Original Research Article

Effect of Different Seedling Growing Media on Tomato and Cabbage Seedling

Abstract

The experiment, conducted during the 2018-20 rabi season at Assam Agricultural University's Experimental Farm in Jorhat, encompassed four different media compositions and two crops, yielding eight treatment combinations. These treatments were arranged in a RBD with three replications. The results demonstrated that the choice of seedling growth media had a significant impact on the performance of both tomato and cabbage seedlings. Tomato seedlings exhibited superior performance when nurtured in plug trays with a growth medium consisting of 50% coconut and 50% vermicompost (M2). These seedlings displayed higher emergence rates, enhanced growth, and increased yields. For cabbage seedlings, the most effective medium consisted of 50% coconut, 50% vermicompost, and a microbial consortium (M3). Notably, both M2 and M3 media formulations also showcased superior field performance. In conclusion, the study underscores the importance of carefully selecting seedling growth media to enhance crop productivity. It recommends the use of M2 for tomato seedlings and M3 for cabbage seedlings to maximize performance. Further research and field trials are recommended to validate these findings across different growing conditions. Ultimately, the research highlights the potential for tailored seedling growth media to significantly increase the agricultural productivity and yield.

Keywords:Tomato, Cabbage,microbial consortium LAI,perlite,vermiculite,yield, cocopeat, vermicompost

1. Introduction

Tomato (Solanum lycopersicum L.) belongs to the Solanaceae family and is cultivated worldwide (Sharma and Singh, 2015). It is considered one of the most essential "nutrient-rich foods" due to its unique nutritional value. Recently, tomatoes have gained attention for their potential in preventing various human diseases. This attention is particularly directed towards carotenoids, with a focus on lycopene, an unsaturated compound. Lycopene is believed to play an active role in cancer prevention, reducing the risk of cardiovascular diseases, and retarding the aging process (Abdel-Monaim, 2012). In fresh, fully ripe tomatoes, lycopene is present in two forms: all-trans (79-91%) and cis- (9-21%) isomers. To fully harness the potential of a transplanted vegetable, it is essential to establish a uniform stand of robust and healthy seedlings.

Traditionally, tomato seedlings are raised in open field nurseries, which face several challenges such as uneven seed germination, intense competition among seedlings for nutrients, light, and water, as well as susceptibility to soil-borne pests and pathogens, leading to inconsistent seedling quality. In an attempt to improve seedling yields, farmers often resort to high-density sowing, which can increase seed costs and resource wastage. With the adoption of hybrid tomato varieties, the cost of seeds has significantly risen. As a result, farmers are actively seeking innovative approaches to reduce seedling mortality and enhance seedling quality.

Cabbage (Brassica oleracea L.), typically grown as an annual crop, despite being biennial, is a nutritious vegetable rich in vitamin C, various B vitamins, potassium, and calcium. Similar to tomatoes, achieving the full potential of a transplanted vegetable hinges on the establishment of a uniform stand of vigorous and healthy seedlings.

Traditionally, cabbage seedlings are cultivated in open field nurseries, which come with various challenges such as irregular seed germination, intense competition among seedlings for nutrients, light, and water, and susceptibility to soil-borne pests and diseases. In an attempt to obtain healthier seedlings, farmers frequently resort to high-density sowing, resulting in elevated seed costs and resource inefficiency. The adoption of hybrid varieties has significantly raised the cost of seeds, putting added financial pressure on farmers. In response, farmers are actively exploring innovative methods to mitigate seedling mortality and obtain high-quality seedlings. Due to the rising costs of seeds, various vegetable crops such as tomatoes, eggplants, peppers, and cucurbits are now being transplanted after nurturing in protected environments. This approach ensures maximum germination rates and robust plant establishment. While seedling production has long been employed for crops like tomatoes, peppers, cucumbers, and eggplants, it has more recently been adopted for leafy vegetables like cabbage and lettuce (Sterrett, 2001). The success of seedling production is significantly influenced by climatic conditions and the choice of seed sowing media.During vegetative production, the seedling stage plays a pivotal role in shaping growth, development, early and overall yields, and the number of fruits per plant. Conventional methods of seedling production can impose stress on plants. The growth media used in this stage are crucial for the efficient development of horticultural seedlings in nurseries. An ideal growing medium offers stable anchorage, acts as a nutrient and water reservoir, facilitates oxygen exchange with the roots, and allows gaseous interactions between the roots and the surrounding atmosphere. The choice of growing media significantly impacts seedling quality in the nursery, which, in turn, influences field re-establishment and the ultimate productivity of an orchard (Abad et al., 2002; Baiyeri, 2006; Agbo and Omaliko, 2006).

