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Effect of Growing Media and Growing Condition on Seedling Growth of Guava (*Psidium guajava* L.) cv. L-49

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ABSTRACT: An experiment was conducted to assess the effect of different growing media and growing conditions on seedling growth of guava in L-49 variety. The growing of guava seedlings requires optimum growing media for better growth of guava plants. The experiment was carried out at CCS Haryana Agricultural University, Hisar at Precision Farming Development Centre (PFDC) during 2021-2022. The experiment was laid out in Randomized Block Design (RBD) comprising of ten treatments and three replications with two environmental conditions (open field and polyhouse). The experiment results indicated that T_7-garden soil: FYM: vermicompost (2:1:1) recorded the maximum height of seedlings, stem girth, internodal length, number of leaves, survival percent and leaf area, T_8-garden soil + FYM + cocopeat (2:1:1) found at par with T_7 for growing parameters. All the parameters found superior under polyhouse condition compared to open field condition. The best growing media identified in present study will help the farmers and nursery professionals for better growth of guava seedlings and help to reduced mortality in guava seedlings.

Keywords: Garden soil, guava, seedlings and vermicompost.

INTRODUCTION

Guava (*Psidium guajava* L.) is India's fifth most important fruit crop after mango, banana, papaya, and citrus. Guava is grown commercially in tropical and subtropical regions of India. It is well adapted and grown in states like Uttar Pradesh, Bihar, Jharkhand, Andhra Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Karnataka and Tamil Nadu. Guava has become quite popular due to its excellent nutritional value, pleasant aroma, good flavour, significant vitamin C content, and pectin content. It is considered as "poor man's apple" due to its nutritional value and availability in the market and accessibility to the poor. High density planting and meadow orchard are two recent strategies that are gaining popularity among farmers. A significant amount of planting material is needed for high density planting. The current demand for high-quality planting materials and the scarcity of budded and grafted plants have had a negative impact on guava output and productivity levels. The supply of quality planting material is essential for good tree survival and better establishment in the field. Poor seed germination and seedling growth that result in the lack of superior rootstock are attributable to inconsistent production of quality planting material. The performance of guava is maximum under vermiculite, sand with FYM (1:1:1) media combination in cuttings, maximum height, stem thickness and maximum no. of leaves (Rani *et al.*, 2015).

A good potting medium is characterized by light weight, friability, good water holding capacity, drainage, porosity, low bulk density, free from fungal spores and insect and low inherent fertility etc. For enhancing, the seed germination and growth of seedlings, the use growing media like soil, FYM, vermicompost and cocopeat are most effective. It is possible to produce seedlings throughout the year by taking the advantage of optimum temperature and relative humidity available in polyhouse condition. Therefore, in view, the present study was undertaken to find out effect of growing media and growing condition on seedling growth of guava in L-49 variety.

MATERIALS AND METHODS

The experiments was carried out in the year 2021-22 at nursery and Precision Farming Development Centre, Department of Horticulture, under both polyhouse and in open field conditions in CCS Haryana Agricultural University, Hisar. The experiment were under both polyhouse and in open field conditions as laid out in randomized block design with three replications, comprising 10 media combinations under each condition. The treatments were maintained under both growing conditions: T_1 :Garden soil, T_2 : Garden soil +

FYM (1:1), T_3 : Garden soil + Vermicompost (1:1), T_4 : Garden soil + Cocopeat (1:1), T_5 : Garden soil + Vermiculite (1:1), T_6 : Garden soil + Sawdust (1:1), T_7 : Garden soil + FYM + Vermicompost (2:1:1), T8: Garden soil + FYM + Cocopeat (2:1:1), T_9 : Garden soil + FYM + Vermiculite (2:1:1), T_{10} : Garden soil + FYM + Sawdust (2:1:1). The matured fruits of guava cv. L-49 were collected Experimental Orchard, Department of Horticulture, thoroughly washed and cleaned properly. Then, the fruits were mashed and mixed with water to extract the seeds by removing the pulpy material. The extracted seeds were dried under shade for one day and were ready for sowing. In each polybags, two seeds were sown during the 2nd week of September, 2021. The polybags were irrigated with water soon after seed sowing and after that, moisture was maintained regularly. The weeding was done manually at regular interval.

$$\text{Survival percentage} = \frac{\text{Total survived seedlings}}{\text{Total germinated seedlings}} \times 100$$

Final data were analysed using online statistical analysis package (OPSTAT, CCSHAU) and treatments means were compared by C.D. at 5% level of significance.

