Effect of sowing media and variety on seedling root growth and field performance of Early Cauliflower (*Brassica oleracea* var*. botrytis*)

ABSTRACT: An experiment was conducted inside greenhouse and in the field of the Experimental Farm, Department of Horticulture, College of Agriculture, Assam Agricultural University, Jorhat for two consecutive years (2018 and 2019) to assess the effect of sowing media and variety on root growth of early cauliflower seedling and subsequent performance of seedling in the main field. The experiment was laid out in Factorial Randomized Block Design with eight treatments comprising of four sowing media [M_1-cocopeat (60%): vermiculite (20%): perlite (20%), M_2-cocopeat (50%): vermicompost (50%), M_3-cocopeat (50%): vermicompost (50%): microbial consortium and M_4-Conventional nursery] and two varieties [V_1 (White Diamond) and V_2 (CFL1522)] replicated thrice. Treatment M_1, M_2 and M_3 were inside green house. The results revealed root parameters at seedling stage were significantly influenced by sowing media. The highest root length (4.94 cm), root fresh weight (0.26 mg) and root dry weight (0.07 mg) of seedling were recorded in M_3. Between the two varieties(*i.e* V_1 and V_2) V_1 exhibited the maximum root length (4.24 cm) while no significant difference was observed for root fresh and dry weight. Among interactions, M_2V_1 recorded maximum root length (5.83 cm) while M_3V_1 recorded maximum root fresh weight (0.28 mg) and dry weight (0.08 mg) of seedling. After transplanting in the field, significant variations for root parameters were observed. Cauliflower plants that were grown in M_3 at seedling stage recorded highest root length (21.94 cm) and volume (74.59 cm^3) but for root dry weight seedlings that were grown in M_2 recorded maximum dry weight *i.e*. 3.28 g. Variety V_2 recorded maximum root length (17.76 cm) and dry weight (2.68 g). M_3V_2 recorded highest root length (22.01 cm), volume (76.46 cm^3) and dry weight (3.48 g). Curd characters were also significantly influence by media while variety showed significant variation for days to curd initiation, harvesting and curd diameter only. M_3 recorded minimum days for curd initiation and harvesting (37.09 and 53.26), maximum curd compactness (53.05 g/cm^3), diameter (12.84 cm), weight (0.41 kg) and shelf life (8.89 days).The interaction effect between media and variety was also found significant. The combination M_3V_1 recorded minimum days for curd initiation and harvesting ((36.55 and 52.32), maximum curd compactness (53.15 g/cm^3) while M_3V_2 recorded maximum curd diameter (13.51 cm), curd weight (0.41 kg) and shelf life (9.50 days) .The combination M_4V_2 recorded maximum days for curd initiation and harvesting (45.46 and 63.87),minimum curd compactness (42.77 g/cm^3) and M_4V_1 recorded minimum curd diameter (10.28 cm), shelf life (4.95 days) while both M_4V_1 and M_4V_2 recorded minimum curd weight (0.27 kg). From the present investigation it can be concluded that for producing quality seedlings in the nursery which will further show good performance in the field seedling can be raised in media(M_3) *i.e*.cocopeat (50): vermicompost (50): microbial consortium @ 1:100 under protected condition.

Key words: Cauliflower, sowing media, seedling, root, curd, green house, field

1. INTRODUCTION

"Healthy seedling production is prerequisite for raising vigorous and profitable crops. Recently, the use of high quality seedlings produced in facilities where climatic conditions are kept under control has increased. In the production of ready-to-plant seedlings, climatic conditions as well as seed sowing media have quite significant impact. Seedling production with conventional methods causes stress in plants. Seeds are sown in different media, which plays a vital role in efficient production of horticultural seedlings in nurseries" (Sterrett, 2001). "The use of suitable growing media or substrates for sowing of seeds directly affects the germination, development of functional shoot and root system. A good growing medium provides sufficient anchorage or support to the plant, serves as reservoir for nutrients and water, allow oxygen diffusion to the roots and permit gaseous exchange between the roots and atmosphere

outside the root substrate" (Abad *et al.,* 2002). "Seedlings obtained from a quality nursery significantly influences re-establishment and the eventual productivity in the main field" (Baiyeri, 2006).

