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# Ameliorative potential of sowing media for production of healthy, disease free and genuine planting material of Broccoli (*Brassica oleracea* var. *italica* L.) under the conditions of Jorhat, Assam

**Roopali Patel, Deepa B Phookan, Sailen Gogoi, IS Naruka and Vandna**

## Abstract
An experiment was conducted at Horticulture Experimental Farm, Department of Horticulture, College of Agriculture, Assam Agricultural University, Jorhat, Assam during the year 2020-21 and 2021-22 for knowing the potentiality of different seedling growing media *viz*., Cocopeat: Perlite: Vermiculite (3:1:1), Cocopeat: Perlite: Vermiculite (2:1:1), Cocopeat: Vermicompost (1:1),Vermicompost: Perlite: Vermiculite (3:1:1), Vermicompost: Perlite: Vermiculite (2:1:1), Cocopeat: Vermicompost: Perlite: Vermiculite (1:1:1:1) and Conventional nursery. These seven treatments were analyzed in RBD with 3 replications. The higher seedling emergence percentage (93.15), seedling height (17.87 cm), leaf area (9.09 $cm^2$), root length (6.04 cm), shoot length (10.24 cm), seedling growth index (1516.35), chlorophyll content (0.32 mg $g^{-1}$fw), minimum days to two-true leaf stage (7.03 days), minimum days to transplanting (28.55 days) and the lowest diseases incidence (3.44%) under the greenhouse condition was recorded in the treatment $T_3$ [(Cocopeat: Vermicompost (1:1)].

**Keywords:** Broccoli, seedling sowing media, seedlings parameters

## Introduction
Broccoli is a high-quality vegetable for fresh use and is one of the most popular frozen vegetables. It is also used as a vegetable in many other countries, such as Spain, Mexico, Italy, France and the United States. Broccoli production in India 674 tones from an area of 369 hectare (Anonymous, 2018). India is the second largest producer of broccoli after China. Nutritionally, it is rich in vitamin-A (2500 I.U.), vitamin C (113 mg), protein (3.6 g), carbohydrates (5.9 g) and minerals like calcium (103 mg), iron (1.1 mg), phosphorous (78 mg), potassium (382 mg) and sodium (15 mg) per 100 g of an edible portion (Rana, 2008) [6].
The composition of the medium influences the quality of the seedlings (Wilson *et al*., 2001) [11]. For a plant to strengthen its new root system there must be a ready supply of moisture and oxygen for growth of all living cells. Coarse-textured media often meet these requirements. Most commercially prepared mixes are termed “artificial”, which means they contain no soil. Artificial growing media are materials other than soils in which plants are grown. These can include organic materials such as compost, peat, cocopeat, vermicompost, and tree bark, or inorganic materials such as clay, vermiculite, minerals, rock wool, etc. (Vaughn *et al*., 2011) [10].

Several growing media such as cocopeat, perlite, vermiculite, rock wool, sawdust, and compost were found to be individually or in combination suitable for high-value crops such as broccoli, tomato, capsicum, and cucumber. The soil is generally used as a basic medium because it is easily available and cheap for supplementing the soil, which is aimed to make media more porous (vermiculite, perlite, cocopeat etc.) while the organic matter (vermicompost) is added so as to supplement adequate nutrients for the seedling. The Growing media have three main functions: 1) provide aeration and water, 2) allow for maximum root growth and 3) physically support the plant. The growing medium should have adequate pore space between the particles (Bilderback *et al*., 2005) [4]. Appropriate particle size selection or combination is critical for a light and fluffy (well-aerated) medium that promotes fast seed germination, strong root growth and adequate water drainage.

## Material and Methods

The present investigation was conducted in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2019-2020 and 2020-21. The methodology followed and the materials used in the present study are detailed below.