RESULTS AND DISCUSSION

Among different treatments, T7- garden soil + FYM + vermicompost (2:1:1) recorded the maximum height of the seedlings (Table 1) at 60, 90 and 120 DAS with the seedling height of 3.61, 5.08 and 6.42 cm respectively. This might be because vermicompost is microbiologically active, nutrient-rich organic manure that provides macronutrients, especially nitrogen, to plant for good root and shoot growth. Vermicompost promotes growth and development of seedlings and stabilize the composition of nutrients in media (Zaller, 2007 in tomato). The results are in line with those obtained by Mirza *et al.* (2015) in karonda and Singh and Verma (2015) in stevia. Seedling height was significantly higher (3.16, 4.35 and 5.12cm) in polyhouse condition compared to open field condition (3.07, 4.06 and 4.78cm) at 60, 90, 120 DAS, respectively. Interaction between growing media and growing conditions were found non-significant. The maximum stem girth was recorded in treatments, T_7- garden soil + FYM + vermicompost (2:1:1) had a higher stem girth i.e., 0.69, 0.98, and 1.42 mm at 60, 90 and 120 DAS respectively. T_1- garden soil (control) recorded the lowest stem girth of 0.33, 0.45 and 0.99 at 60, 90 and 120 DAS. This is due to the action of different kinds of enzymes present in the earthworm's body. The bioavailability of different nutrients presents in Vermicompost increased and led to increased growth characteristics like plant height and stem girth. The Vermicompost containing humic substances results in higher levels of auxin activity, which leads to more cell division and more growth in terms of height and seedling girth (Canellas *et al.*, 2002). The results are in line with those obtained by Samir *et al*. (2016) in Khirni and Mirza *et al.* (2015) in Karonda. Between two growing conditions, polyhouse recorded the highest stem girth (0.52, 0.66 and 1.19mm) compared to field condition (0.46, 0.58 and 1.09mm) at 60, 90 and 120 DAS. Interaction between growing media and growing conditions were found non-significant. The maximum internodal length (cm) in guava was noticed in T7- garden soil + FYM + vermicompost (2:1:1) i.e., 0.45, 0.55 and 0.79 cm at 60, 90, and 120 DAS respectively, while lowest internodal length of 0.28, 0.31 and 0.38 cm was noticed in T_1- garden soil (control) at 60, 90, and 120 DAS respectively. This might be due to improve the nutrient availability through vermicompost helps improved the physical conditions of the soil leading to more internodal length due to higher auxin activity (Canellas *et al*., 2002). Between two growing conditions, highest internodal length were observed in polyhouse condition compared to field condition at 60, 90, and 120 DAS respectively. Interaction between growing media and growing conditions were found non-significant.

Table 1: Effect of different growing media on height of the guava seedling (cm).

Treatments	Height of the seedling (cm)								
	60 DAS			90 DAS			120 DAS		
	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean
T_1	2.86	2.88	2.87	3.20	3.50	3.35	4.07	4.25	4.16
T_2	3.04	3.05	3.05	4.07	4.17	4.12	4.33	5.00	4.67
T_3	3.17	3.19	3.18	4.47	4.63	4.55	5.10	5.14	5.12
T_4	2.95	2.96	2.96	3.63	3.90	3.77	4.22	4.60	4.41
T_5	2.89	2.93	2.91	3.57	3.83	3.70	4.17	4.53	4.35
T_6	2.88	2.91	2.90	3.37	3.73	3.55	4.10	4.37	4.23
T_7	3.43	3.78	3.61	4.73	5.43	5.08	6.13	6.70	6.42
T_8	3.22	3.47	3.35	4.60	5.00	4.80	5.90	6.26	6.08
T_9	3.21	3.32	3.26	4.54	4.70	4.62	5.13	5.30	5.22
T_{10}	3.06	3.09	3.06	4.40	4.57	4.48	4.63	5.07	4.85
Mean	3.07	3.16		4.06	4.35		4.78	5.12	
C.D. (at 5%)	C=0.05, T=0.12, C×T=NS			C=0.10, T=0.17, C×T=NS			C=0.11, T=0.21, C×T=NS		

Table 2: Effect of different growing media on stem girth of guava seedling (mm).

Treatments	Stem girth (mm)								
	60 DAS			90 DAS			120 DAS		
	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean
T_1	0.31	0.34	0.33	0.41	0.49	0.45	0.95	1.02	0.99
T_2	0.42	0.50	0.46	0.48	0.60	0.54	1.07	1.16	1.11
T_3	0.48	0.55	0.52	0.58	0.67	0.63	1.09	1.19	1.14
T_4	0.41	0.47	0.43	0.46	0.55	0.51	1.04	1.10	1.07
T_5	0.40	0.44	0.42	0.43	0.54	0.49	1.02	1.09	1.05
T_6	0.34	0.41	0.37	0.42	0.51	0.47	1.00	1.06	1.03
T_7	0.67	0.71	0.69	0.96	1.00	0.98	1.35	1.48	1.42
T_8	0.62	0.65	0.63	0.89	0.96	0.93	1.24	1.42	1.33
T_9	0.50	0.57	0.54	0.60	0.67	0.64	1.10	1.19	1.15
T_{10}	0.45	0.51	0.48	0.52	0.61	0.57	1.08	1.17	1.13
Mean	0.46	0.52		0.58	0.66		1.09	1.19	
C.D. (at 5%)	C=0.02, T=0.03, C×T=NS			C=0.02, T=0.03, C×T=NS			C=0.02, T=0.04, C×T=NS		

[C=Growing conditions, T =Growing media, C×T= Growing conditions x Growing media]

Table 3: Effect of different growing media on internodal length of guava seedling (cm).

