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Effect of Growing Media on Seed Germination and Seedling Growth of Acid Lime (*Citrus aurantifolia* Swingle)

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A B S T R A C T

The present investigation was carried out at Citrus Research Station(TNAU), Sankarankovil, Tirunelveli district during the year 2019. In this experiment, freshly extracted acid lime seeds were sown into different media *viz*., soil, sand, FYM, Poultry manure, Vermicompost and Cocopeat with different combinations and proportions, to study their effect on seed germination and seedling growth of acid lime at different stages of seedling growth. Five seedlings from each treatment were taken out for recording data on Plant height (cm), Stem girth (mm), Number of leaves per plant, Number of roots per plant, Root length, Fresh weight of seedling and Dry weight of seedling. Recording of data was continued at an interval of every 30 days and up to 180 DAS. The results indicated that the medium viz; soil + sand + FYM + Poultry manure+ Vermicompost + Cocopeat each in equal proportion (1:1:1:1:1:1)exhibited significantly better result for almost all the parameters studied. Seedlings raised in this combination of media had maximum height of seedling (54.70 cm), stem girth (2.20 mm), no. of leaves per seedling(42), no. of roots per seedling(109), root length(54.33 cm), seedling fresh weight(13.87 mg) and dry weight of seedling(6.58 mg) and found to be significantly superior over other treatments used at 180 days after sowing.

Introduction

Citrus fruits are the third important tropical and sub-tropical fruits, after mango and banana, which contribute 12.4 % share in total fruit production in India. They also have a unique property of refreshing and restoring the physical strength of the body owing to its rich Vitamin C and mineral content. It is grown in 114 countries in the world and out of these, 53 countries are growing citrus commercially. India ranks sixth place in citrus production globally with a total area of 1.07 million ha and production of 10.48 million tonnes contributing 25 per cent of total world citrus area.

Among citrus group, lime and lemon contribute nearly 20 percent and lime alone is grown in an area of 2, 86,400 ha with a production of 28.35 lakhs t in India with a productivity of 9.9 metric t /ha. India is the largest producer of acid lime in world. Acid lime seeds are recalcitrant in nature. The recalcitrant seeds impose serious storage problems due to their desiccation and chilling sensitivity (Chin and Roberts, 1980). These seeds undergo no maturation and drying during final phase of seed development and are thus shed in moist condition. Storage above critical level of time leads to loss of viability. Growing media also plays an important role in germination of seed and further growth of seedling. It is a substrate that provides, the required elements and physical support to the growing plants. Media should also have good water holding capacity, so that proper growth of seedling takes place. Nursery men often face with the problem of poor germination of lime seed, owing to their poor storage period and they also lack information on use of improper growing media for nursery raising. Keeping in view of the above an investigation was carried out to find out the influence of varying growing media on seed germination and growth of acid lime seedlings at Citrus Research Station, Sankarankovil.

Materials and Methods

The experiment was conducted in the shade net House at Citrus Research Station, Tamil Nadu Agricultural University, Sankarankovil during 2018 - 2019. Seeds from fully ripened acid lime fruits (Var. PKM 1) were extracted manually and rubbed in ash to remove sticky material on seed.

Seeds were sown immediately in different media(Soil, Sand, FYM, Poultry manure, Vermicompost and Cocopeat) prepared at different proportions / combinations. As such there were eleven treatments vi T_1 -Soil + Sand+ FYM (2:1:1), T_2-Soil + Sand+ Poultry manures (2:1:1), T_3-Soil + Sand+ Vermicompost (2:1:1), T_4-Soil + Sand+ Cocopeat (2:1:1), T_5–Soil + Sand + FYM + Poultry manure (1:1:1:1), T_6 –Soil + Sand + FYM + Vermicompost (1:1:1:1), T_7– Soil + Sand + FYM + Cocopeat (1:1:1:1), T_8–Soil + Sand + Poultry manure + Vermicompost (1:1:1:1), T_9-Soil + Sand + Poultry manure + Cocopeat (1:1:1:1), T_{10}-Soil + Sand + Vermicompost + Cocopeat (1:1:1:1) and T_{11} - Soil + Sand + FYM + Poultry manure + Vermicompost + Cocopeat (1:1:1:1:1:1), replicated thrice.

Preliminary data on EC, Ph, N, P and K contents in individual media tried was earlier recorded. Black polythene bags of 6" × 8" size were filled with different growing media as per the treatment combination during October, 2018. Single seed was dibbled at about 2 to 3 cm depth in each polythene bag.