Treatment detail (Nursery Media composition)

| Treatment | Components | Ratio |
|---|---|---|
| $T_1$ | Cocopeat: Perlite: Vermiculite | (3:1:1) |
| $T_2$ | Cocopeat: Perlite: Vermiculite | (2:1:1) |
| $T_3$ | Cocopeat: Vermicompost | (1:1) |
| $T_4$ | Vermicompost: Perlite: Vermiculite | (3:1:1) |
| $T_5$ | Vermicompost: Perlite: Vermiculite | (2:1:1) |
| $T_6$ | Cocopeat: Vermicompost: Perlite: Vermiculite | (1:1:1:1) |
| $T_7$ | Conventional nursery | - |

All the observed data were statistically analyzed by the method of analysis of variance describe by Panse and Sukhatme (1978) [13]. The data obtained from different treatments during field experimentation were subjected to the analysis of variance by Randomized Block Design. The size of plot was 3.60 m x 3.15 m and the total experimental area was 330 sq. m. The space between replications was 60 cm and between plots was 50 cm. The plant population in each plot was 42.

**Fig 1:** Overview of experimental plot

## Result and discussion

### Fresh weight of root (mg)

Data presented in Table 1 and Fig 2 revealed that there is a significant difference in root fresh weight among the sowing media. The highest fresh weight of root (311.83 mg) was recorded in $T_3$ [Cocopeat: vermicompost (1:1)], followed by (301.15mg) under $T_6$ [Cocopeat: Vermicompost: Perlite: Vermiculite (1:1:1:1)] and the lowest fresh weight of 161.67 mg was recorded with the seedlings grown in the conventional nursery ($T_7$). Treatment $T_7$ observed significantly the lowest root fresh weight among all the sowing media.

Burogohin *et al*., (2022) [3] reported the highest fresh weight of roots (0.26 mg) in the media containing [(Cocopeat: Vermicompost (50:50)] and the lowest of 0.05mg in the grown in conventional nursery. Vermicompost increases the humic acid content which is known to increase the total and available nitrogen, phosphorous, potassium and organic matter along with the good qualities of cocopeat in improving water retention capacity and porosity might have increased the fresh of roots in cauliflower seedlings. A Similar result was also reported by Mirabi and Hasanabadi (2012) [7].

### Root dry weight (mg)

Data presented in Table 1 shows the highest dry weight of root 85.67mg in the sowing media $T_3$ [Cocopeat: vermicompost (1:1)], followed by 83.34 mg in $T_6$ [Cocopeat: Vermicompost: Perlite: Vermiculite(1:1:1:1)]. However, the non-significant difference was observed between the treatment $T_3$ and $T_6$. The lowest dry weight of root (52.33 mg) was recorded in sowing media $T_7$ (Conventional nursery).

The increased dry weight of root in $T_3$ treatment may be due to the increased fresh weight of root. Tsui C (1984) [12] stated that vermicompost creates rich environment in the root zone, which indirectly produced the growth-promoting hormone *viz*., Indole acetic acid (IAA), resulted in the increased root growth and thereby increasing in dry weight of the root. The cocopeat also plays important role in maintaining the appropriate porosity of growing media resulting in a better root system and consequently increase dry matter production in tomato seedlings.

### Seedling fresh weight (g)

Table 1. Represent the seedling fresh weight, which differed significantly among different sowing media under greenhouse and conventional nursery. The highest seedling

