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OFF-SEASON RAISING OF BOTTLE GOURD [*Lagenaria siceraria* (MOL.) STANDL.] SEEDLINGS USING DIFFERENT GROWING MEDIA UNDER POLYTUNNEL

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ABSTRACT

The experiment was conducted on bottle gourd for off-season nursery raising in the semi-arid region of Punjab during 2020 and 2021. The experiment comprised of four treatments i.e., M_1 - Vermiculite + Perlite + cocopeat, 1:1:3, M_2 - Vermiculite + Perlite + Vermicompost, 1:1:3, M_3 - Rice bran + Vermicompost, 1:3, M_4 - Sand + Soil + FYM, 1:1:3. The plug tray of 50 cells was used and kept under polytunnel condition and out of the four treatments; M_3 (Rice bran + Vermicompost, 1:3) media gave the better response during both the years. The maximum germination percentage (59.40), seedling girth (0.480), number of leaves (3.53), percent healthy seedling (93.21) were found in both the years in M_3 followed by M_1 (Vermiculite + Perlite + cocopeat, 1:1:3) media. Similarly, higher shoot and root parameters were recorded for media M_3 (Rice bran + Vermicompost, 1:3) followed by M_1 (Vermiculite + Perlite + cocopeat, 1:1:3). Maximum B: C ratio (3.37:1) of bottle gourd seedlings in both the years was observed under M_3 (Rice bran + Vermicompost, 1:3) respectively. Further, it may be concluded that M_3 (Rice bran + Vermicompost, 1:3) media is worth recommendable for farmers to get higher net returns from bottle gourd seedlings.

Keywords: Bottle gourd, Germination, Media, Plug tray, Polytunnel

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Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is an important cultivated annual crop grown throughout the country. The origin of bottle gourd is Africa.It is grown for its tender fruits which are basically used as a vegetable and also used to prepare sweets, pickles, raita and other delicious preparations.The dried shells of mature fruits are hard and used as containers, utensils, musical instruments or ornamental items. Bottle gourd is also used in Ayurvedic Pharmacopoeia in India. Its fruits are traditionally used as a nutritive agent having cardioprotective, cardiotonic, general tonic, diuretic, aphrodisiac, antidote to certain poisons and scorpion stings, alternative purgative and cooling agents. It cures pain, ulcers and fever and is used for pectoral-cough, asthma and other bronchial disorders. The seeds are the edible part. In China, where people boil it in salt and eat it as an appetizer. It has been used routinely as a source of rootstock for watermelon and other cucurbit crops as a means to reduce the incidence of soil-borne diseases and to promote the vigour of the root system of the crop under low-temperature conditions (Lee and Oda, 2003).

It is one of the most nutritive menus for humans and tones up their energy and vigour because it happens to be a valuable source of carbohydrates, proteins, vitamins and minerals. The edible 100 g bottle gourd fruit contains 96.3 per cent moisture, 2.9 per cent carbohydrate, 0.2 per cent protein, 0.1 per cent fat and 0.5 per cent mineral matter. The mineral elements namely calcium, phosphorus, iron, potassium, sodium and iodine were reported to be present in a fair amount. The fruits are also known to have good sources of essential amino acids such as leucine, phenylalanine, threonine, cystine, valine, aspartic acid and proline, alongwith a good source of vitamin B, especially thiamine, riboflavin, niacin and ascorbic acid. The fruits are rich in pectin also, which showed good prospects for Jelly preparation.

It can be cultivated in all kinds of soil but thrives best in heavily manured loam soil. It requires a warm humid climate, but can also be grown during dry weather with plenty of watering. Under the north Indian conditions, it is cultivated both in spring-summer (February to June) and rainy (July to November) seasons. However, in the southern part of India, where the temperature does not fall much, bottle gourd can be grown throughout the year.

The vegetable nursery production has become a highly commercialized business, wherein most farmers buy their plugs from professional growers. Many factors help to produce quality seedlings. These include the use of high-quality seeds, growing media with good drainage, water holding capacity, and providing optimal rates of fertility. Further, seedlings are germinated under

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more or less optimal conditions to obtain uniform stands and are grown in protected culture under greenhouse conditions. The rate of plant development, root structure, plant height and vegetative matter can be optimally controlled under these conditions. Container cell sizes can be adjusted to produce plant sizes that conform to customer demands. The advent of plug transplants has allowed growers of many specialities crops the ability to greatly reduce seed costs, increase stand uniformity, and in many cases, increase early yields and quality of the products produced. In future, many more crops may be grown as seedling transplants, especially those of high economic value due to earliness and potentially high seed cost (Pandiyaraj, 2017). A considerable amount of research has been done on the offseason raising of bottle gourd seedlings under polytunnel conditions. However, adequate work has not been done on the effects of growing media on the offseason raising of bottle gourdseedlings. Keeping this in view, the experiment was undertaken to study the off-season raising of bottle gourd seedlings by using different growing media under polytunnel conditions.