Plug trays are becoming an increasingly favored method for raising seedlings due to their ability to ensure even distribution of light, water, and nutrients among all the plants, which promotes healthy seedling development. Furthermore, the choice of growing media significantly influences seed germination, seedling growth, and the initial performance of the seedlings.In addition to traditional farmyard manure, vegetable cultivators are increasingly turning to alternative growing media for nurturing seedlings of various vegetable crops. Notably, vermicompost, cocopeat, vermiculite, perlite, and microbial consortium have gained popularity. Each of these media offers unique advantages. Cocopeat, for instance, boasts excellent physical properties, with a high total pore space, ample water retention, minimal shrinkage, low bulk density, and gradual biodegradation (Prasad, 1997). Perlite and vermiculite play a critical role in aeration and drainage, effectively storing and gradually releasing significant amounts of water as required. Vermicompost contains macro and micronutrients. It also contains humic acids and plant growth-promoting substances such as auxins, gibberellins, and cytokinins. Additionally, it harbors nitrogen-fixing and phosphorus-solubilizing bacteria, enzymes, and vitamins, which collectively enhance the availability of plant nutrients. This, in turn, leads to increased plant growth, higher yields, and improved produce quality (Atiyeh et al., 2001). The combination of arbuscular mycorrhizal fungi (AMF) and bacteria significantly increased the plant biomass tomato compared to individual inoculations, indicating synergistic interactions between these microorganisms(Sharma, et al., 2020; Nacoon et al., 2020; Singhet al., 2015; Liu et al., 2019; Estrada et al., 2013; Ziane et al.,2017**)**. Pre-sowing inoculation of both planting material and the growth medium with a consortium of beneficial microorganisms represents an innovative approach to produce high-quality and disease-resistant seedlings in horticultural production. This microbial consortium is a product that combines nitrogen-fixing, phosphorus and potassium solubilizing, and plant growth-promoting microorganisms in a single formulation. The combined action of these formulated microbes has the potential to foster robust and healthy seedlings while significantly curbing cultivation costs by reducing the need for fertilizers in vegetable production. Comparative research on seedling performance between open-field nurseries and plug trays, as well as the effects of various growth media under greenhouse conditions in Assam, remains limited in the existing literature. This knowledge gap led to the design of the present study. Our investigation aims to assess how different seed sowing media impact the growth, quality, and vitality of cabbage seedlings, and subsequently, how they influence the yield and associated attributes of cabbage plants in the main field.

2. Materials and Methods

The field experiments were carried out at the Experimental Farm of the Department of Horticulture, Assam Agricultural University, Jorhat, Assam, India during the rabi seasons of 2018-2019 and 2019-2020. The experimental site, located at 26.47°N latitude and 94.12°E longitude, has an elevation of 86.8 meters above mean sea level. The soil at this site is well-drained sandy loam with a pH of 5.20, organic carbon content of 0.93%, and available N, P, and K levels of 212.21 kg/ha, 20.34 kg/ha, and 118.42 kg/ha, respectively.

The experimental treatments included four different nursery media compositions:

M1: Cocopeat (60): Vermiculite (20): Perlite (20); M2: Cocopeat (50): Vermicompost (50)
M3: Cocopeat (50): Vermicompost (50): Microbial consortium (6g/kg media); M4: Conventional nursery (soil: sand: FYM).
Two crops were tested:C1: Tomato (Arka Rakshak) and C2: Cabbage (Rare Ball.
A total of eight treatment combinations (M1C1, M2C1, M3C1, M4C1, M1C2, M2C2, M3C2, and M4C2) were arranged in a Randomized Block Design (RBD) with three replications. Various seedling attributes were recorded just before transplanting, including seedling emergence percentage (SE %), days to 2-true leaf stage (DTLS), seedling height (SH), stem diameter (SD), leaf area (LA), days to transplant (DT), root length (RL), seedling vigour index (SVI), seedling fresh weight (SFW), seedling dry weight (SDW), and total chlorophyll content (TCC), which was measured using a portable leaf chlorophyll meter. Seedling vigor was determined by multiplying the germination percentage with seedling dry weight, following the method of Abdul-Bakki and Anderson (1973).

Economic analysis was conducted based on the benefit-to-cost (B:C) ratio, calculated from net returns and the cost of production using existing market rates. Healthy seedlings were transplanted in the main field at plots measuring 3.0 m x 2.7 m, with 45 cm spacing within and between rows. The field crops received a uniform dose of 20 t/ha of farmyard manure, along with the recommended amount of inorganic fertilizers. Recommended cultural and plant protection practices were uniformly applied to all plots as needed. Observations in the main field were recorded on ten randomly selected plants from each plot.

