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Effect of Different Media on Growth of Cauliflower Seedling

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ABSTRACT

The growing medium plays a significant role in the quality and performance of vegetable seedlings. Therefore, this study was undertaken to investigate the effect of media on the growth of cauliflower (Brassica oleracea var. botrytis) seedlings. The experiment was conducted inside a plastic house at the Spices Crop Development Center (SCDC), Panchkhal, Kavrepalanchowk, Nepal, from August to September 2020. The seven media types used in this study include pure cocopeat, peatmoss, vermicompost, and soil, cocopeat plus peatmoss (1:1 by volume), cocopeat plus vermicompost (1:1 by volume), and soil plus compost (1:1 by volume). The experiment was conducted under RCBD with seven treatments and three replications. Data on germination percentage, number of leaves, shoot length, shoot diameter, shoot fresh weight, root length, and root fresh weight were recorded and analyzed using ANOVA in RStudio. Results indicated that there were significant differences among media for the germination percentage, shoot diameter, and shoot fresh weight at $p \leq 0.05$. Maximum germination of 75.25% was observed in cocopeat, which also produced the best overall growth performance, followed by a combination of cocopeat plus vermicompost and cocopeat plus peatmoss, while soil and peatmoss proved to be poor. The study concludes that cocopeat-based media enhance growth and quality in cauliflower seedlings and can be recommended for commercial nursery practices in Nepal.

Keywords: Cocopeat, growth, peatmoss, seedling, vermicompost

INTRODUCTION

Cauliflower (*Brassica oleracea* var. botrytis) ranks among the most important winter vegetables in Nepal, due to its high market demand and broad adaptability from Terai plains to the high hills, and also contributing significantly to household income and national vegetable production (Giri et al., 2018; Dahal et al., 2019). With increasing

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population and food preference, consumption has continued to rise; accordingly, the need for high-quality seedlings capable of ensuring better field establishment with higher yields is pressing further. The quality of seedlings depends basically on the characteristic features of the growing medium. Traditionally, soil is the majorly used nursery substrate but often causes problems such as the presence of pathogens, poor aeration, compaction, and inconsistent nutrient availability which may inhibit seedling vigor and root growth (Landis et al., 2014). In this regard, the use of soilless media, which give better physical and chemical properties, enhanced aeration, balanced moisture retention, and reduced disease risk, has become more prevalent. Among the numerous soilless media, cocopeat with high water-holding capacity, favorable pH, good aeration, and slow rate of decomposition, generally stands for a strong alternative to soil. Peatmoss contributes good aeration and buffering, while vermicompost enhances nutrient supply, microbial activity, and structural quality (Ismail et al., 2013; Lazcano and Dominguez, 2014). Compost, although nutrient rich, may have limitations such as high bulk density and salinity when used alone (Raviv, 2013). Despite the growing adoption of alternative media in many countries, limited scientific information is available in Nepal regarding their comparative performance for cauliflower seedling production. Hence, this study was initiated to explore the performance of different media combinations on key growth parameters to identify the most suitable nursery substrates for cauliflower.

MATERIALS AND METHODS

Study area

The experiment was conducted inside a plastic house at the Spices Crop Development Center (SCDC), Panchkhal, Kavrepalanchowk district, Nepal. The site lies in the mid-hill region with warm summer temperatures suitable for vegetable seedling production.

Experimental Design

The experiment was conducted from August to September 2020, designed as a Randomized Complete Block Design (RCBD), with seven treatments and three replications. The treatments were:

- T1: Cocopeat
- T2: Peatmoss
- T3: Vermicompost

- T4: Soil
- T5: Cocopeat + peatmoss (1:1 by volume)
- T6: Cocopeat + vermicompost (1:1 by volume)
- T7: Soil + compost (1:1 by volume)

A total of 21 plastic trays containing 128 cells each were washed and filled with their respective media. Cocopeat was pre-soaked to improve its physical condition. Cauliflower seeds were sown uniformly in each cell, and the trays were arranged according to the RCBD layout. Irrigation was provided lightly after sowing and subsequently when needed.

Data collection

The following parameters of seedling growth were monitored:

- Germination percentage: Counted at 5, 10, and 15 days after sowing (DAS).
- No. of leaves: Recorded from five randomly selected seedlings per treatment at 15, 22, and 30 DAS.
- Shoot length: Measured (cm) at 15, 22, and 30 DAS using a ruler.
- Shoot diameter: Measured (mm) at 30 DAS using a vernier caliper.
- Shoot fresh weight: Measured at 30 DAS after separating the shoots from the roots.
- Root length: Measured (cm) at 30 DAS from uprooted seedlings.
- Root fresh weight: Weighted (g) at 30 DAS.

Data analysis

Data were entered in Microsoft Excel and analyzed using RStudio. The ANOVA was conducted to test the differences among treatments. Significant means were separated by Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Germination percentage

There were significant differences in media concerning germination percentage in all observation stages. Cocopeat always showed the highest germination percentage. Similarly, (Bhandari & Kharal, 2019) also reported the maximum germination percentage of tomato seed in cocopeat compared to other growing media used. The lowest germination percentage was recorded in soil when calculated 5 DAS. However,

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10 DAS and 15 DAS, the lowest germination percentage were recorded from peatmoss which were statistically similar with vermicompost and soil. Even though, peat has very favourable water-holding capacity, high CEC, it is low in nutrient contents and pH (Raviv, 2013).