The soil is generally used as a basic medium because it is cheapest and easily available. Essentially perlite and vermiculite are used in the horticultural industry because they both provide good aeration and drainage, they can retain and hold substantial amount of water and later release it as per the requirement. These are sterile and free from diseases, having a fairly neutral pH (especially perlite which is neutral), non-toxic, safe to use, and relatively inexpensive. Vermiculite absorbs large quantities of water and also holds positively charged nutrients like potassium, magnesium and calcium because of its plate like structure.

"Cocopeat or coir , an agricultural by-product obtained after the extraction of fibre from the coconut husk is considered a growing medium component with acceptable pH, EC and other chemical attributes (Abad *et al.,* 2002) as it has good physical properties, high total pore space, high water content, low shrinkage, low bulk density and slow biodegradation (Evans *et al.,* 1996 and Prasad, 1997) provides phosphorous and potassium and can hold water up to nine times its weight".

vermicompost has good structure, moisture-holding capacity, relatively arge amounts of available nutrients, and microbial metabolites that may act as plant growth regulators.

A pre-sowing inoculation of planting material as well as the planting medium with the consortia of beneficial microorganisms is an innovative approach for production of quality and healthy seedlings in horticultural production in general and transplanted vegetables in particular. A microbial consortium is a carrier based product containing nitrogen fixing, phosphorus and potassium solubilising and plant growth promoting microorganisms in a single formulation.

Early cauliflower **(***Brassica oleracea* var*. botrytis*)is a popular and remunerative crop for the farmers of Assam as it catches the early market.The present investigation was carried out to evaluate the effect of growing media on quality seedling production with healthy roots of early cauliflower and performance of those seedlings afterwards in the main field.

2. MATERIALS AND METHODS

The experimental site was conducted in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat (26.47 °N latitude and 94.12 °E longitude and at 86.8 m above MSL) during the month of July-November in two consecutive years, 2018 and 2019.The soil was sandy loam soil having pH 5.00, organic carbon 0.55% and available N, P and K were 212.52 kg ha^{-1}, 40.45 kg ha^{-1} and 110.64 kg ha^{-1}.

The experiment composed of four Nursery Media composition [M_1- Cocopeat (60): Vermiculite (20): Perlite (20); M_2-Cocopeat (50): Vermicompost (50); M_3-Cocopeat (50): Vermicompost (50): Microbial consortium and M_4: Conventional nursery (soil: sand: FYM)] and two variety (V_1- White Diamond and V_2 - CFL 1522). Thus, eight treatment combinations were laid out in factorial Randomized block design (RBD) with three replications. The protrays were used for nursery raising with cocopeat, vermiculite, perlite, vermicompost and microbial consortium as growing media and seeds of early cauliflower hybrid variety 'White Diamond' and 'CFL-1522' which are popular and commercially available in Jorhat were sown in protrays (one seed per cell) under protected conditions in the second week of July. One conventional nursery was also raised for sowing same seeds with soil, sand and FYM as growing media. Microbial Consortium consisting of *Azotobacter*, *Azoospirullum* and Phosphate Solubilising Bacteria (PSB) was mixed with respective media at a ratio of 1:100 and mixed properly and sprinkled and heaped. Coco peat was soaked and washed before mixing with other media.

After a deep ploughing, well-rotten cowdung manure was applied at the rate of 20 t/ha in the soil 20 days before transplanting. Plots of 3.6 m x 2.7 m dimension were prepared and the treatments were allocated randomly. Healthy seedlings of 22-28 days old were selected and transplanted on 2nd week of August at a spacing of 45 cm x 45 cm accommodating 48 plants per plot in both the years. Recommended cultural and plant protection measures were followed equally in all the plots as and when required.