Data from two years of experimentation were subjected to statistical analysis, and individual year data was computed and combined to calculate the pooled mean. Treatment means were compared using the least significant difference (LSD) test at the 0.05 level of significance. All statistical analyses were performed using the INDOSTAT version 8.0 statistical package.

3. Results and Discussion

3.1 PerformanceofTomato seedlings

The results indicated significant differences among the various seed sowing media, as presented in Table 1, 2, and Figure 1. Specifically, media M2 exhibited several favorable attributes including a higher seedling emergence (SE) rate of 98.42%, greater seedling height (SH) at 15.47 cm, a stem diameter (SD) of 3.23 mm, larger leaf area (LA) measuring 8.35 cm^3, a substantial seedling vigor index (SVI) at 2268.54, a seedling fresh weight (SFW) of 1.53 g, a seedling dry weight (SDW) of 0.37 g, and a total chlorophyll content (TCC) of 1.61 mg g^{-1} fresh weight. Seed germination requires a combination of water, oxygen, and appropriate temperature. Water softens the protective seed coat, oxygen is necessary for aerobic respiration to provide energy for germination, and the embryo relies on breaking down its food stores for energy. The seed also needs a warm temperature to accelerate the chemical reactions involved in seed growth and the formation of new cells during the embryonic growth process. The greenhouse provided the necessary temperature control, while growing media M2, with its good water retention capacity, moisture supply, and adequate porosity, facilitated both moisture supply and gaseous exchange between the media and the seed, resulting in improved seedling emergence. These findings are consistent with previous research by Zaller (2007) and Hota and Arulmozhiselvan (2017). The increased seedling height in media M2 can be attributed to its conducive effect on water retention, porosity, proper aeration, and the presence of substantial nutrients, particularly nitrogen and micronutrients necessary for robust plant growth (Chopde et al., 1999). A similar outcome was observed by Nissi (2018) in tomato. Furthermore, the combined application of vermicompost and cocopeat in media M2 resulted in a larger stem diameter. This might be due to the synergistic combination of these factors, which enhanced the physical characteristics of the media and improved its nutritional properties (Sahni et al., 2008). This may have led to better nutrient availability, resulting in the production of more photosynthetically functional leaves and, consequently, thicker seedlings (Borah et al., 1994). These findings are in line with the results obtained by Parasana et al. (2013). The leaves of seedlings raised in media M2 also exhibited higher leaf chlorophyll content, primarily due to the presence of nitrogen in vermicompost. This likely enhanced the photosynthetic rate, dry matter production, and, subsequently, increased the fresh and dry weight of the plants (Awasthi et al., 1996). Interestingly, the conventional nursery, which used a mixture of soil, sand, and farmyard manure (FYM), produced better results than media M1 (Cocopeat: Vermiculite: Perlite). This superiority might be attributed to the availability of essential nutrients (N, P, and K) from FYM, along with proper moisture, despite being cultivated under open-field conditions.

Table 1: Pooledmean data analysis oftwoyears 2018-20 for the various traits

Treatment	SE (%)	DTLS	SH (cm)	SD (mm)	LA(cm2)	DT
M1	93.67	14.08	8.34	1.92	2.59	29.12
M2	98.42	10.35	15.47	3.23	8.35	21.38
M3	97.34	10.95	14.74	3.06	7.58	22.74
M4	94.17	16.83	11.68	2.23	2.89	28.90
S.Ed(±)	1.22	1.27	2.12	0.13	0.98	1.48
CD(0.05)	3.04	3.15	4.95	0.31	2.32	3.17

Table 2: Pooledmean data analysis oftwoyears 2018-20 for the various traits

Treatment	RL(cm)	SVI	SFW (g)	SDW (g)	DMA(%)	TCC (mgg-1fw)
M1	5.84	1348.64	0.51	0.09	18.83	0.81
M2	10.25	2268.54	1.53	0.37	24.18	1.61
M3	10.37	2201.28	1.49	0.35	23.74	1.28
M4	5.89	1518.91	0.56	0.10	17.83	0.73
S.Ed(±)	1.32	25.54	0.04	0.02	1.91	0.04
CD(0.05)	3.01	61.29	0.09	0.04	4.41	0.09