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MATERIALS AND METHODS

The experiment was conducted to study the effect of different growing media on bottle gourd seedlings under polytunnel during the years 2020 and 2021 at PAU-Regional Research Station, Abohar, District Fazilka, Punjab. The experiment was conducted in a completely randomized design with four treatments replicated five times to minimize the error. Four growing media were used i.e.,

Treatment	Ratio
M_1 - Vermiculite + Perlite + cocopeat	1:1:3
M_2 - Vermiculite + Perlite + Vermicompost	1:1:3
M_3 - Rice bran + Vermicompost	1:3
M_4 - Sand + Soil + FYM	1:1:3

Plug tray vegetable seedlings preparation

In each treatment, 50 holes plug tray was used. Different media used for raising the bottle gourd seedlings. Half of each cell in the tray was filled with media. A single seed was kept in each cell of the plug tray and trays were filled with media. The plug tray seedling was grown under waking polytunnel for its better growth and development. It is reasoned that all the vital inputs to the growing seedling are rendered precisely in a regulated way to allow them to acquire these attributes. Based on the moisture content of media, watering to the seedlings was done in the evening for the subsequent 15 days using a rose can. After 7 to 10 days, the seed sprouted with two leaves, application of water was increased gradually depending on the moisture level in trays. Bottle gourd seeds *Punjab Bahar* were sown one in each plug/cell into 50 cells of trays filled with the different growth media. Seedling emergence was determined on all the 50 cells of a tray. Thereafter, growth and development parameters were measured using twenty-five randomly tagged seedlings from each replication throughout the study. After 7-10 days of sowing the number of normal seedlings germinated were counted and expressed in percentage. At the end of the 25 days of sowing, the length of the seedling was measured and the average length was calculated and represented in cm. The girth of the seedling was measured using the vernier calliper and the mean girth was expressed in cm. The total number of leaves in the plants were counted and recorded. After 25 days of sowing, the number of healthy seedlings was counted and expressed in percentage. Fresh and dry shoot root weights were recorded by weighing balance. For calculating economics, the total seedlings along with seeding rates for inputs and output were used. The net returns were calculated by subtracting the cost of raising seedlings for each from the gross return gained from the economic seedlings. B: C ratio was computed by dividing gross return with the cost of raising seedlings for each media.The data so obtained was subjected to final statistical analysis (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect of growing media on the biometric parameter of bottle gourd seedlings

A significant difference was observed among different treatments for germination percentage in both years.The germination percentages during both the years as well as in pooled analysis are shown in Table 1 which depicts that there is a significant difference in per cent germination. The highest germination was found to be 59.40 per cent with M_3 (Rice bran + Vermicompost, 1:3) media in the pooled year followed by 59.10 per cent in M_1 (Vermiculite + Perlite + cocopeat, 1:1:3). However, both the values were found statistically at par with each other. Similarly, Dhatt and Kaler (2009) also reported the growing media combinations of decomposed cow dung, press mud and rice husk charcoal mixed in 1:1:1 (v/v) ratio gave the best results for nursery and plant growth parameters.

The shoot length of the plant was also defined significantly among different treatments in both the year of the experiment. The growth media M_3 was significantly at par with M_1 in both the years as well as in pooled analysis (Table 1). Use of M_3 (Rice bran + Vermicompost, 1:3) and M_1 (Vermiculite + Perlite + cocopeat, 1:1:3) media increased the shoot length to the tune of 78.57 and 70.54 per cent, respectively over M_4 (Sand + Soil + FYM, 1:1:3.).The result showed that M_3 is good for increasing the shoot length because of

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Table 1. Effect of growing media on the biometric parameter of bottle gourd seedlings under polytunnel during 2020-21.

