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Short Communication

Evaluation of different growing media for tomato nursery

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Tomato (*Solanum lycopersicum*) from family Solanaceae is one of the most popular and widely grown vegetable crops in the world for its nutritive and medicinal value (Sharma and Singh, 2015). Tomato fruits are consumed fresh or processed and are a source of minerals and vitamins (Eivazi et al. 2013). The red fruit contain lycopene, a carotenoid that helps to prevent various diseases. During 2019 tomato it occupies an area of 0.88 million hectares with an annual production of 18.7 million MT in India. In Punjab tomato is grown over an area of 10.20 thousand ha with production of 252.60 thousand tonnes and average yield of 248 q/ha during 2018-19 (Anonymous 2019). The production of healthy and vigorous tomato seedling is the most important factor in successful production and yield of tomato fruits. Germination of the seed is a critical stage, because the rest of the plant life is directly dependent upon the rate of its. However, growth medium used for potted plants plays an important role in germination rate, and many other physiological parameters including plant height, number of leaves, spike length, number of florets per spike, spike diameter and yield, etc. (Vendrame et al. 2005). Healthy seedlings production is prerequisite for raising vigorous and profitable crops. Seedlings are grown in different growth media, which plays a vital role in efficient production of seedlings in nurseries (Sterrett 2001). Media is a substrate that provides the required elements and physical support to the growing plants. All soils used for media are not always perfect for the germination of seeds and subsequent growth of seedling. Seed germinate in containers have limited volume of soil and nutrients. Good growth media should have good water holding capacity, drainage and other physical and chemical properties so that it can raise healthy seedling. So it is desirable to provide such soil media or mixture, which fulfils the requirements for maximum seed germination and better seedling growth. Vermi-compost, cocopeat, sphagnum moss, etc. are organic in nature and vermiculite, perlite and sand are inorganic in nature. Organic media decompose readily, get compact easily and thus decrease pore space and increase aeration in soil. Use of some coarse minerals component has been found useful in increasing aeration and improving drainage. Sand, vermiculite and perlite play important role in providing good growth media. One of the most important reasons for the poor quality of the plants produced in many nurseries in India is the poor quality of the potting mixture (Kumar 2015). Peat used as growth media is collected from bogs, marshes, and wetlands, which are often fragile ecosystems of great ecological and archaeological value (Bustamante et al. 2008). Peat moss, due to its appropriate physical properties, such as, low bulk density and high total porosity and its high nutrient exchange capacity constitute one of the main substrate components. Many authors have studied influence of different growth media on seed germination, seedling emergence, seedling growth and quality of seedlings in a nursery (Unal 2013). The quality of the growing media used in containerized seedling production is largely influenced by their physical, chemical and biological properties (Herrera et al. 2008). Growing media is not only a place where seeds are sown, and seedlings raised, but also a source and reservoir of plant nutrients. It also anchors the root system and therefore supports the plant (Abad et al. 2002). A good growing media should be composed of mixtures that are tender enough for seeds to easily germinate, retain moisture, drain excessive water and provide sufficient plant nutrients for seedling growth and development (Olaria et al. 2016). Tomato production has been intensified over the years, however, yields continue to be low due to several production constraints such as

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growth media, pests, diseases and environmental factors. The incidence of insect-pests may vary from season to season and crop growth stages. In India, about 16 pests reportedly feed on tomato, commencing from germination to harvesting stage which reduces its yield and also degrades quality. The major pests attacking nursery seedlings of tomato are whitefly (*Bemisia tabaci* Gennadius, Homoptera: Aleyrodidae) and aphids (*Aphis gossypii* Glover, Hemiptera: Aphididae). Keeping all this in view, the importance of media to produce seedling this research work focused with following objectives: to investigate the effect of different media on tomato seedling growth; to find a suitable media for raising tomato seedlings in nursery; and incidence of insect pest on seedlings on different media