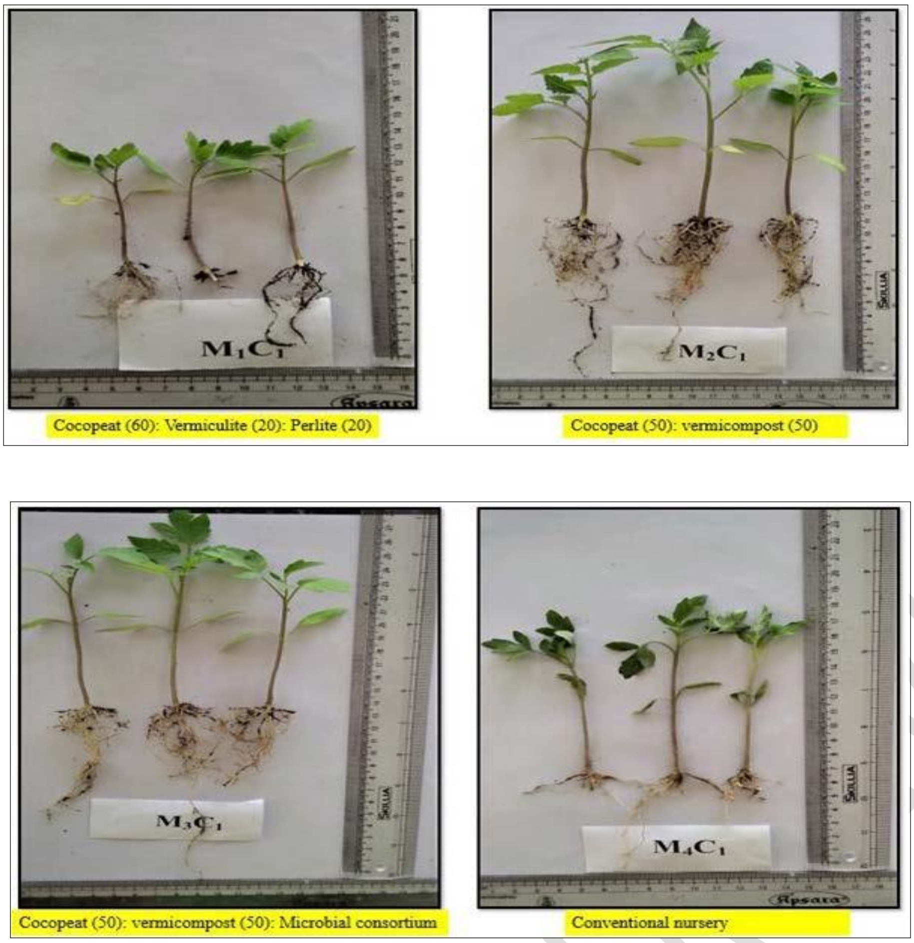

Fig1: Seedlinggrowthunderdifferentgrowingmedia

3.2 Performanceof Cabbage seedlings

The results demonstrated significant variations among the different seed sowing media, as outlined in Table 3, 4, and Figure 2. Particularly, media M3 exhibited numerous favorable characteristics, such as a higher seedling emergence (SE) rate of 92.67%, a stem diameter (SD) of 3.12 mm, a larger leaf area (LA) measuring 9.15 cm^3, a longer root length (RL) at 12.01 cm, a substantial seedling vigor index (SVI) of 2358.43, a seedling fresh weight (SFW) of 1.72 g, a seedling dry weight (SDW) of 0.38 g, and a total chlorophyll content (TCC) of 0.99 mg g^{-1} fresh weight. The higher seedling emergence percentage observed in media M3 can be attributed to its superior water-holding capacity, moisture supply, and adequate porosity, which facilitate optimal moisture and gaseous exchange between the media and the seeds, thereby enhancing seedling emergence. Additionally, the maintenance of proper temperatures in the greenhouse contributed to favorable seedling emergence. These findings are consistent with those of Zaller (2007). The increased leaf area can be attributed to microbial activity. Media M3 contained a microbial consortium that included azotobacter, azospirillum, and phosphate-solubilizing bacteria. Vermicompost, also present in this media, contains beneficial microorganisms that possess the ability to produce growth-regulating substances, resulting in an increase in leaf area. Similar outcomes were observed by Subbaiah et al. (2018) in brinjal. The larger stem diameter in media M3 can be attributed to better nutrient availability, which led to the substantial production of photosynthetically active leaves, ultimately resulting in thicker seedlings. Microorganisms present in vermicompost and the microbial consortium synthesize plant growth hormones, particularly auxin, gibberellin, and cytokinin. The significant increase in root growth may be due to the higher availability of auxin in this particular growing media (M3). These findings align with those of Ngaatendwe et al. (2015). The elevated vigor index in media M3 is likely due to the increased germination and seedling height, which both contributed to a higher vigor index. These results are consistent with the findings of Prajapati et al. (2017) and Parasana et al. (2013).

Table 3: Pooled mean analysis of cabbage yield attributing traits: 2018-20.