Different seedling attributes namely root length, root fresh and dry weight were recorded just before transplanting. In the main field the observations were recorded from six randomly selected plants from each plot on root length, root volume and root dry weight at the time of harvesting. Root length was measured from the base of the plant to the tip of the roots using a scale, and the value was expressed in centimeter. Root volume was measured by the water displacement method suggested by Raja and Bishnoi (1990) and it was expressed in cubic centimeters (cc). Roots of sampled plants were washed with water and oven dried at 65 ± 5 °C until constant weight was reached and expressed as root dry weight in gram. For recording the days for curd initiation the number of days taken from transplanting to the days when the curds were visible in 50 % plants in a plot was recorded. Similarly, the numbers of days taken from the date of transplanting to the day when the curds become fully developed, compact or mature in 50 % of the plants in a plot were recorded for days to harvesting. After removing the stalk and leaves, sample curds were weighed in physical balance and average was taken and expressed in curd weight in kilogram. The diameter of cauliflower curd was measured at the point of maximum width from two different sides (equatorial length) after cutting the sample curds into two equal halves longitudinally and average was expressed in centimeter. Compactness was determined by following index method modified by Pearson (1931). The shelf life of cauliflower was measured in number of days taken to become non-marketable curd or refused curd (due to shrinkage and physiological deterioration in shape, size and colour) when they are stored at room temperature

Pooled data of two years was taken (2018 & 2019)which are presented here for drawing conclusions after subjecting the same to statistical analysis using the statistical package SPSS (20.0) at 5% critical difference (CD) for testing the significant differences among the treatment means.

3. RESULTS AND DISCUSSION

3.1 Effect on root parameters of seedlings in nursery

The data presented in Table 1 clearly revealed that different sowing media had significant effect on root length and fresh and dry weight of roots of early cauliflower seedling. However, variety had significant influence only on root length.

Table 1: Effect of sowing media, variety and their interaction on root parameters of cauliflower seedling (pooled mean of two years, 2018 & 2019)

Media	Root length (cm)	Root Fresh Weight(mg)	Root Dry Weight (mg)
M_1(3Cocopeat: 1Vermiculite : 1Perlite)	3.66	0.06	0.01
M_2(1Cocopeat: 1Vermicompost)	4.76	0.12	0.04
M_3(1Cocopeat:1Vermicompost:Microbial consortium)	4.94	0.26	0.07
M_4(Soil:Sand: FYM)	2.72	0.05	0.02
S.Ed.(±)	0.14	0.01	0.01
CD(0.05)	0.28	0.02	0.01
Variety			
V_1 (White Diamond)	4.24	0.13	0.03
V_2 (CFL 1522)	3.80	0.12	0.04
S.Ed.(±)	0.10	0.01	0.00
CD(0.05)	0.20	NS	NS
Interaction (MXV)			
$T_1(M_1V_1)$	3.26	0.07	0.02
$T_2(M_1V_2)$	4.07	0.05	0.01
$T_3(M_2V_1)$	5.83	0.14	0.02
$T_4(M_2V_2)$	3.69	0.11	0.06
$T_5(M_3V_1)$	5.28	0.28	0.08
$T_6(M_3V_2)$	4.60	0.24	0.07
$T_7(M_4V_1)$	2.60	0.04	0.01
$T_8(M_4V_2)$	2.83	0.06	0.03
S.Ed.(±)	0.20	0.01	0.01
CD(0.05)	0.40	0.03	0.02

