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subbaraman.Sriram@icar.gov.in
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Mahala, P.; Sharma, R.K.
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Effect of different growth media on biometric parameter of brinjal and chilli seedlings under shade net house

P. Mahala pmahala@pau.edu
Regional Research Station, India
R.K. Sharma
Punjab Agricultural University, India

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Abstract: The study was undertaken for two consecutive years (2017 and 2018) to evaluate the effect of different growth media on various growing parameters and incidence of insect pest on brinjal and chilli seedlings. Seedlings were grown in protray using six types of growing media. The highest germination percentage (71.11), plant height (11.05 cm), number of leaves (5.81) and percentage healthy seedlings (89.82) were observed with vermiculite + perlite + vermi- compost (1:1:2) during both the years in brinjal. Similarly in chilli, highest germination percentage (66.33), plant height (9.81 cm), number of leaves (5.62) and percentage healthy seedlings (87.61) were observed with vermiculite + perlite + vermi-compost (1:1:2). There was significantly low incidence of whitefly in brinjal (1.49 whitefly/leaf) and chilli (1.65 whitefly/ leaf) seedling grown in media with vermiculite + perlite + vermi-compost (1:1:2). Hence, vermiculite + perlite + vermi-compost (1:1:2) was found as optimum growth media for growing of chilli and brinjal seedlings. The findings of this study recommend the use of vermiculite + perlite + vermi-compost (1:1:2) as growth media for raising nursery by farmers as it had significant positively effect on plant growth parameters of seedlings that lead to increase production of chilli and brinjal.

Keywords: Brinjal, chilli, germination percentage, growth media , growth parameters.

INTRODUCTION

Brinjal (*Solanum melongena* L.) and chilli (Capsicum annum L.) are the principal crops of Solanaceae family grown in sub-tropics and tropics. Both are popular vegetable crops of Punjab, India. In India area under brinjal and chilli cultivation is estimated at 758.0and 399 .0 thousand hectares with total production of 13154 & 4393 metric tonnes, (NHB, 2021) In Punjab, brinjal occupies 5.47-thousand- hectare area with production of 139.79 thousand tonnes and average yield of 225.72 q ha-1 during 2018-19. Similarly, chilli is grown over an area of 8.78 thousand hectare with production of 17.63 thousand tonnes and average yield of 20.09 q ha-1 during 2020- 21 (Anonymous 2021). Both vegetables are first grown in nursery and thereafter transplanted in the fields. Therefore, growing of healthy nursery is prerequisite for a productive crop stand that depends on the growth medium in which these nursery plants are grown and which cause a serious challenge to brinjal and chilli growers.

Germination of the seed is pre-requisite for raising good nursery. All soils used as a growing media are not always perfect for the germination

of seeds and subsequent growth of seedling. Growth medium used for potted plants plays an important role on various growth parameters like plant height, number of leaves, spike length, number of florets per spike, spike diameter and yield, etc. by providing proper nutrient supply, moisture and adequate aeration besides physical support to the growing plant (Bhardwaj et al., 2019). Growing media used for nursery production of brinjal and chilli contain a variety of organic and inorganic ingredients. Organic ingredients include peat moss, bark, coconut coir, rice hulls, etc. Inorganic components include perlite, pumice, vermiculite, sand, hydrogel, etc. Soils are generally unsatisfactory for producing plants in containers because of improper aeration, drainage and poor water holding capacity (Najar et al., 2015). The selection of growing media by farmers mainly depends on cost, their availability and plant requirements. Substrates used commonly in nursery raising are peat, cocopeat, perlite, vermiculite, hydrogel, rockwool (Gruda et al., 2016; Savvas and Gruda, 2018).Growing media is not only a place where seeds are sown and seedlings raised, but also a source and reservoir of plant nutrients (Dahanayake et al., 2012).