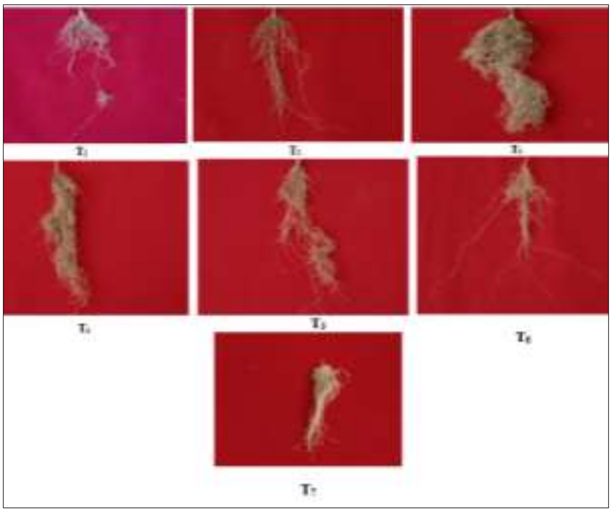

**Fig 2:** Fresh root of broccoli seedling under different sowing media

Fresh weight (0.95 g) was recorded under the sowing media $T_3$ [Cocopeat: Vermicompost (1:1)] followed by 0.92 g in $T_6$ [Cocopeat: Vermicompost: Perlite: Vermiculite (1:1:1:1)]. However, the treatment $T_3$ and $T_6$ was at par. The lowest seedling fresh weight (0.81 g) was recorded under the sowing media $T_7$ (Conventional nursery).

Vermicompost with organic amendment and vermicompost+ cabbage residue (1:1) significantly increased the weight of seedlings and shoot weight of seedling under greenhouse conditions. Similar results were also reported by Bhardwaj (2013) [2]. Humic acid and humic substance of vermicompost might have enhanced the soil's physical conditions, favoured growth of soil microflora and helped in solubilizing the reserve minerals which subsequently resulted in greater uptake of plant nutrients and make them available throughout the growth period of plant and positively increase fresh weight of seedlings.

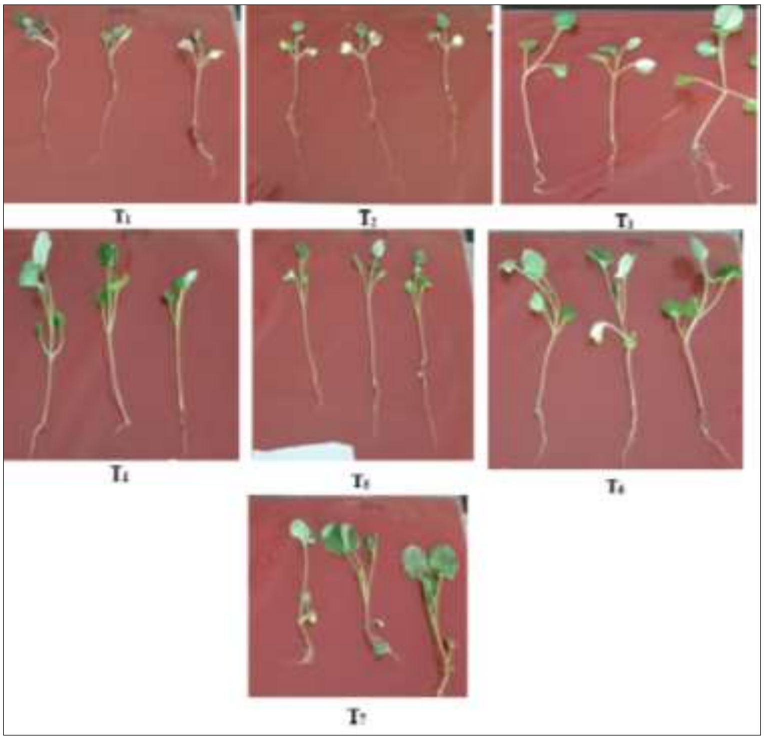


**Fig 3:** Distinct difference can be seen among different sowing media (Broccoli seedlings)

**Table 1:** Amelioration of sowing media for root fresh weight, root dry weight, seedling fresh weight of Broccoli seedlings