Treatments	Internodal length (cm)								
	60 DAS			90 DAS			120 DAS		
	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean
T_1	0.27	0.28	0.28	0.30	0.32	0.31	0.35	0.40	0.38
T_2	0.31	0.32	0.32	0.35	0.44	0.39	0.51	0.54	0.53
T_3	0.33	0.34	0.34	0.43	0.48	0.46	0.54	0.61	0.57
T_4	0.30	0.31	0.30	0.33	0.39	0.36	0.50	0.53	0.52
T_5	0.29	0.30	0.30	0.32	0.36	0.34	0.48	0.50	0.49
T_6	0.28	0.29	0.29	0.31	0.34	0.33	0.38	0.41	0.39
T_7	0.42	0.49	0.45	0.51	0.60	0.55	0.77	0.82	0.79
T_8	0.38	0.39	0.39	0.47	0.55	0.51	0.69	0.76	0.73
T_9	0.34	0.37	0.36	0.45	0.53	0.49	0.60	0.66	0.63
T_{10}	0.31	0.38	0.35	0.37	0.47	0.42	0.52	0.58	0.55
Mean	0.32	0.35		0.38	0.45		0.53	0.58	
C.D. (at 5%)	C=0.01, T=0.03, C×T=NS			C=0.02, T=0.02, C×T=NS			C=0.02, T=0.03, C×T=NS		

[C=Growing conditions, T =Growing media, C×T= Growing conditions × Growing media]

Table 4: Effect of different growing media on number of leaves per guava seedling.

Treatments	Number of leaves								
	60 DAS			90 DAS			120 DAS		
	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean	In Field	In Polyhouse	Mean
T_1	2.94	3.03	2.99	3.08	3.90	3.49	5.78	6.00	5.89
T_2	3.43	4.00	3.72	4.18	4.53	4.36	6.19	6.92	6.56
T_3	3.88	4.43	4.16	4.67	5.06	4.87	7.19	7.58	7.39
T_4	3.22	3.42	3.32	4.03	4.47	4.25	6.03	6.62	6.33
T_5	3.13	3.36	3.25	3.83	4.22	4.03	5.98	6.28	6.13
T_6	3.00	3.18	3.09	3.17	4.15	3.66	5.86	6.15	6.01
T_7	4.48	4.98	4.73	5.77	6.33	6.05	8.39	8.93	8.66
T_8	4.29	4.75	4.52	5.47	6.02	5.75	7.86	8.43	8.15
T_9	4.16	4.44	4.30	5.23	5.67	5.45	7.53	7.97	7.75
T_{10}	3.75	4.20	3.98	4.48	4.75	4.62	6.59	7.08	6.84
Mean	3.63	3.98		4.39	4.91		6.74	7.20	
C.D. (at 5%)	C=0.09, T=0.17, C×T=NS			C=0.14, T=0.23, C×T=NS			C=0.15, T=0.23, C×T=NS		

[C=Growing conditions, T =Growing media, C×T= Growing conditions × Growing media

Data showed that number of leaves per guava seedling differed significantly with respect to different growing media in both growing conditions i.e., open field and polyhouse (Table 4). The data showed that among different recorded maximum number of leaves, T_7- garden soil + FYM + vermicompost (2:1:1) i.e., 4.73, 6.05 and 8.66 at 60, 90, and 120 DAS significantly superior respectively over all other treatments. The lowest numbers of leaves were recorded in T_1 garden soil (control) i.e., 2.99, 3.49 and 5.89 at 60, 90, and 120 DAS respectively. The increase in the number of leaves/seedlings might be due to the use of fresh extracted seed and media content having a higher amount of nutrients as compared to other growing

media, which promote early growth. The findings are supported by Parasana *et al*. (2013) in mango, Mirza *et al.* (2015) in Karonda etc. Interaction between growing media and growing conditions was found non-significant.