A good growing media should be composed of mixtures that are tender enough for seeds to easily germinate, retain moisture, drain excess water and provide sufficient plant nutrients for seedling growth (Choudhary and Deena, 2020). Brinjal and chilli are attacked by various insect-pests, causing significant losses to brinjal and chilli farmers resulting in low productivity .These crops are attacked by number of insect pests right from nursery stage till harvesting (Salve et al., 2020). According to Kumar et al., (2019) jassid (Amrasca biguttula biguttula) and whitefly (Bemisia tabaci) were recorded as major pests in nursery crop of brinjal. The damage of 15-20% caused by jassid and whitefly on brinjal had also reported by (Gangwar et al., 2014; Singh, 2015; Borah et al., 2017). Subhashree et al., (2018) reported aphid (Aphis gossypii) and whitefly (Bemesia tabaci) as major pests of nursery crop of chilli. There is also need to study the incidence of these insect pest on nursery plants of brinjal and chilli grown in different growing media. The present study was carried out to explore the most suitable growing media of sowing for raising chilli and brinjal seedlings in nursery.

MATERIALS AND METHODS

The present study was conducted to investigate the effect of different growing media on brinjal and chilli seedlings under shade net house during the years 2017 and 2018 at Dr. D R Bhumbla Regional Research Station, Ballowal Saunkhri, District SBS Nagar, Punjab. The experiment was conducted in CRBD with six treatments with four replications. Six growing media M_1 :[Vermiculite + Perlite + Vermi-compost (1:1:2); M_2 :Vermiculite + Perlite + Cocopeat (1:1:2); M_3:Sand + Soil + Farm yard manure (1:1:2); M_4 : Farm yard manure + Vermi-compost (1:1); M_5 :Farm yard manure and M_6 :Vermi-compost were used.

Brinjal seeds of PBH-3, were sown one in each plug/ cell into 98 cells of trays filled with the different growth media. Similarly, chilli seeds of variety Punjab Sindhuri were also sown as described for brinjal. Thereafter, growth and development parameters were measured using twenty-five (25) randomly tagged seedlings from each replication throughout the study. After 5 days of sowing, the number of normal seedlings germinated were counted and expressed in percentage. At the 30 DAS (days after sowing), the length of seedling was measured and the average length was calculated and expressed in centimeter. The seedling girth was measured using vernier caliper and mean girth was expressed in centimeter. The total number of leaves in the plants were counted and recorded. After 30 DAS the number of healthy seedlings were counted and expressed in percentage.

Three leaves from upper, middle and lower canopies of five seedlings selected randomly were collected and observed with the help of magnifying glass (10×) for the presence of insect pest. Mean population of the insects was expressed as number of insect/leaf/plant in each replication. All analyses of data sets were performed using the statistical analysis (Gomez and Gomez, 1984). Data on various growth parameters and insect pest was recorded.

RESULTS AND DISCUSSION

Germination: The germination percentage of both brinjal and chilli seeds were significantly affected by the growth medium (Table 1 and 2). The significantly higher germination percentage for brinjal was found to be 71.11% with Vermiculite + Perlite + Vermicompost (1:1:2), while lowest germination (60 %) was recorded in Vermiculite + Perlite + Cocopeat (1:1:2). Other growth media germination percentage varied from 61-66%. Similarly for chilli, significantly higher germination was found to be 66.33% with Vermiculite + Perlite + Vermi-compost (1:1:2), while lowest germination (40.20 %) was recorded in Vermiculite + Perlite + Cocopeat (1:1:2) (Table 2). Low germination in Vermiculite + Perlite + Cocopeat (1:1:2) may be due to low water retention capacity and low nutrient availability (Meena et al., 2017). Growing media greatly influences seed germination, seedling emergence and growth of seedlings in a nursery because these media serve reservoir of moisture and plant nutrients. These results are in line with Mahala and Sharma (2020) who reported that media containing Vermiculite + Perlite + Vermi-compost (1:1:2) resulted in highest germination (62.40%) while lowest germination (43.24 %) was observed in media containing Vermiculite + Perlite + Cocopeat (1:1:2) in tomato seedlings.