Table 1. Effect of different media on germination % of cauliflower seedling

Treatments	Germination, %		
	5 DAS	10 DAS	15 DAS
T1	74.99^{a}	74.99^{a}	75.25^{a}
T2	8.58^{de}	10.14^{d}	11.70^{d}
T3	16.66^{d}	16.92^{d}	16.92^{d}
T4	1.06^{e}	18.48^{d}	19.52^{d}
T5	39.31^{c}	39.31^{c}	39.31^{c}
T6	57.81^{b}	63.53^{b}	64.06^{b}
T7	12.49^{de}	13.28^{d}	13.28^{d}
Grand Mean	30.13	33.81	34.29
SEM(±)	0.55	0.47	0.47
CV, %	22.14	16.93	16.93
F-Test	***	***	***

*Means followed by the same letter (s) in a column are not significantly different at 5 % level of significance (P≤0.05);SEM: Standard Error of Mean; CV: Coefficient of Variation;***:Significant at 0.1% level of significance*

Number of leaves

Media composition had no significant effect on the leaf number at any stage. Though there were slight numerical differences, these were statistically similar across treatments. However, (IJARBN, 2019) reported that using cocopeat as media component and organic fertilizer for fertigation showed an increase in number of leaves of lettuce compared to peat as a media component and synthetic fertilizer for fertigation.

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Table 2. Effect of different media on no. of leaf of cauliflower seedling

Treatments	Number of leaves		
	15 DAS	**22 DAS**	**30 DAS**
T1	1.33	1.93	2.80
T2	1.26	1.86	2.26
T3	1.60	1.86	2.46
T4	1.53	2.13	3.33
T5	1.26	2.00	3.13
T6	1.60	2.13	3.13
T7	2.00	2.13	2.86
Grand Mean	**1.51**	**2.01**	**2.85**
SEM (±)	**0.03**	**0.02**	**0.33**
CV (%)	**28.29**	—	—
F-Test	**NS**	**12.28 (NS)**	**14.37 (NS)**

Shoot length

There were no significant differences in shoot length among the various media. However, treatment means for soil and soil + compost were numerically higher, while cocopeat-based treatments were uniform but of shorter length. (Lazcano et al., 2009) suggested that addition of compost or vermicompost in peat-based media increased the aerial biomass of tomato plants.

Shoot diameter

Media had a significant effect on shoot diameter. The largest shoot diameter was recorded on both soil and soil + compost and was closely followed by cocopeat. On the other hand, the peatmoss, the vermicompost and the mixed treatments produced smaller diameters. Soil organic matter provides nutrients to plants and improve soil aggregation and water-holding capacity of soil. Soil particles attract positively charged cations and make them available for plants (Balasubramanian, 2017).

Shoot Fresh Weight

Media also had a significant effect on shoot fresh weight. The highest shoot fresh weight was recorded in the soil+ compost treatment, closely followed by the soil only

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treatment. Treatment with cocopeat and its mixes gave lower shoot weights, despite higher germination rates. And experiment conducted by (Demisie et al., 2019) taking different soil mixtures also showed an increase in shoot fresh weight of tomato seedling in mixtures where organic matter were in higher proportion

Table 3. Effect of different media on shoot length of cauliflower seedling

Treatments	Shoot length (cm)		
	15 DAS	22 DAS	30 DAS
T1	2.71	3.78	4.58
T2	2.26	3.54	4.18
T3	3.15	3.83	4.40
T4	3.00	4.54	5.50
T5	2.94	3.41	3.99
T6	2.61	3.88	4.82
T7	3.45	5.18	5.82
Grand Mean	2.87	4.02	4.76
SEM(±)	0.03	0.05	0.05
CV, %	13.27	14.98	13.31
F-Test	**NS**	**NS**	**NS**

Table 4. Effect of different media on shoot diameter, shoot fresh weight, root length and root fresh weight of cauliflower seedling

Treatments	Shoot diameter, cm	Shoot fresh Weight, g	Root length, cm	Root fresh Weight, g
	30 DAS	30 DAS	30 DAS	30 DAS
T1	1.30[a]	0.04[b]	6.15	0.02
T2	1.18[b]	0.04[b]	7.12	0.02
T3	1.29 [b]	0.04[b]	5.33	0.02
T4	1.46[a]	0.05[a]	7.98	0.03
T5	1.29[b]	0.04[b]	6.18	0.02
T6	1.29[b]	0.04[b]	6.52	0.02
T7	1.42[a]	0.06[a]	7.11	0.04
Grand Mean	1.32	0.05	6.63	0.03
SEM(±)	0.05	0.00	0.09	0.00
CV, %	47.95	11.29	17.58	27.67
F- Test	*	*	**NS**	**NS**

**: Significant at 5% level of significance; NS: Non-significant*

Root Length and Root Fresh Weight

Media had no significant effect on root length and root fresh weight. Greater values for soil + compost and peatmoss, however, were slightly observed. However, a study

conducted by (Abbey et al., 2012) suggested that increasing the proportion of vermicompost in coir leads to the increase in fresh weight of Swiss chard.

CONCLUSION AND RECOMMENDATION

Considering all growth variables together, cocopeat proved to be the best medium for yielding healthy and uniform cauliflower seedlings, particularly for germination and early growth. Cocopeat + vermicompost and cocopeat + peatmoss performed equally well and could provide balanced physical and nutrient properties. Soil and soil + compost resulted in higher stem strength and biomass production but had a low germination rate and lower uniformity. These findings identify the use of well-aerated, pathogen-free, and lightweight media as an important component for cauliflower seedlings in nursery production. Thus, cocopeat-based media can be recommended for commercial nursery operations in Nepal where input quality and uniform seedling production are priorities.

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