Treatment	SE (%)	DTLS	SH (cm)	SD (mm)	LA (cm^2)
M1	83.56	12.72	7.08	2.01	4.68
M2	90.45	10.59	10.90	3.02	8.87
M3	92.67	10.21	10.35	3.12	9.15
M4	91.78	13.66	9.15	2.56	8.04
S.Ed(±)	2.38	0.39	0.59	0.07	0.77
CD(0.05)	5.95	0.87	1.26	0.21	1.46

Table 4: The pooled mean values for the years 2018-19 and 2019-20 in the cabbage for the followings triats.

Treatment	DT	RL (cm)	SVI	SFW (g)	SDW (g)	TCC($mgg^{-1}fw$)
M1	27.19	5.68	1264.61	0.72	0.14	0.80
M2	22.62	8.82	2175.26	1.64	0.36	0.93
M3	22.54	12.01	2358.43	1.72	0.38	0.99
M4	29.57	4.51	1384.83	1.18	0.23	0.78
S.Ed(±)	1.65	1.23	42.68	0.06	0.03	0.03
CD(0.05)	4.10	3.46	101.50	0.15	0.07	0.06

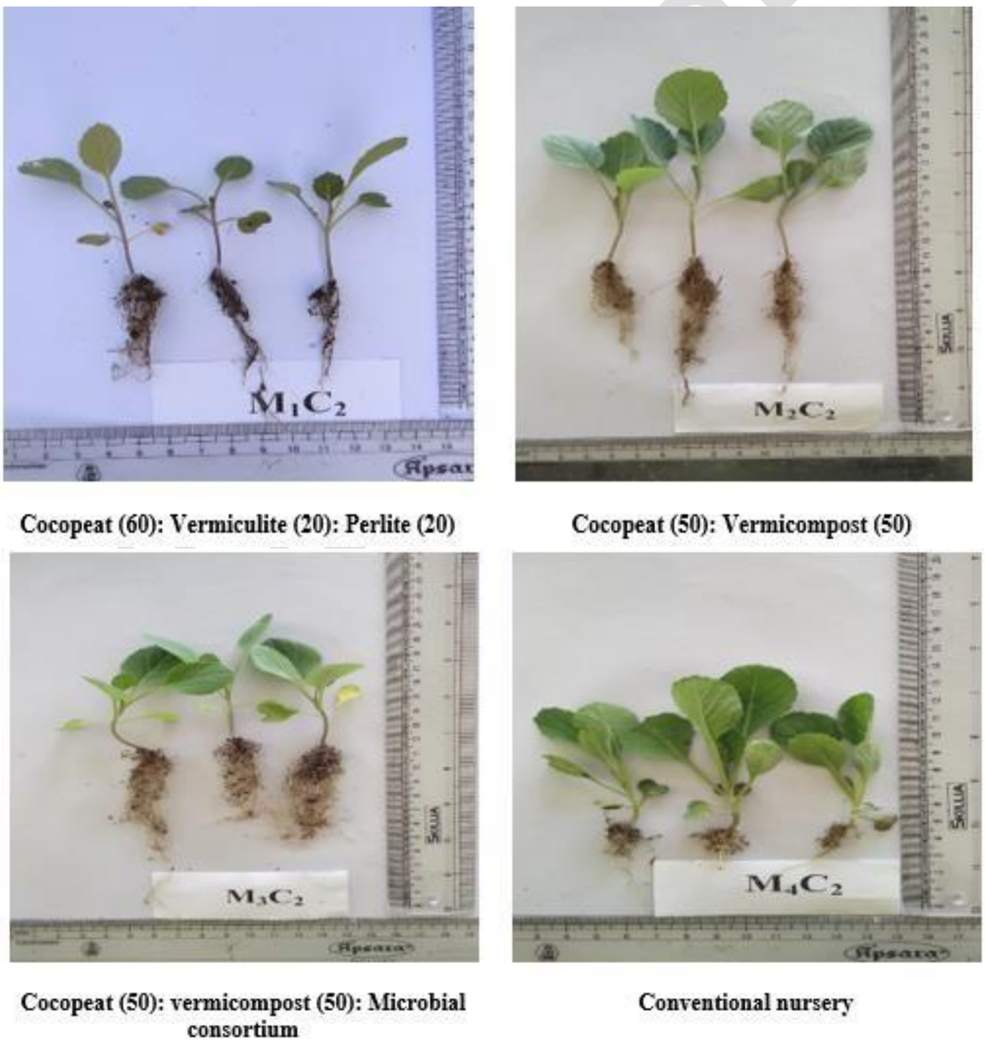

Fig 2: Seedlinggrowth underdifferent growingmedia

3.3 Performanceof Tomato seedlinginthemainfield

The seedling raised in media M2 under greenhouse conditions exhibited superior performance in the main field. The key observations and parameters are presented in Table 5, 6, 7, and 8. Table 5: Days to Seedling Establishment (SE), Post-transplant Growth, and Fruit Attributes, Days to Seedling Establishment (SE): The seedlings from M2 took significantly fewer days to establish themselves in the main field, with an average of 4.29 days.Post-transplant Growth: After 30, 60, and 90 days of transplant (DT), the plants from M2 showed significantly greater plant height (PH) at 70.43 cm, 95.30 cm, and 118.50 cm, respectively.Fruit Attributes: The seedlings from M2 produced more leaves, resulting in a higher leaf area index (LAI) of 5.45. The plants also exhibited more extensive root systems, with an average root length (RL) of 60.53 cm. The days required for Days to Flowering (DF) was 31.71, and the days to reach 50% fruit set was 46.89. Harvesting took 93.69 days on average. Each individual fruit was heavier, with an average weight of 66.78 grams. The yield per plant was 2.85 kilograms, leading to a remarkable yield per hectare of 105.63 tons. Additionally, the Benefit: Cost (B:C) ratio was favorable at 5.28. The rapid establishment of seedlings in the main field, with more leaves and extensive root systems, contributed to uniform and fast growth. This was likely due to the increased root length, which allowed for quicker water and nutrient absorption and higher seedling vigor. The active root system facilitated uniform and rapid growth with minimal transplant shock. The increased number of leaves was associated with greater plant