The longest roots (4.94cm) were produced in the treatment M_3 *i.e* cocopeat (50): vermicompost (50): microbial consortium which was at par with M_2 *i.e* cocopeat (50): vermicompost (50) and the shortest roots (2.72 cm) were produced in M_4 (conventional nursery). The highest root length recorded in M_3 might be due to the beneficial effect on root growth by cocopeat, vermicompost and microbial consortium. This is in agreement with Hartmann and Kester, 1997 who reported improvement of root parameters in medium consisting of soil + sand + vermicompost + vermiculite + cocopeat (1:1:1:1:1) with *Azotobacte*r might be due to improved soil texture, structure, porosity, water holding capacity, activity of useful soil micro fauna and flora, maintained soil temperature and improved soil health and nutrient status of medium.Further, the vermicompost also provides close contact between seed and media; increases steady moisture supply that facilitates root respiration and encourages overall root growth (Chatterjee and Choudhuri, 2007). Cocopeat also provides better aeration in the root zone. This result gets support from Venkata Subbaiah *et al*. (2018) who attributed increased root length of brinjal with 6g Arka microbial consortium per 1kg cocopeat to production of plant growth promoting substances by plant growth-promoting microbes which were known to cause enhanced cell division and root development.

In case of variety, V_1 (White Diamond) recorded the longer roots (4.24 cm) between the two varieties which might be attributed to its varietal character.

In the interaction effect between sowing media and variety, significant variations were recorded. M_2V_1 recorded the highest root length (5.83 cm) which was followed by M_3V_1, M_3V_2 and M_1V_2. The shortest roots (2.60 cm) were produced in M_4V_1.The combined influence of both media and variety might have resulted the longest roots in M_2V_1.

The highest fresh weight of roots (0.26 mg) was recorded in M_3, followed by M_2 (0.12 mg) and M_1 (0.06 mg) and the lowest in M_4 (0.05mg). Significant interaction effects among the media and variety were observed in regards to root fresh weight. The highest fresh weight (0.28 mg) was recorded M_3V_1, followed by M_3V_2 and M_2V_1. The lowest (0.04 mg) was recorded in M_4V_1. Increased fresh weight in M_3 might be due to the direct plant growth promotion by microbial consortium solubilizing or mobilizing important nutrients (phosphorous, potash, zinc, sulphur and iron) or fixing atmospheric nitrogen for the uptake of plants. These are also known to produce various plant growth promoting hormones like indole acetic acid, gibberlic acid, cytokinins and ethylene (Arshad and Frankenberger, 1993). 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. Similar result was also reported by Mirabi and Hasanabadi (2012) and Yadav, *et al*. (2012).

The highest dry weight (0.07 mg) of root was recorded in M_3 followed by M_2 (0.04 mg) The lowest was recorded in M_1 (0.01 mg) but was at par with M_4 (0.02 mg).The interaction among the media and variety also showed significant variation. The highest dry weight (0.08 mg) was recorded M_3V_1 which was at par with M_2V_2 and M_3V_2 followed by M_4V_2.The lowest was recorded in M_4V_1 but not statistically superior to M_1V_1, M_1V_2 and M_2V_1.

"Increased dry weight in M_3 was due to increased fresh weight of roots. Tsui (1984) stated that because of the indirect production of the indole acetic acid (auxin), on the effect on zinc and considering that vermicompost is a rich environment of nutrition, result in the root growth increase with the effect in the hormone production and the dry material increase. Overall, the cocopeat attendance according to the appropriate porosity results in the better root system improvement and consequently results in the dry material increase" (Casenave *et al*, 1990). This result is in line with Mirabi and Hasanabadi, 2012.

3.2. Effect on root parameters of cauliflower plants in field as affected by seedlings grown in different media

Root parameters like root length, root volume and root dry weight were significantly influenced by seedlings grown in different media as evident from Table 2. Effect of variety was not found to be significant for root volume. The maximum root length (21.94 cm) was noticed in M_3 which was followed by M_2 (19.58 cm) and M_1 (17.00 cm) and the minimum (9.97 cm) was recorded in the traditional sowing

media with soil, sand and FYM (M_4). Maximum root length (17.76 cm) was noticed in variety V_2. The longest roots in M_3 can be attributed to the increased root length of seedling which was also revealed in field condition. The interaction effects were statistically significant with maximum length (22.01 cm) was noticed in M_3V_2 but was at par with M_3V_1 and followed by M_2V_2. Minimum length (9.87 cm) was showed by M_4V_2 and at par with M_4V_1.

