtropical regions. Because of its medicinal properties, nutrient content, and taste, it has a high market demand. The leaves are high in dietary fibres, minerals including calcium, phosphorus, and iron, as well as antioxidants like carotene, vitamin C, and folic acid (Vethamoni and Thampi, 2018). Raw in salads, cooked, steamed or sauteed, the leaves are wonderful. The leaves go well with a number of foods, including potatoes, cauliflower, paneer, and chicken, making it a versatile recipe for vegetarians and non-vegetarians alike.

Green leafy vegetables have long been recognized as the most abundant sources of protein, vitamins, and minerals (Solanki *et al.,* 2018). Antioxidant vitamins such as ascorbic acids, phenols, and others are vital in the human diet because they act as anti-

cancer agents. For several reasons in today's world, organic farming of vegetables is gaining importance. One of the most important reasons is the increasing health consciousness among the populations. Besides the growing interest in organic farming, the alarming pesticide residue content in vegetables available in the local market is a major concern among consumers. So, switching over to organic cultivation of vegetables is a growing need (Ramesh Kumar, 2014).

The term growing media is amongst others, used to describe the material used in the container to grow a plant. Composted materials have routinely been used as a growing medium or component of growing media (Schroeder and Sell, 2009). A suitable growing medium combined with integrated nutrient management has been reported to have a positive influence on growth, yield, soil-physiochemical status, and nutrient uptake. Nutrient management is considered to be essential for increasing the yield and quality of the crop. Nowadays increasing fertilizer costs and ill health effect by inorganic fertilizers have necessitated the use of organic amendments.

Growing media always plays an important role in the growth and quality of potted plants. The growing medium serves as both a growing medium and a nutrition source for the plants. The media composition used influences the quality of plants (Wilson *et al*., 2002). Coir compost medium has a high moisture retention capacity (Waiba *et al.,* 2020). Bachman and Metzger (2008) revealed that application of vermicompost improved plant growth and development, root initiation and root biomass, and was essential for maintaining vigorous plant growth capable of withstanding environmental stress. Soilless cultivation can be accomplished with vermicompost as a component of the growing medium (Gonzalez *et al.*, 2010). Vermicompost provides beneficial microbes, macronutrients, and hormones that affect plant development and productivity (Theunissen *et al.*, 2010). Growing media not only acts as a growing place but also as a source of nutrients for plant growth. Hence, there is a need to study growing media and find out the best media for palak production under shade net conditions.

Materials and Methods

A study was carried out on "Standardization of growing media for palak (*Beta vulgaris* var. *bengalensis*) var. Arka Anupama under shade net conditions." It was undertaken at RVS Agricultural College, Thanjavur during 2018-2019. The entire research was laid out on the shade net. The Palak variety 'Arka Anupama' was raised for the experiment. The containers used for raising the crop were UV (ultra violet) stabilized grow bags of 50 cm in height and 30 cm in diameter. Growing media was prepared using various components based on the constitution as per the treatments. Components such as digested coir pith, red soil, FYM, and vermicompost were collected and used for preparing the media. The components were mixed in different propositions to make the respective growth media. The study was set up in a Completely Randomized Design (CRD) and comprised of eight treatments, replicated thrice. The treatments areT_1: Digested coir compost + FYM (1:1 ratio), T_2: Digested coir compost + Vermicompost (1:1 ratio), T_3 : Digested coir compost + Red Soil (1:1 ratio), T_4: Digested coir compost + Red soil + FYM (2:1:1 ratio), T_5: Digested coir compost + Red soil + Vermicompost (2:1:1 ratio), T_6: Digested coir compost + FYM + Vermicompost (2:1:1 ratio), T_7: Digested coir compost + Red soil + FYM + Vermicompost (1:1:1:1 ratio) and T_8: Digested coir compost (control). Five palak seeds were sowed in the grow bag at different places. Thinning is an important operation when each seed produces more than one seedling. One robust seedling was retained per hill and totally five seedling maintained per grow bag. The weeds were removed from the grow bags as and when they appeared. Irrigations were given in the morning. The harvest was done at 45-60 DAS. The plant height, number of leaves per plant, length of leaves, root length, yield per plant and yield per bag were all recorded and analyzed. Web Agri Stat Package (WASP) 2.0, developed by ICAR-Central Coastal Agricultural Research Institute, Goa (http://icargoares.in/was p2.0/index.php), was used to compare mean using Analysis of Variance (ANOVA) at a 5% significant level.

Results

Plant height (cm)

Significant differences existed among the growing media treatments in respect of plant height at the time of harvest (Table 1). The highest plant height at the time of harvest was recorded in the treatment T_6

(39.33 cm) and was on par with T_2 and T_4. However, the treatment T_8 registered the lowest plant height of 12.33 cm and was on par with T_3.

Number of leaves per plant

Profound differences existed among the growing media treatments in respect of number of leaves per plant was furnished in the Table 1. The highest number of leaves per plant at the time of harvest was recorded in the treatment T_6 (12) and was on par with T_7. However, the treatment T_8 registered the lowest number of leaves per plant of 4.67 and was on par with T_3.

Leaf length (cm)

Significant differences existed among the growing media treatments in respect of leaf length at the time of harvest (Table 1). The highest leaf length at the time of harvest was recorded in the treatment T_6 (35.21 cm) and was on par with T_2 and T_4. However, the treatment T_8 registered the lowest leaf length of 8.33 cm and was on par with T_3.

Root length (cm)

Root length showed profound differences due to growing media treatments (Table 1). The highest length of root at the time of harvest was recorded in the treatment T_6 (20.33 cm) and was on par with T_4 and T_1. However, the treatment T_8 registered the lowest root length of 5.83 and was on par with T_3.