Treatment	Germination (%)			Shoot length (cm)			Root length (cm)			Seedling girth (cm)			Number of leaves			Percentage of healthy seedling		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
M1	58.60	59.60	59.10	18.80	19.40	19.10	11.40	11.60	11.60	0.480	0.490	0.485	3.40	3.38	3.39	90.10	90.66	90.38
M2	47.80	49.00	48.40	16.40	16.60	16.50	10.60	11.20	10.90	0.380	0.410	0.395	3.20	3.08	3.14	84.79	86.86	85.83
M3	58.80	60.00	59.40	19.80	20.20	20.00	11.40	11.60	11.60	0.480	0.480	0.480	3.60	3.46	3.53	92.36	94.06	93.21
M4	37.40	37.60	37.50	10.80	11.60	11.20	9.40	9.40	9.40	0.370	0.380	0.375	3.00	3.04	3.02	78.80	79.10	78.95
C.D.@5%	1.789	2.201	2.32	1.047	1.527	1.84	0.741	0.709	1.04	0.037	0.048	0.054	N/A	0.331	0.693	2.872	3.641	4.143

better porosity, nutrition and water holding capacity with rice bran and vermicompost in the media. Similarly, Nissi (2018) found that organic matter from vermicompost improve nutrient availability which favoured shoot and root growth.

A significant result was found in both the years for root length. Data further revealed that use of M_3 (Rice bran + Vermicompost, 1:3) and M_1 (Vermiculite + Perlite + cocopeat, 1:1:3) media significantly increased the root length to the extent of 23.40 per cent over M_4 (Sand + Soil + FYM, 1:1:3.), being statistically at par with each other and M_2(Vermiculite + Perlite + Vermicompost, 1:1:3). As the root length and shoot length is directly proportional for that similar result M_3 was found best. Smilar result was also found by Sahni *et al.* (2008). The Vermicompost provides a better growth medium for plant establishment.

The data given in Table 1 indicate that seedling girth increased significantly during both the years and in pooled mean. It is further evident from data presented in the Table that use of M_1 (Vermiculite + Perlite + cocopeat, 1:1:3) and M_3 (Rice bran + Vermicompost, 1:3) media significantly increased the seedling girth to the extent of 29.33 and 28.0 per cent, respectively over M_4 (Sand + Soil + FYM, 1:1:3.). As a result, M_1 is providing the best result for seedling girth but the media is not cost-effective in comparison to the M_3 treatment. Similar finding was also reported by Suthar (2006) where growing media containingVermiculite + Perlite + Vermicompost (1:1:2) gave aximum seedling growth.

A further review of the data (Table 1) revealed that the maximum number of leaves (3.53) was recorded in M_3 (Rice bran + Vermicompost, 1:3) media and the minimum number of leaves (3.02) was found in M_4 (Sand + Soil + FYM, 1:1:3) media. A similar result was also found by Dhatt and Kaler (2009).

The percent healthy seedling was one of the prime parameters that were significantly variable among different growth media during both the years as well as in pooled analysis (Table 1). The maximum healthy seedling (93.21) was observed in M_3 (Vermiculite + Perlite + Vermicompost, 1:1:3) treatment which is at par with M_1 (Vermiculite + Perlite + cocopeat, 1:1:3) that was 90.38 per cent. The minimum result was observed in M_4 (Sand + Soil + FYM, 1:1:3) treatment that was 78.95 per cent. A similar result was also found by Singh *etal*. (2010). Where cucurbit seedlings were raised in multi-celled plastic plug trays containing media coco-peat, vermiculite and perlite as soil-less media in a 3:1:1 ratio. This technique is not only efficient in vigorous root development but also suitable to avoid any damage to the roots and shoots of the seedlings at the time of transplanting. This technology is economical and suitable for the cucurbit growers in the northern

Table 2. Effect of growing media on shoot and root weight parameter of bottle gourd seedlings under polytunnel during 2020-21.

Treatment	Fresh shoot weight (g)			Fresh root weight (g)			Dry shoot weight (g)			Dry root weight (g)		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
M1	4.252	4.148	4.20	0.269	0.278	0.273	0.280	0.285	0.282	0.025	0.025	0.025
M2	3.204	3.268	3.24	0.251	0.26	0.255	0.273	0.273	0.273	0.024	0.024	0.024
M3	4.266	4.202	4.23	0.257	0.264	0.261	0.315	0.343	0.329	0.024	0.024	0.024
M4	2.53	2.626	2.58	0.12	0.12	0.120	0.211	0.214	0.213	0.012	0.012	0.012
C.D.@5%	0.437	0.289	0.505	0.023	0.027	0.033	0.017	0.018	0.023	0.002	0.002	0.003

Table 3. Effect of growing media on the economics of bottle gourd seedlings under polytunnel during 2020-21.