The experiment was conducted to study the effect of different growing media on tomato seedlings under shade net house during the years 2017 and 2018 at Regional Research Station, Ballowal Saunkhri, District SBS Nagar, Punjab. The experiment was conducted in CRD with six treatments replicated thrice. Six growing media were used such as 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]. In each treatment 98 holes protray was used. Different media used for raising the tomato seedlings. Half of each cell in the tray was filled with media. Single seed was kept in each cell of the protray and trays were filled with media. The tray seedlings are grown under controlled environments and have appreciable vitality and plant stand after transplantation. It is reasoned that all the vital inputs to the growing seedling are rendered precisely in a regulated way so as 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 rose cans. After 4 to 5 days, the seed sprouted with two leaves, application of water was increased gradually depending on moisture level in trays. Tomato seeds of Punjab Varkha Bhahar 4, were sown one in each plug/cell into 98 cells of trays filled with the different growth media. Seedling emergence was determined on all the 98 cells of a tray. 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 end of the 30 days after sowing, the length of 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 30 days of sowing the number of healthy seedlings were counted and expressed in percentage. For insect pest: Five plants were selected at random from each plot. Three leaves from upper, middle and lower canopies from each sampled plant were collected and observed very carefully and minutely with the help of magnifying glass (10x) for the presence of insect. Data on various growth parameters and insect pest was recorded. Mean population of the insects was expressed as number of insect/leaf/plant in each replication. The data so obtained was subjected to final statistical analysis (Gomez and Gomez 1984).

Different growing media effect germination percentage as growing media influences seed germination, seedling emergence and growth of seedlings in a nursery (Baiyeri and Mbah 2006) because it is a reservoir of moisture and plant nutrients (Grower 1987). The germination percentages during both the years as well as in pooled analysis are shown in table 1 which depicts that there is significant difference in % germination. The highest germination was found to be 62.40% with Vermiculite + Perlite + Vermi-compost (1:1:2). The lowest germination 43.24 % was recorded in Vermiculite + Perlite + Cocopeat (1:1:2). The growth media such as Vermiculite + Perlite + Vermi-compost (1:1:2), Sand + Soil + Farm yard manure (1:1:2) and Farm yard manure + Vermi-compost (1:1) significantly not influenced the plant height of tomato seedlings. The highest plant height was observed in the growth medium of Vermiculite + Perlite + Vermi-compost (1:1:2) during both the years as well as in pooled analysis. The highest plant height (11.82 cm) was recorded in Vermiculite + Perlite + Vermi-compost (1:1:2). The lowest plant height (7.11) was recorded in Vermiculite + Perlite + Cocopeat (1:1:2) with 30 days aged seedlings (table 1).

There was no significant effect of growth media on seedling girth and insect pest incidence during both years of studies (table 1 and 2). Similarily, there was incidence of whitefly and aphid but the incidence was non-significant among different growing media. Our studies agree 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 (VOCs) related that depends on nitrogen concentrations of the plant. As studies were conducted on nursery plants so there could be not much difference in plants in respect of nitrogen content so there is no significant difference in different treatments. The number of leaves (5.85) was highest in 30 days old seedlings grown in the media of Vermiculite + Perlite +

Table 1: Effect of different growing media on germination and growth parameters of tomato seedlings under shade net house.

Name of treatments	Germination (%)			Plant height (cm)			Seedling girth (cm)			Number of leaves			Percentage of healthy seedling		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
M_1	66.98	57.82	62.40	12.66	10.98	11.82	0.36	0.31	0.335	5.50	6.20	5.85	87.33	79.44	83.385
M_2	49.03	37.44	43.24	8.65	5.56	7.11	0.23	0.21	0.22	3.66	4.60	4.13	51.16	42.76	46.96
M_3	64.11	51.18	57.65	11.90	8.76	10.33	0.26	0.22	0.24	4.99	5.68	5.335	81.42	72.94	77.18
M_4	58.53	46.74	52.64	11.16	7.92	9.54	0.26	0.2	0.23	4.80	5.34	5.07	75.77	68.32	72.045
M_5	52.36	41.56	46.96	9.16	6.54	7.85	0.25	0.19	0.22	4.12	4.88	4.5	64.15	55.28	59.715
M_6	55.94	43.34	49.64	10.40	7.02	8.71	0.26	0.20	0.23	4.75	5.14	4.945	69.07	58.72	63.895
CD (5%)	2.23	3.6	4.22	0.664	0.8	1.04	NS	NS	NS	0.483	0.25	0.46	5.72	3.79	4.36

Vermi-compost (1:1:2) and the lowest number of leaves (4.13) was found in Vermiculite + Perlite + Cocopeat (1:1:2) during both the years as well as in pooled analysis. These results were supported by the findings of Raiz et al. (2008) who counted maximum number of leaves in leaf compost mixture. The possible reason was nutritional contribution of the treatment that produced maximum number of leaves. The results of affected growth parameters on seedlings and growth media are shown in table 1.