| Treatment | Root fresh weight (mg) | | | Root dry weight (mg) | | | Seedling fresh weight (g) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2019-2020 | 2020-2021 | Pooled | 2019-2020 | 2020-2021 | Pooled | 2019-2020 | 2020-2021 | Pooled |
| $T_1$ | 203.20 | 207.67 | 205.67 | 58.67 | 61.00 | 59.84 | 0.84 | 0.86 | 0.85 |
| $T_2$ | 177.67 | 173.67 | 175.67 | 54.00 | 57.67 | 55.83 | 0.84 | 0.86 | 0.85 |
| $T_3$: | 310.33 | 313.33 | 311.83 | 84.33 | 87.00 | 85.67 | 0.94 | 0.96 | 0.95 |
| $T_4$: | 281.67 | 286.00 | 283.83 | 72.33 | 74.33 | 73.33 | 0.90 | 0.88 | 0.89 |
| $T_5$: | 262.33 | 267.67 | 265.00 | 62.00 | 65.00 | 63.50 | 0.86 | 0.87 | 0.87 |
| $T_6$: | 303.67 | 298.63 | 301.15 | 82.67 | 84.00 | 83.34 | 0.92 | 0.91 | 0.92 |
| $T_7$: | 160.33 | 163.00 | 161.67 | 51.67 | 53.00 | 52.33 | 0.83 | 0.78 | 0.81 |
| S. Ed (±) | 2.24 | 2.51 | 1.84 | 2.05 | 1.77 | 1.23 | 0.04 | 0.05 | 0.03 |
| CD (0.05) | 4.88 | 5.49 | 3.77 | 4.48 | 3.85 | 2.52 | 0.09 | 0.10 | 0.06 |

**Seedling dry weight (g)**

Pooled data differed significantly among different sowing media treatments under the greenhouse and conventional nursery in respect of seedling's dry weight (Table 2). The highest seedling dry weight (0.40 g) was recorded in the sowing media $T_3$ [Cocopeat: Vermicompost (1:1)] followed by (0.39 g) $T_6$ [Cocopeat: Vermicompost: Perlite: Vermiculite (1:1:1:1)] and the lowest seedling dry weight (0.24 g) was recorded in $T_7$ (conventional nursery). However, the treatment $T_3$ and $T_6$ were observed at par.

Salas and Ramirez (2001) [9] also found the highest dry matter production of seedlings sown in the growing media containing vermicompost. Subbaiah *et al*., (2018) [8] reported that the leaves of ivy gourd seedlings raised in Cocopeat: Vermicompost (1:1) based growing media has higher chlorophyll content due to the presence of the highest composition of vermicompost which might certainly upgrade the photosynthesis rate, dry matter production and more fresh and dry weight of the seedling.

**Dry matter accumulation (%)**

The highest dry matter accumulation of 42.10% was recorded in the sowing media $T_3$ [Cocopeat: Vermicompost (1:1)] under greenhouse conditions (Table 2). This treatment showed better performance among all the sowing media followed by 40.69% in treatment $T_6$ [Cocopeat: Perlite: Vermiculite: Vermicompost (1:1:1:1)]. However, the treatment $T_3$ and $T_6$ were statistically at par. The lowest dry matter accumulation of 29.81% was recorded in seedlings grown under the conventional nursery. Cocopeat has a carbon-nitrogen (C:N) ratio of 104:1 and can store and release nutrients to plants for longer periods and the vermicompost possessed a higher and more soluble levels of major nutrients like nitrogen. The availability of nitrogen increases the chlorophyll content in the leaves which ultimately both factors (Cocopeat and Vermicompost) increase the photosynthesis and thereby accumulation of more dry matter in plants.

**Total chlorophyll content (mg g $^{-1}$fw)**

The perusal of data in the table 3 showed the broccoli seedlings grown in greenhouse and conventional nursery using different sowing media had significant effect on chlorophyll content.

The highest (0.32 mg $g^{-1}$fw) was recorded in $T_3$ [Cocopeat: Vermicompost (1:1)] followed by 0.31 mg $g^{-1}$fw in $T_6$ [Cocopeat: Vermicompost: Perlite: Vermiculite (1:1:1:1)] and the lowest of 0.21 mg $g^{-1}$fw was found in $T_7$ (Conventional nursery).

Nitrogen and magnesium are important elements for the formation of chlorophyll in plant. The increased chlorophyll content in leaves of seedling by the application of media having the combination of vermicompost and cocopeat may be due to the stimulated nutrient uptake especially the nitrogen element, which have a role in the assimilation of various proteins and amino acid and thereby more synthesis of chlorophyll.