The data related to survival percentage was shown in Table 5 showed that different treatments, significantly higher survival percentage (82.18 %) was found in T_7- garden soil + FYM+ vermicompost (2:1:1) at 120 DAS, which is followed by T_8- garden soil+ FYM + cocopeat (2:1:1) with the survival percentage of 80.54%. The lowest survival percentage (70.17%) was observed in T_1-garden soil (control). Interaction between growing media and growing conditions were not significant. T_7 garden soil + FYM + vermicompost (2:1:1) had a considerable impact on survival rates, owing to the synergetic effect of FYM and vermicompost in improving the physical condition of the medium and nutritional factors. The highest survival percent (82.18%) is due to proper aeration in root zone and optimum nutrient availability (Choudhary *et al*., 2020 in papaya). Between growing conditions, maximum survival percentage was observed in polyhouse condition (75.79) compared to filed condition (73.99%) at 120 DAS. This may be due to reduction of water stress and congenial climate available in green house.

Table 5: Effect of different growing media on survival percentage of guava seedling.

Treatments	Survival (%)		
	In Field	In Polyhouse	Mean
T_1: Garden soil	69.33	71.00	70.17
T_2: Garden soil + FYM (1:1)	73.30	75.17	74.23
T_3: Garden soil + Vermicompost (1:1)	73.70	75.80	74.75
T_4: Garden soil + Cocopeat (1:1)	71.23	72.70	71.97
T_5: Garden soil + Vermiculite (1:1)	71.03	72.53	71.78
T_6: Garden soil + Sawdust (1:1)	69.84	71.88	70.86
T_7: Garden soil + FYM + Vermicompost (2:1:1)	81.60	82.77	82.18
T_8 : Garden soil + FYM + Cocopeat (2:1:1)	79.82	81.25	80.54
T_9: Garden soil + FYM + Vermiculite (2:1:1)	76.63	79.25	77.94
T_{10}: Garden soil + FYM + Sawdust (2:1:1)	73.37	75.53	74.45
Mean	73.99	75.79	74.89
C.D. (at 5%)	C=0.63, T=0.96, CxT=NS		

[C=Growing conditions, T =Growing media, C×T= Growing conditions x Growing media]

Leaf area (cm^2). It is showed in Table 6 that growing media had a significant impact on leaf area in both open field and polyhouse conditions. Among different treatments, maximum leaf area of seedlings (6.31cm^2) was recorded in T_7 - garden soil + FYM+ vermicompost (2:1:1) which was followed by T_8-garden soil + FYM + cocopeat (2:1:1) (5.90cm^2). Minimum leaf area of seedlings (3.42 cm^2) was recorded in T_1 - garden soil (control) at 120 DAS. Between growing conditions, maximum leaf area of seedlings was noticed in polyhouse condition (5.27cm^2) compared to field condition (4.20 cm^2) at 120 DAS. Interaction between growing media and growing conditions was found non-significant. The physiological changes observed in vermicompost treated plants could be attributed to the humic substances and nutrients, especially microelements like Zn present in vermicompost. The vermicompost increased leaf area and biomass in various plants have been reported by some researchers (Bachman and Metzger 2008; Wang *et al*., 2010). Poly house nursery conditions gave maximum establishment and growth parameters irrespective of treatments might be due to the congenial micro-environmental conditions it provided compared to harsh and uncontrolled climatic conditions of open field nursery (Rymbai *et al*. 2012).

Table 6: Effect of different growing media on guava leaf area (cm^2).

Treatments	Leaf Area (cm^2)		
	In Field	In Polyhouse	Mean
T_1: Garden soil	3.21	3.63	3.42
T_2: Garden soil + FYM (1:1)	3.59	5.15	4.37
T_3: Garden soil + Vermicompost (1:1)	4.73	5.90	5.32
T_4: Garden soil + Cocopeat (1:1)	3.47	4.90	4.18
T_5: Garden soil + Vermiculite (1:1)	3.34	4.79	4.07
T_6: Garden soil + Sawdust (1:1)	3.26	3.97	3.62
T_7: Garden soil + FYM + Vermicompost (2:1:1)	5.91	6.70	6.31
T_8: Garden soil + FYM + Cocopeat (2:1:1)	5.54	6.25	5.90
T_9: Garden soil + FYM + Vermiculite (2:1:1)	5.11	6.11	5.61
T_{10}: Garden soil + FYM + Sawdust (2:1:1)	3.85	5.27	4.56
Mean	4.20	5.27	4.73
C.D. (at 5%)	C=0.15, T=0.24, C×T=0.34		

[C=Growing conditions, T =Growing media, C×T= Growing conditions x Growing media]

CONCLUSIONS

All the parameters seedling heights, stem girth, internodal, number of leaves and survival percentage were found better than control. The results obtained with respect to height of seedling, stem girth, internodal length and number of leaves of guava seedlings were found maximum in T_7- garden soil + FYM + vermicompost (2:1:1) at 60, 90, 120 DAS as compared to other treatments. The highest survival percentage and leaf area of seedling were also found best in T_7 treatment 120 DAS. The results also revealed that among the growing conditions poly house found best for all growing parameters compared to open field condition.

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Conflicts of Interest. None.

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