The Percent healthy seedling was one of the prime parameters that was significantly variable among different growth media during both the years as well as in pooled analysis (table 1). Percent healthy seedling (83.39) was highest in media containing Vermiculite + Perlite + Vermi-compost (1:1:2) whereas the lowest percent of healthy seedlings (46.96) was observed with Vermiculite + Perlite + Cocopeat (1:1:2). This is due to variation of available nutrients in the selected growth media. The results protrayed that growing media had a pronounced effect on the growth parameters like germination, plant height, seedling girth, number of leaves and percentage of healthy seedlings of tomato. The overall evaluation indicated that the growing media containing Vermiculite + Perlite + Vermi-compost (1:1:2) proved the best over rest of the treatments. The observations were recorded on growth characters, maturity parameters, yield and yield attributes and quality characters. The results portrayed that growing media had a pronounced effect on the growth, production and quality of tomato. The overall, evaluation indicated that the growing media containing Vermiculite + Perlite + Compost (1:1:3) followed by Sand + Soil + FYM (1:1:2) proved the best. The rice bran + vermicompost media was not found good due to compacting nature of rice bran.

Table 2: Effect of different growing media on insect pest incidence of tomato seedlings under shade net house.

Name of treatments	Insect pest incidence					
	Mean No. of whitefly/leaf			Mean No. of aphid/leaf		
	2017	2018	Pooled	2017	2018	Pooled
M_1	2.22	2.78	2.50	3.18	1.14	2.16
M_2	2.34	2.82	2.58	3.02	1.12	2.07
M_3	2.18	2.76	2.47	3.12	1.08	2.1
M_4	2.12	2.84	2.48	3.16	1.18	2.17
M_5	2.46	2.72	2.59	3.22	1.10	2.16
M_6	2.28	2.74	2.51	3.08	1.16	2.12
CD (5%)	NS	NS	NS	NS	NS	NS

Present results were not in line with reported by Awang et al. (2009) working on seedlings growing with coir pith and manures. Coir pith was a good growth media with acceptable pH, electrical conductivity and other chemical attributes. It has the virtuous oxygen diffusion and provides support for fast growth of the seedlings due to availability of better nutrition with water in root zone of seedlings when compared with vermicompost. This result was parallel to the finding of Nissi (2018) who suggested vermiculite and perlite improves water holding capacity, permeability and airflow in the media, affects physical, chemical & biological properties of the media and is a source of soil nutrients. Organic matter from vermicompost may also improve nutrient availability and improve phosphorus absorption, and all these factors are favoured for seed germination, height of seedlings, root length, leaf area, fresh and dry weight of shoot and root. Combined application of vermicompost, coco peat, vermiculite and perlite in different treatments showed significant positive effect on germination, seedling growth and plant biomass, probably owing to a synergistic combination of all these factors in improving physical condition of the media and providing nutritional factors (Sahni et al. 2008). Vermi-compost provides a better growth medium for plant establishment. However, the air-filled porosity (AFP), easily available water (EAW) and aeration media were not at the recommended level which in turn limit the root growth and lowered the water holding capacity. Therefore, the media coir pith alone was more suitable than vermin compost with coir pith because of the better physical properties and enhanced nutrient level. In the present study the effect of organic manure and vermicompost on the germination, growth and yield parameters on vegetable crops like tomato (*Lycopersicum esculentum*) grown in control soil and amended soil was studied. Ramaligam and Thilagar (2000) reported that the reduction in pH towards neutrality, reductions in

organic matter, organic carbon, sulphur, calcium, manganese, zinc and significant elevations particularly in nitrogen, phosphorus and potassium levels in the vermicompost of sugarcane trash compared to control levels. Suthar (2009) demonstrated that during the vermicompost of some crop residue mixed with cattle dung resulted in an increase in total N (91-144%), available P (63-105%) and exchangeable K (45-90%) content of it. The results portrayed that growing media had a pronounced effect on the growth parameters like germination, plant height, number of leaves and percentage of healthy seedlings of tomato. The overall, evaluation indicated that the growing media containing Vermiculite + Perlite + Vermi-compost (1:1:2) proved the best over rest of the treatments.

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