Table 2: Effect of sowing media, variety and their interaction on root parameters of cauliflower plants in field (pooled mean of two years 2018 & 2019)

Media (M)	Root length (cm)	Root volume (cm^3)	Root Dry Weight (g)
M_1(3Cocopeat: 1Vermiculite : 1Perlite)	17.00	66.48	2.03
M_2(1Cocopeat: 1Vermicompost)	19.58	59.49	3.28
M_3(1Cocopeat:1Vermicompost:Microbial consortium)	21.94	74.59	3.21
M_4(Soil:Sand: FYM)	9.97	44.88	1.66
S.Ed.(±)	0.39	0.91	0.12
CD(0.05)	0.79	1.84	0.24
Variety (V)			
V_1 (White Diamond)	16.49	61.50	2.41
V_2 (CFL 1522)	17.76	61.22	2.68
S.Ed.(±)	0.28	0.64	0.08
CD(0.05)	0.56	NS	0.17
Interaction (MXV)			
$T_1(M_1V_1)$	15.21	70.22	1.64
$T_2(M_1V_2)$	18.80	62.73	2.42
$T_3(M_2V_1)$	18.80	56.30	3.43
$T_4(M_2V_2)$	20.36	62.69	3.13
$T_5(M_3V_1)$	21.87	72.73	2.94
$T_6(M_3V_2)$	22.01	76.46	3.48
$T_7(M_4V_1)$	10.07	46.77	1.63
$T_8(M_4V_2)$	9.87	43.00	1.69
S.Ed.(±)	0.55	1.28	0.17
CD(0.05)	1.12	2.60	0.34

The media, M_3 maintained the superiority with highest root volume of 74.59 cm^3 and lowest was obtained in M_4 (44.88 cm^3).Significant interaction effects of media and variety was observed where M_3V_2 recorded maximum root volume (76.46 cm^3) followed by M_3V_1 and minimum with 43.00 cm^3 in M_4V_2.Because of the vigorous production of leaves and longer roots more carbohydrate assimilation and nutrient took place, for which it might have increased the root volume in M_3.

Maximum root dry weight (3.28 g) was recorded in M_2 which was at par with M_3 (3.21 g) and the lowest dry weight (1.66 g) was recorded in the treatment M_4. In case of variety, maximum dry weight (2.68 g) was recorded in V_2.The increased root dry weight might be due production of improved root system by cocopeat and vermicompost in seedling stage also might have been carried over by plants and increased the fresh weight of roots in field and consequently, the dry weight. Similar observation was mentioned by Matsubara *et al*. (2002) in Welsh onion seedlings raised in plug trays which produced maximum shoot dry weight (532 mg $plant^{-1}$) and highest root dry weight (94 mg $plant^{-1}$) in the main field after eight weeks of transplanting.

The interaction effect was also found significant. The highest dry weight (3.48 g) was recorded M_3V_2 which was at par with M_2V_1. The lowest was recorded in M_4V_1 (1.63 g) but not statistically superior from M_1V_1 and M_4V_2.

3.3. **Effect on yield attributes of cauliflower in field as affected by seedlings grown in different media**

Yield attributes like days to curd initiation, days to curd harvesting, curd compactness, curd diameter, curd weight, and curd shelf life were significantly influenced by seedlings grown in different media (Table 3).