height, indicating better nutrient availability. Leaf Area Index (LAI) is a significant ecological parameter, signifying the photosynthetically active area. The higher LAI was a result of more leaves on the plant, enabling increased photosynthesis. Moreover, the extensive root system contributed to greater fruit weight due to increased photosynthate transfer to the roots. The amplified photosynthesis, linked to a higher LAI, ultimately led to heavier fruit weight. These findings highlight the robust performance of seedlings raised in media M2, emphasizing the importance of greenhouse conditions and appropriate media for successful crop production. The early establishment of seedlings and the subsequent enhanced growth parameters positively impacted fruit attributes, ultimately leading to higher yields and a favorable B:C ratio. Similar outcomes have been reported in other studies, such as the one by Jett et al. (1995) in broccoli.

Table 5: Pooledmean analysis oftwoyears 2018-20 of the following traits.

Treatment	Days toestablishment	Plant height (cm)at30 DAT	Plant height (cm)at60 DAT	Plant height (cm)at90 DAT	Leafnumbers	Leafareaindex (LAI)	Specific leaf weight (mg cm-2)
M1	5.83	51.68	85.23	100.78	30.84	3.29	8.29
M2	4.29	70.43	95.30	118.50	41.56	5.45	18.22
M3	4.41	60.70	93.94	114.74	38.77	5.20	19.59
M4	6.21	55.37	89.86	103.34	35.08	4.67	13.45
S.Ed(±)	0.77	6.16	2.39	4.75	2.37	0.33	2.82
CD(0.05)	1.69	13.61	5.99	9.90	5.37	0.65	5.67

Table 6: Pooledmean analysis oftwoyears 2018-20 of the following traits.

Treatment	Membrane stabilityindex(%)	Relative leafwatercontent (%)	Rootlength (cm)	Root dryweight(g)	Days to50 % flowering	Days to50%fruit set

M1	62.73	77.24	38.45	12.38	35.67	56.22
M2	70.71	79.48	60.53	15.95	31.71	46.89
M3	66.91	77.20	54.77	15.95	32.80	46.92
M4	57.59	78.78	40.10	11.46	37.26	50.55
S.Ed(±)	2.39	0.86	4.25	1.12	0.83	2.83
CD(0.05)	4.06	1.17	7.76	2.70	1.78	6.37

Table 7: Pooledmean analysis oftwoyears 2018-20 of the following traits.

Treatment	No. of flowerclusterper plant	No. offruits per cluster	Days tofirst harvest	Individualfruitweight (g)	Fruityield per plant(kg)	Totalyield (tha-1)
M1	9.65	5.12	109.51	59.77	2.04	75.29
M2	10.78	6.37	93.69	66.78	2.85	105.63
M3	10.83	6.15	99.29	65.57	2.73	101.01
M4	10.22	5.32	107.06	58.71	2.15	79.73
S.Ed(±)	0.24	0.13	2.58	0.87	0.15	1.89
CD(0.05)	0.45	0.24	5.35	1.91	0.55	4.72

Table 8:Pooledmeanofproduction economics of tomato 2018-20.