The leaves of seedling raised in the media $T_3$ [Cocopeat: Vermicompost (1:1)] has higher leaf chlorophyll content, may be due to the presence of nitrogen in vermicompost, which might certainly upgrade the photosynthetic rate (Awasthi *et al*., 1996) [1]

**Disease incidence (%)**

Based on the pool data mean of two consecutive years of the experiments (Table 3), the lowest diseases incidence (3.44%) was recorded under $T_3$ [Cocopeat: vermicompost (1:1)] treatment and the highest of 7.28% in $T_7$ (Conventional nursery).

Vermicompost accelerates plant growth directly by supplying nutrients and indirectly by enhancing the communities of plant-friendly microbes by suppressing soil-borne diseases and working as a plant protector (Canellas *et al*., 2002) [5].

**Table 2:** Amelioration of sowing media for Seedling dry weight and Dry matter accumulation of Broccoli Seedlings

| Treatment | Seedling dry weight (g) | | | Dry matter accumulation (%) | | |
|---|---|---|---|---|---|---|
| | 2019-2020 | 2020-2021 | Pooled | 2019-2020 | 2020-2021 | Pooled |
| $T_1$: | 0.25 | 0.29 | 0.27 | 29.76 | 33.72 | 31.74 |
| $T_2$: | 0.25 | 0.28 | 0.27 | 29.76 | 32.56 | 31.16 |
| $T_3$: | 0.39 | 0.41 | 0.40 | 41.49 | 42.71 | 42.10 |
| $T_4$: | 0.32 | 0.33 | 0.33 | 35.56 | 37.50 | 36.53 |
| $T_5$: | 0.29 | 0.32 | 0.31 | 33.72 | 36.78 | 35.25 |
| $T_6$: | 0.37 | 0.36 | 0.39 | 40.82 | 40.56 | 40.69 |
| $T_7$: | 0.25 | 0.23 | 0.24 | 30.12 | 29.49 | 29.81 |
| S. Ed (±) | 0.03 | 0.03 | 0.02 | 6.29 | 0.95 | 0.73 |
| CD (0.05) | 0.07 | 0.05 | 0.04 | 13.70 | 2.07 | 1.60 |

**Table 3:** Amelioration of sowing media for total chlorophyll content and Disease incidence of Broccoli Seedlings

| Treatment | Total chlorophyll content ($mg\ g^{-1}fw$) | | | Disease incidence (%) | | |
|---|---|---|---|---|---|---|
| | 2019-2020 | 2020-2021 | Pooled | 2019-2020 | 2020-2021 | Pooled |
| $T_1$ | 0.25 | 0.24 | 0.25 | 6.28 | 6.24 | 6.26 |
| $T_2$ | 0.23 | 0.23 | 0.23 | 5.46 | 4.77 | 5.11 |
| $T_3$: | 0.32 | 0.33 | 0.32 | 3.54 | 3.34 | 3.44 |
| $T_4$: | 0.31 | 0.27 | 0.28 | 4.95 | 4.45 | 4.70 |
| $T_5$: | 0.28 | 0.25 | 0.26 | 4.14 | 4.00 | 4.07 |
| $T_6$: | 0.31 | 0.30 | 0.31 | 4.10 | 3.41 | 3.75 |
| $T_7$: | 0.20 | 0.22 | 0.21 | 7.06 | 7.51 | 7.28 |
| S. Ed (±) | 0.02 | 0.02 | 0.02 | 0.59 | 0.66 | 0.26 |
| CD (0.05) | 0.04 | 0.05 | 0.03 | 1.28 | 1.43 | 0.56 |

**Conclusion**

The findings of this investigation showed that broccoli seedling raised under conventional greenhouse with the sowing media $T_3$ [(Cocopeat: Vermicompost (1:1) and sowing media $T_6$ [Cocopeat: Vermicompost: Perlite: Vermiculite (1:1:1:1)] is more effective than raising seedlings in the traditional open field i.e.$T_7$ (Conventional nursery). These media have a significant ameliorative potential to produce broccoli seedlings that are robust and healthy, which ultimately leads to improved performance in the main field after transplanting in terms of yield and yield attributing characters

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