Table 3: Effect of sowing media, variety and their interaction on yield attributes of cauliflower in field(pooled mean of two years, 2018 & 2019)

Media(M)	Days to curd initiation	Days to curd harvesting	Curd compactness (g/cm^3)	Curd diameter (cm)	Curd weight (kg)	Curd shelf life (days)
M_1(3Cocopeat: 1Vermiculite : 1Perlite)	41.84	57.47	47.85	11.22	0.32	6.78
M_2(1Cocopeat: 1Vermicompost)	38.90	53.96	50.84	11.49	0.35	7.56
M_3(1Cocopeat:1Vermicompost: Microbial consortium)	37.09	53.26	53.05	12.84	0.41	8.89
M_4(Soil:Sand: FYM)	45.42	62.75	43.61	10.38	0.27	5.17
S.Ed.(±)	0.31	0.54	0.49	0.22	0.01	0.15
CD(0.05)	0.64	1.09	1.00	0.45	0.01	0.31
Variety (V)						
V_1 (White Diamond)	41.04	56.08	49.09	10.98	0.33	6.63
V_2 (CFL 1522)	40.58	57.63	48.59	11.99	0.34	7.57
S.Ed.(±)	0.22	0.38	0.35	0.16	0.01	0.11
CD(0.05)	0.45	0.77	NS	0.32	NS	NS
Interaction (MXV)						
$T_1(M_1V_1)$	43.32	57.34	47.76	10.98	0.29	6.22
$T_2(M_1V_2)$	40.36	57.59	47.93	11.45	0.35	7.33
$T_3(M_2V_1)$	38.91	53.05	50.99	10.50	0.37	7.06
$T_4(M_2V_2)$	38.89	54.88	50.69	12.49	0.33	8.06
$T_5(M_3V_1)$	36.55	52.32	53.15	12.18	0.40	8.28
$T_6(M_3V_2)$	37.62	54.20	52.96	13.51	0.41	9.50
$T_7(M_4V_1)$	45.39	61.62	44.46	10.28	0.27	4.95
$T_8(M_4V_2)$	45.46	63.87	42.77	10.49	0.27	5.39
S.Ed.(±)	0.44	0.76	0.70	0.32	0.01	0.21
CD(0.05)	0.90	1.55	1.41	0.64	0.02	0.43

Days to curd initiation, days to curd harvesting and curd diameter were found to be significantly influenced by variety. Days to curd initiation was minimum in M_3 with 37.09 days and maximum days was taken by M_4 (45.42). The seedlings which were grown in M_3 also took minimum days for curd initiation which might be the result of increased plant vigour, better and early establishment in field. This finding is in conformity to Chatterjee and Mal (2016) who opined that the seedling which received vermicompost and biofertilizer as growth media significantly influenced the main crop performance and recorded the minimum days for head formation in cabbage.

In case of variety, minimum days (40.58) was taken by V_2.Because of its varietal character V_2 revealed its' potential to produce curd in minimum days when grown in suitable substrate in the nursery and carried over the character to field.

Significant interaction effects were observed for days to curd initiation. The least number of days was observed in M_3V_1 (36.55) immediately followed by M_3V_2 and the maximum in M_4V_2 (45.46) which was at par with M_4V_1.

Days to curd harvesting was the minimum (53.26 days) in the treatment M_3 but found to be at par with M_2, while the maximum was found in M_4 (62.75). As the M_3 took minimum days for curd formation, consequently the days for curd harvesting is also minimum. Similar result was reported by Chatterjee and Mal (2016) in cabbage.

Regarding variety minimum days (56.08) were recorded in V_1 which might be because of its' genetical and environmental effect

There was significant effect of interaction on days to curd harvesting. M_3V_1 took minimum days (52.32) and was at par with M_2V_1 and the maximum days (63.87) were recorded in M_4V_2.

The most compact curd (53.05 g/cm^3) was noticed in M_3 which was significantly different from M_2, M_1 and M_4. The lowest compactness was recorded in M_4 (43.61g/cm^3). "Poor quality seedling cannot be improved by any means of management after being transplanted to the field and the genetic inheritance of a given variety will be revealed if and only if it is supplemented by proper seedling management practices" (Abdissa *et al*., 2010).Proper nourishment in the nursery with nutrients and better water retention by media M_3 might have led to compact curd formation by plants.