Seedling height: The seedling height was also influenced by different treatments in both brinjal and chilli. Growing media (Vermiculite + Perlite + Vermicompost (1:1:2) had recorded the significantly higher values for seedling length (11.05 cm) than other treatments. The lowest seedling height (7.41 cm) was recorded with Vermiculite + Perlite + Cocopeat (1:1:2) (Table 1) with 30 days old seedlings. Data on effect of

media on chilli seedling height depicted that significantly higher values (9.80 cm) was observed with Vermiculite + Perlite + Vermi-compost (1:1:2), while chilli seedling raised with Vermiculite + Perlite+ Cocopeat (1:1:2) media showed lowest plant height (7.01cm). These results were in conformation with Mahala and Sharma (2020) who also reported media containing Vermiculite + Perlite + Vermi-compost (1:1:2) resulted in highest plant height (11.82 cm) in tomato seedling.

Seedling girth: The significantly higher seedling girth (0.17 cm and 0.15) was recorded with M_1 i.e., Vermiculite + Perlite + Vermicompost (1:1:2) in brinjal and chilli, respectively, while the lowest values were recorded in M_5 in both the crops.

Number of leaves/seedlings: The number of leaves per seedling was also influenced by different media treatments in both brinjal and chilli. The number of leaves per seedling (5.81) was significantly higher in 30 days old seedlings grown in the Vermiculite + Perlite + Vermi-compost (1:1:2) and the lowest number of leaves (3.62) was found in Vermiculite + Perlite + Cocopeat (1:1:2) during pooled analysis in brinjal seedlings. For chilli seedlings, significantly higher number of leaves (5.62) was observed when chilli seedlings were raised with Vermiculite + Perlite + Vermi-compost (1:1:2) and lowest number of leaves (3.63) was observed when Vermiculite + Perlite + Cocopeat (1:1:2) was used as media for raising chilli nursery (Table 2). The possible reason was nutritional contribution of the media that produced maximum number of leaves.

Healthy seedling: The per cent healthy seedling was one of the prime growth parameters that was significantly variable among different growth media (Table 1). Per cent healthy seedling was highest in brinjal and chilli i.e. 89.82 and 87.61, respectively in media containing Vermiculite + Perlite + Vermicompost (1:1:2), whereas the lowest percentage of healthy seedlings was 60.43 and 51.58 in brinjal and chilli, respectively grown in Vermiculite + Perlite + Cocopeat (1:1:2). This might be due to the variation of available nutrients in the selected growth media. Mahala and Sharma (2020) also reported that media containing Vermiculite + Perlite + Vermi-compost (1:1:2) resulted in maximum per cent healthy (83.39 %) seedling in tomato which is in line with our studies.

Insect pest incidence: Brinjal and chilli seedlings grown on different media were critically analyzed for the incidence of any insect pest (Table 3). There was significant difference in incidence of jassid (0.68-1.23 jassid/leaf) and whitefly (.49-3.20 whitefly/leaf) when brinjal seeds are raised in different growth media. Lowest incidence of whitefly (1.49 whitefly/leaf) and jassid (06.8 jassid /leaf) was recorded in Vermiculite + Perlite + Vermi-compost (1:1:2). Similarly in chilli seedlings there was significant difference in whitefly and aphid incidence among the treatments (Table 3). There was significant low incidence of whitefly (1.65 whitefly/leaf) and aphid (0.28 jassid/leaf) in Vermiculite + Perlite + Vermi-compost (1:1:2). Thus,

Table 1:
Effect of different growing media on biometric parameters of brinjal seedlings under shade net house condition (Pooled data)

Name of treatments	Germination (%)	Plant height (cm)	Seedling girth (cm)	Number of leaves/seedlings	Percentage of healthy seedling
M1	71.11	11.05	0.17	5.81	89.82
M2	60.06	7.41	0.11	3.62	60.43
M3	66.92	9.77	0.14	5.11	83.42
M4	64.70	9.33	0.14	4.09	78.01
M5	61.75	8.02	0.10	5.05	65.22
M6	63.43	9.67	0.11	4.01	70.87
CD (5%)	1.576	1.024	0.016	0.093	1.568