Yield per plant (g)

Significant differences existed among the growing media treatments in respect of yield per plant at the time of harvest (Table 2). The highest yield per plant at the time of harvest was recorded in the treatment T_6 (97.77 g). However, the treatment T_8 registered the lowest yield per plant of 5.45 g and was on par with T_3.

Yield per bag (g)

Yield per bag at the time of harvestshowed profound differences due to growing media treatments (Table 2). The highest yield per bag at the time of harvest was recorded in the treatment T_6 (490.50 g). However, the treatment T_8 registered the lowest yield per bag of 27.98 g and was on par with T_3.

Table 1. Effect of growing media on plant height, number of leaves per plant, leaf length and root length in Palak

Treatments	Plant height (cm)	Number of leaves per plant	Leaf length (cm)	Root length (cm)
T_1	34.08	9.83	31.29	19.25
T_2	37.42	10.33	32.50	18.00
T_3	13.50	6.00	10.2	66.50
T_4	37.00	9.17	32.25	19.50
T_5	35.17	9.83	31.75	18.25
T_6	39.33	12.00	35.21	20.33
T_7	29.92	11.00	28.83	14.00
T_8	12.3	34.6	78.33	5.83
SEd	1.78	0.6	71.48	0.97
CD (0.05)	3.77	1.4	23.1	32.06

Table 2. Effect of growing media on Yield per plant (g) and yield per bag (g) in Palak

Treatments	Yield per plant (g)	Yield per bag (g)
T_1	64.38	321.92
T_2	79.70	398.50
T_3	7.18	35.92
T_4	80.80	404.00
T_5	81.13	405.67
T_6	97.77	490.50
T_7	58.15	290.75
T_8	5.45	27.98
SEd	6.29	31.16
CD (0.05)	13.33	66.06

Discussion

Plant height is the primary characteristic that decides the vigour of the plant. The highest plant height was observed in the growing media T_6: Digested coir compost + FYM + Vermicompost (2:1:1 ratio) (Table 1). The possible reasons for accelerated plant height may be due to the application of vermicompost, hormonal activity, as well as increased nitrogen content. It has been reported that the microbial population increased at a tremendous rate as the organic manures decomposed, with the subsequent release of nitrogen for the growth (Yadav and Lourduraj, 2005). The results are in agreement with the findings of Umesh *et al*. (2011) in *Solanum nigrum*; Kashem *et al*. (2015) and Naganandhini (2016) in tomato.

The number of leaves per plant and leaf length have a direct influence on the yield of palak. The highest number of leaves per plant and leaf length were recorded in the treatment T_6: Digested coir

compost + FYM + Vermicompost (2:1:1 ratio) (Table 1). This could be attributed to the availability of a sufficient quantity of nutrients in the plants applied with vermicompost and FYM, which stimulated the growth of plants as reported by Kale (1998) and also due to the availability of more nutrients along with growth stimulating substances excreted by earth worms into their casts. Bharadwaj and Omanwar (1994) reported that more leaves per plant were produced due to the enriched available nutrient pool in the soil through the application of vermicompost. The positive effect of vermicompost on plant growth could be attributed to the presence of plant growth regulators like auxins, cytokinins, gibberellins, and humic acid in vermicompost, produced by the increased activity of beneficial microbes such as fungi, bacteria, yeasts, actinomycetes, and algae (Arancon *et al*., 2005). Similar findings were also reported by Patil *et al.* (2004) and Jabeen *et al.* (2017).

Root length was significantly influenced by growing media treatments. The treatment T_6: Digested coir compost + FYM + Vermicompost (2:1:1 ratio) recorded the highest root length (Table 1). The results are in agreement with the findings of Ramesh Kumar (2014) in amaranthus. The inclusion of organic manures like FYM, vermicompost, and coir pith compost, which contained adequate nutrients and aided in better moisture retention, might have led to better root proliferation. Besides, the organic manures would have improved the soil's physical properties. Najar and Khan (2013) reported that a significant increase in root length was observed in tomatoes when vermicompost is used as a growing medium. Coir pith compost along with vermicompost would have enhanced the dampness of the medium, which would have initiated the rooting (Isaac *et al*., 2015).

Maximization of yield is the ultimate objective of any type of crop production. The highest yield of 97.77 g per plant and the highest yield of 490.50 g per bag at the time of harvest was recorded in the treatment T_6: Digested coir compost + FYM + Vermicompost (2:1:1 ratio). However, treatment T_8 registered the lowest yield per plant and yield per bag (Table 2). As suggested by Rajamanickam *et al.* (2011) in Mint, vermicompost may have contributed to improving the physical conditions of the soil. Besides supplying adequate major and minor nutrients, it has also enhanced the absorption, translocation, and assimilation of nutrients, resulting in higher yields as suggested by Rajamanickam *et al.* (2011) in Mint. Vermicompost acts as a chelating agent and regulates the availability of micronutrients for plants, thereby increasing the growth and yield by providing nutrients in an available form. Similar results were also obtained by Yadav and Vijayakumari (2003) and Theunissen *et al.* (2010). The availability of nutrients slowly over a longer period of time may result in less loss of nutrients through leaching, resulting in an increase in yield attributing characteristics to organic manures (Sagre and Guhe, 1991).

Conclusion

Based on the results of this study, it can be concluded that the growing media of T_6: Digested coir compost + FYM + Vermicompost (2:1:1 ratio) had a positive effect on the growth and yield of palak var. Arka Anupama under shade net conditions.

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