Treatment	Gross expenditure (Rs.ha-1)	Gross return(Rs. ha-1)	Net return(Rs.ha -1)	B:C ratio
M1	261446	1129350	867904	3.32
M2	252398	1584450	1332052	5.28
M3	252554	1515150	1262596	4.99

M4	239762	1195950	956188	3.98

Fig3: TomatoFruitclusterunderdifferenttreatments

3.4 Performance of Cabbage seedling inthemainfield

Seedlings raised in media M3 [Cocopeat (50): Vermicompost (50): Microbial consortium] under greenhouse conditions displayed remarkable performance in the main field. The key observations and parameters are presented in Table 9, 10, and 11. Table 9: Days to Seedling Establishment, Post-transplant Growth, and Head Attributes.

Days to Seedling Establishment: Seedlings from M3 took only 3.34 days to establish themselves in the main field.

Post-transplant Growth: After 30 days of transplanting, these plants showed impressive plant height, reaching 21.84 cm.

Head Attributes: The plants produced a higher Leaf Area Index (LAI) of 12.16, indicative of an extensive photosynthetically active area. The root length was substantial, averaging 22.07 cm. The plants also had a greater number of wrapping leaves, with an average of 37.45. Heading initiation required fewer days, only 41.64, and the plants were ready for harvest in just 62 days. The heads were notably heavy, with an average weight of 1.58 kilograms and a substantial head diameter of 15.91 cm. The compactness of the heads was high, registering at 4.09. The head yield per hectare was outstanding at 77.42 tons, and the Benefit: Cost (B:C) ratio was favorable at 3.88.

These impressive results can be attributed to the early establishment of seedlings in the main field, rapid growth, and a high number of wrapping leaves. The plants displayed an extensive photosynthetically active area (LAI), contributing to their robust growth. The substantial root length and quick initiation of heading and harvesting demonstrated their overall vigor. The notable head weight and size, along with high compactness, underscored the quality of the produce. The outstanding head yield per hectare and a favorable B:C ratio are indicative of the economic viability of this approach. Seedlings raised in media M3 under greenhouse conditions exhibited exceptional performance in the main field. Their rapid establishment, vigorous growth, and impressive head attributes make this combination a valuable choice for optimizing cabbage production.

Table 9: Pooled mean oftwoyears2018-20 in the followingstraits.

Treatment	Days toestablishment	Plant height (cm)at30 DAT	Plant height (cm)at60 DAT	Leafnumbers	Leaf area index(LAI)
M1	4.29	17.00	26.27	38.03	8.89
M2	3.36	21.35	29.73	48.03	10.39
M3	3.34	21.84	29.27	49.18	12.16
M4	5.41	17.69	26.68	39.52	9.31
S.Ed(±)	0.54	0.65	0.71	4.68	0.86
CD(0.05)	1.17	1.40	1.61	10.68	1.84

Table 10: Root length, root dry weight, no. of non-wrapping and wrapping leaves, days to head initiation and days to harvesting (Pooled mean oftwoyears2018-19 and 2019-20)

Treatment	Root length(cm)	Root dryweight(g)	No. of non-wrappingleaves	No. of wrappingleaves	Days to headinitiation	Days toharvesting
M1	17.28	12.83	10.01	28.02	43.41	67.23
M2	20.29	15.25	11.48	36.55	41.89	62.77
M3	22.07	16.20	11.73	37.45	41.64	62.00
M4	17.02	12.21	10.13	29.39	42.73	65.89
S.Ed(±)	0.61	0.82	0.68	0.53	0.77	2.21
CD(0.05)	1.33	1.83	1.53	1.15	1.58	5.16

Fig 4 : Cabbage at head initiation stage under different treatments

Table 11: Headweight,headdiameter,headcompactness, headyieldandB:Cratio(Pooledmean oftwoyears2018-19and2019-20)

Treatment	**Head weight (kg)**	**Headdiameter(cm)**	**Headcompactness**	**Head yield(t ha^{-1})**	**B:C ratio**
M1	1.21	13.08	6.12	59.29	2.54
M2	1.51	14.87	5.13	73.99	3.67
M3	1.58	15.91	4.09	77.42	3.88
M4	1.3	13.01	6.85	64.43	3.55

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S.Ed(±)	0.1 2	0.47	0.49	0.96	-
CD(0.05)	0.2 6	1.04	1.07	2.08	-