Table 2:
Effect of different growing media biometric parameters of chilli seedlings under shade net house (Pooled data)

Name of treatments	Germination (%)	Plant height (cm)	Seedling girth (cm)	Number of leaves/seedlings	Percentage of healthy seedling
M1	66.33	9.80	0.15	5.62	87.61
M2	40.20	7.01	0.12	3.63	51.58
M3	63.58	8.41	0.12	5.01	81.87
M4	60.01	8.18	0.13	4.84	76.41
M5	50.84	7.65	0.10	4.11	63.99
M6	58.35	7.87	0.10	4.81	69.57
CD (5%)	0.816	0.219	0.017	0.276	0.975

Table 3:
Effect of different growing media on insect pest incidence of brinjal and chilli seedlings under shade net house (Pooled data)

Name of treatments	Insect pest incidence			
	Brinjal		Chilli	
	Mean No. of whitefly/leaf	Mean No. of jassid/leaf	Mean No. of whitefly/leaf	Mean No. of aphids/leaf
M1	1.49 (1.58)	0.68 (1.30)	1.65 (1.63)	0.28 (1.13)
M2	3.20 (2.05)	1.18 (1.48)	3.22 (2.05)	0.95 (1.40)
M3	1.73 (1.65)	0.72 (1.31)	1.57 (1.60)	0.43 (1.20)
M4	1.87 (1.69)	0.77 (1.33)	1.68 (1.64)	0.48 (1.22)
M5	3.25(2.06)	1.23 (1.49)	3.07 (2.02)	1.03 (1.43)
M6	1.65(1.63)	0.67 (1.29)	1.68 (1.64)	0.38 (1.18)
CD (5%)	**0.08**	**0.09**	**0.09**	**0.10**

*Value in parenthesis is square root transformation

it can be concluded that significant difference in incidence of insect pest occurs on these seedlings that may be attributed to different growth factors. These findings are in agreement with Islam et al. (2017), who reported that infestation behaviour of the whiteflies could be affected by the quantity of plant released volatile organic compounds that depends on availability of nitrogen content in the plant. Above results are also

in agreement with studies conducted by Mahala and Sharma (2020) who reported that there was effect of growing media on the insect pest incidence in tomato seedling.

The results of present studies showed growing media had a pronounced effect on plant growth parameters like germination per cent, plant height, number of leaves, percentage of healthy seedlings, insect pest incidence on brinjal and chilli seedlings. The overallevaluation indicated that the growing media containing Vermiculite + Perlite + Vermi-compost (1:1:2) proved the best growing media in both brinjal and chilli nursery plants. This result was parallel to the finding of Nissi (2018) who stated that vermiculite and perlite improve water holding capacity, permeability and airflow in the media thus improving germination, development and rooting system of plants. Combination of vermicompost, vermiculite and perlite showed a significant positive effect on germination, seedling growth owing to improving physical condition of the media and providing increasing nutritional availability. These results are akin to the findings of Meena et al., 2017, where soil + vermicompost + vermiculite (1:1:1) provided highest performance of seedling growth of papaya. The vermicompost increased leaf area and biomass in various plants have been reported by Yadav et al., (2012), which agree with findings of current study. Results of these studies are in line with Kumar et al. (2019) which depicted jassid and whitefly as the major sucking pests of brinjal both in nursery and field crop. Similarly these results are also in accordance with Saini et al. (2017), where chilli crop was attacked by whitefly and aphid in nursery leading to 10-15% incidence by these sucking pests.

CONCLUSIONS

Considering the above-mentioned results, it may be concluded that planting seeds of brinjal and chilli in growing media containing Vermiculite + Perlite + Vermicompost in the ratio 1:1:2 resulted in maximum germination of healthy seedling, enhanced growth of subsequent seedling and lowest incidence of insect pest. The findings of this study recommend use of Vermiculite + Perlite + Vermicompost (1:1:2) as growth media for raising chilli and brinjal nursery by farmers as it has significant positively effect on plant growth parameters.

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