The effect of variety on curd compactness was found to be non- significant.

The interaction effects were statistically significant with maximum compactness (53.15 g/cm^3) was noticed in M_3V_1 but at par with M_3V_2 and the minimum (42.77 g/cm$^{3)}$ was recorded in M_4V_2 .

Significant effect of media on curd diameter was recorded. The highest diameter (12.84 cm) was recorded M_3 and the lowest (10.38cm) was found in M_4. Increase in root length and root volume might have led to more absorption of nutrients and water in the plants grown in M_3 in nursery. Moreover, more carbohydrate production in leaves due to improved vigour might have led to increased curd diameter which serve as the sink of the food materials produced by plants.

Variety had significant influence on curd diameter with maximum diameter (11.99 cm) in V_2.

Significant interaction effect of media and variety was found for curd diameter. The highest diameter (13.51 cm) was observed in M_3V_2 and the lowest (10.28 cm) was recorded in M_4V_1. The combined influence of M_3 and V_2 might have led to higher diameter in M_3V_2.

The observations recorded at curd harvest stage revealed that media had significant influence on curd weight. The highest curd weight (0.41 kg) was obtained in M_3 and was found to be statistically superior to all other treatments. The lightest curds (0.27 kg) were harvested in M_4 plots. Among various essential plant nutrients, nitrogen is an essential for plant growth, development and reproduction. Nitrogen is associated with vigorous vegetative growth. It is helpful in production of large and compact curds. A proper use of nitrogen improves the curd size, nutrient value and reduces the chances of buttoning Phosphorus is a constituent of nucleic acid, phytin and protein. So, an adequate supply of phosphorus in early stage of plant life is an important in laying down the primordia for the reproductive parts of the cauliflower. It is also an essential constituent of majority of enzymes which are of great importance in the transformation of energy in carbohydrate and fat metabolism and also in respiration in plants. Proper nourishment of seedlings through uniform utilization of the light, water and nutrients among all the plants might have led to increased weight of curd. This finding is in line with Chatterjee and Mal (2016) who reported quality plantable seedlings have encouraged vigorous growth of the field crop and subsequently helped in achieving maximum marketable head with maximum yield in cabbage. Chatterjee and Mal (2016) found maximum head weight with vermicompost and biofertilizer as nursery media.

Varieties did not bring about significant effect on the curd weight

Significant interaction effects were observed among different treatments Maximum curd weights (0.41 kg) were observed in M_3V_2 which were at par with M_3V_1. Both M_4V_1 and M_4V_2 recorded the smallest curd (0.27 kg).

It is evident from Data in Table 3 that media had significant effect on shelf life of curds The highest number of days (8.89) was recorded in M_3, followed by M_2 (7.56 days) and then M_1 (6.78 days). The lowest shelf life (5.17 days) was recorded in M_4. Better physiological condition as manifested in the plants might have reduced the storage loss of weight, colour, and compactness of curds which in turn increased the shelf life of curd.

There was significant effect of interaction between sowing media and variety on curd shelf life. Curds had the highest shelf life (9.50 days) in M_3V_2 and followed by M_3V_1 and the lowest shelf life (4.95 days) was recorded in M_4V_1.

CONCLUSION:

The present investigation highlighted significant variations in root length, root fresh weight and root dry weight of seedlings due to different media in the nursey as well as in the field after transplanting. The effect of variety was not significant for all the parameters. Interaction effect between media and variety was also significant. The curd characters also affected by different media. Varietal effect was not seen for all the parameters. Therefore it can be concluded that for producing quality seedlings in the nursery which will further show good performance in the field seedling can be raised in media(M_3) *i.e*. cocopeat (50): vermicompost (50): microbial consortium @ 1:100 under protected condition.

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