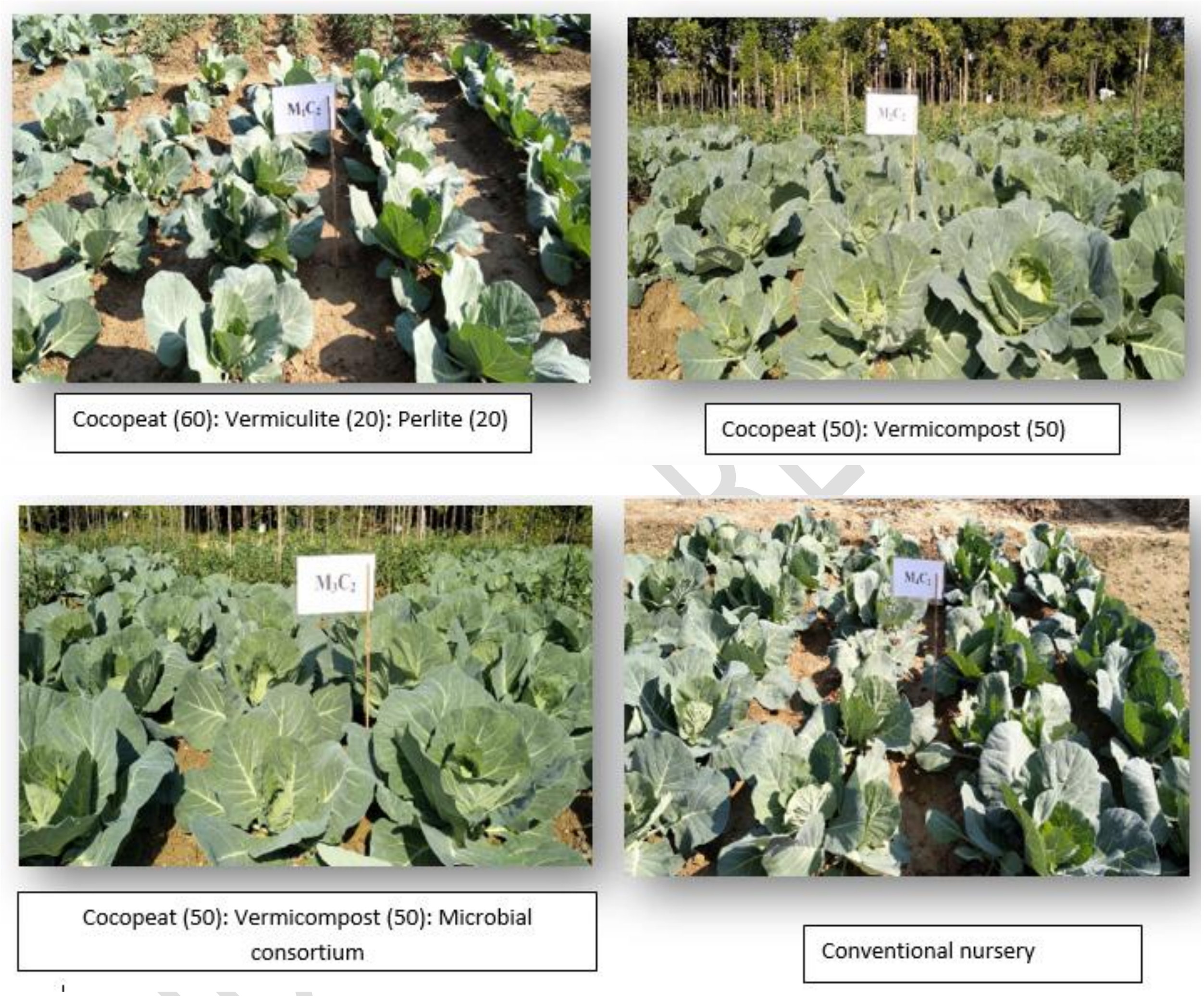

Fig 5 : Cabbage at vegetative stage under different treatment

Conclusion

The results of this study clearly demonstrate the superiority of two specific methods for raising healthy and vigorous seedlings of tomato and cabbage in a greenhouse environment. These methods outperform the traditional open field seedling raising approach (M4: conventional nursery) and offer substantial benefits in terms of yield and associated characteristics. Media M2 (Cocopeat 50%: Vermicompost 50%): This medium, when used in a greenhouse, provides an efficient and effective way to nurture tomato and cabbage seedlings. The seedlings raised in this medium exhibited robust growth, quick establishment, and impressive characteristics, ultimately leading to enhanced performance in the main field. Media M3 (Cocopeat 50%: Vermicompost 50%: Microbial Consortium): The use of this medium in a greenhouse setting also proved highly efficient for producing top-quality seedlings of tomato and cabbage. These seedlings displayed remarkable attributes, including rapid establishment, vigorous growth, and impressive yields in the main field. The advantages of these greenhouse-based methods are evident, as they enable the production of healthy and vigorous seedlings that translate to outstanding performance in the main field. This enhanced performance is characterized by improved yields and associated attributes. Overall, these findings highlight the potential of adopting greenhouse-based seedling raising methods for tomato and cabbage cultivation. Such methods have the capacity to revolutionize seedling production and significantly contribute to the success and productivity of tomato and cabbage crops.

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