Treatment	Gross Return (Rs. per 50 seedlings/portray)			Net Return (Rs. per 50 seedlings/portray)			B:C Ratio		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
M1	117.20	119.20	118.20	72.52	74.52	73.52	2.62	2.67	2.65
M2	95.60	98.00	96.80	31.70	34.10	32.90	1.49	1.53	1.51
M3	117.60	120.00	118.80	82.30	84.70	83.50	3.33	3.40	3.37
M4	74.80	75.20	75.00	43.25	43.65	43.45	2.37	2.38	2.38
C.D.@5%	3.31	4.40	4.635	3.31	4.40	4.635	0.080	0.118	0.120

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plains of India.With the introduction of this technique, farmers can grow a large number of seedlings as per the requirement for off-season cultivation of cucurbits for fetching the high price of their off-season produce. A similar result was also found by Mahala and Sharma (2020).

Growing media also had a significant effect on fresh shoot weight during both the years as well as in pooled analysis (Table 2). Use of M_3 (Rice bran + Vermicompost, 1:3) and M_1 (Vermiculite + Perlite + cocopeat, 1:1:3) media increased the fresh shoot weight to the extent of 63.95 and 62.79 per cent in the pooled analysis, respectively over M_4 (Sand + Soil + FYM, 1:1:3) media. The vermicompost and rice bran are cost effective also increasing the fresh shoot weight due to porosity and nutrient availability.

It may be conferred from the data (Table 2) that use of M_1 (Vermiculite + Perlite + cocopeat, 1:1:3), M_3 (Rice bran + Vermicompost, 1:3) and M_2 (Vermiculite + Perlite + Vermicompost, 1:1:3) media to fresh root weight were found significantly superior in comparison to M_4 (Sand + Soil + FYM, 1:1:3) media. M_1, M_3 and M_2 media registered 127.50, 117.50 and 112.50 per cent fresher root weight, respectively over M_4. Similar results were also found by Yang and Cheng (1997). They reported that seedlings raised on nutrient-rich, porous media gave better shoot growth that shows cost-effective soil less media is M_3 which contain rice bran and vermicompost.

It is clear from the data presented in Table 2 that the use of M_3 (Rice bran + Vermicompost, 1:3) media significantly enhanced the dry shoot weight as compared with M_1, M_2 and M_4 media. It increased the dry shoot weight to the extent of 16.67, 20.51 and 54.46 per cent in the pooled analysis, respectively over M_1, M_2 and M_4 media. A similar finding was also reported by Raiz *et al.* (2008) who counted a maximum number of leaves in leaf compost mixture. The possible reason was the nutritional contribution of the treatment that produced a maximum number of leaves.

Dry root weight was also significantly affected by different growing media. M_1 (Vermiculite + Perlite + cocopeat, 1:1:3), M_3 (Rice bran + Vermicompost, 1:3) and M_2 (Vermiculite + Perlite + Vermicompost, 1:1:3) media registered 108.33, 100 and 100 per cent more dry root weight over M_4 (Sand + Soil + FYM, 1:1:3) media.

Effect of growing media onthe economics of bottle gourd seedlings

Different growing media significantly influenced the net returns during both the years as well as in pooled analysis (Table 3). Pooled data indicating that bestgrowing media M_3 (Rice bran + Vermicompost, 1:3) fetched significantly higher net returns over other growing media. The use of M_3 fetched the significantly higher net returns of Rs. 83.50 per 50 seedlings/portray among all the growing media.

The data given in Table 3 indicate that the B: C ratio increased significantly with the use ofM_3 (Rice bran + Vermicompost, 1:3) media during both the

years and in pooled mean. The use of M_3 (Rice bran + Vermicompost, 1:3) media attained the maximum B: C ratio (3.37) among all the media and it registered 27.17, 41.60 and 123.18 per cent increase in B: C ratio over M_1 (Vermiculite + Perlite + cocopeat, 1:1:3), M_4 (Sand + Soil + FYM, 1:1:3) and M_2 (Vermiculite + Perlite + Vermicompost, 1:1:3).

It may be concluded that M_3 (Rice bran + Vermicompost, 1:3) media is worth recommendable for farmers to get higher net returns from bottle gourd seedlings.

Authors' contribution

Conceptualization of research work and designing of experiments (PM, KS); Execution of field/lab experiments and data collection (PM); Analysis of data and interpretation (PM, VP); Preparation of manuscript (PM, KS, PKA)

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