There were 100 poly bags in each replication and after sowing these polythene bags were kept separately under net house having 50% shade level. Five seedlings from each treatment were taken out for recording data on plant height (cm), stem girth (mm), number of leaves per plant, number of roots per plant, root length, fresh weight of seedling and dry weight of seedling. Recording of data was continued at an interval of every 30 days and up to 180 DAS. Earlier, observation on days to 50% germination was also recorded and the data were statically analyzed.

Results and Discussion

Physical characteristics of media

The Electrical conductivity of the different media ranged from 0.62dS m^{-1} (T_1 -Soil + Sand+ FYM (2:1:1) to 2.64dS m^{-1} (T_5–Soil + Sand + FYM + Poultry manure (1:1:1:1) and poultry manure added may be the reason for

this increased EC. The pH value of all the media was found to be almost same ie. mild acidic to neutral range, which varied from 5.44 (T_4 –Soil + Sand+ Cocopeat (2:1:1) to 7.26 (T_7– Soil + Sand + FYM + Cocopeat (1:1:1:1) and found to be feasible for acid lime seedling production in general.

The N, P and K analysis of the media showed that T_{11} –Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat (1:1:1:1:1:1) had maximum values of all the three parameters viz; 146,50 and 400 Kg / ac respectively, highlighting the significance of this media for better seedling growth (Table.1).

Shoot parameters

The results revealed that commencement of seed germination was almost equal ie.13 days after sowing in all the treatments. Treatment T6 viz; Soil + Sand + FYM + Vermicompost (1:1:1:1), recorded the maximum value of 16 days for commencement of germination. 100% seed germination was recorded in T11 - Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat (1:1:1:1:1:1), followed by T_{10}, which may be due to the higher N, P and k content in this media..

Significant differences for all the shoot parameters studied was seen only from 150 DAS and until then the differences were not in any sequence.

This may be due to the fact that the seedlings required nearly 5 months for exhibiting their active growth rate and potential performance utilizing the available nutrient content and physical characteristics in the respective media prepared (Table.5).

Nursery media containing soil + sand + FYM + Poultry manure + vermicompost + cocopeat (1:1:1:1:1:1) combination gave significantly increased height of seedling (54.70 cm) and no. of leaves per seedling(42) after 180 days of sowing, though stem girth (2.20 mm) was found non-significant.

However, minimum height of seedling (33.12 cm) was registered with soil + sand + FYM + poultry manure (1:1:1:1), no. of leaves/ seedling (27.33) with soil + sand + poultry manure (2:1:1) and stem girth (1.76 mm) with soil + sand + poultry manure + vermicompost (1:1:1:1) (Table 7).

Similarly, the shoot parameters recorded superiority over other treatments for soil + sand + FYM + poultry manure + vermicompost + cocopeat (1:1:1:1:1:1) at 90, 120 and 150 days after sowing. The increase in the shoot growth parameters due to application of soil + sand + FYM + Poultry manure + vermicompost + cocopeat (1:1:1:1:1:1) could be attributed to the conducive effect of this medium mixture on water holding capacity, porosity, soil aeration and supplying substantial amount of nutrient specially nitrogen and micro nutrients for good root and shoot growth over control (Chopde *et al.,* 1999).

Increase in number of leaves might be mainly due to corresponding increase in plant height (Govind and Chandra, 1993). This treatment also has higher leaf chlorophyll content which might certainly improve the photosynthetic rate, dry matter production and their by more fresh and dry weight of shoot.

The increase in height of seedling with FYM, poultry manure and vermicompost may be due to reason that it stimulates nutrient uptake especially nitrogen which has a role in the assimilation of numerous amino acids that are subsequently incorporated in proteins and nucleic acid, which provides framework for chloroplast, mitochondria and other structures in which the most of the biochemical reactions occurs (Awasthi *et al.,* 1996).

Table.1 Observations on various physical characteristics of media

Details of treatment	EC dS m^{-1}	pH	N Kg / ac	P Kg / ac	K Kg / ac
T_1 -Soil + Sand+ FYM (2:1:1)	0.62	7.00	70	18	337
T_2 -Soil + Sand+ Poultry manures (2:1:1)	2.11	6.05	98	50	386
T_3 -Soil + Sand+ Vermicompost (2:1:1)	0.82	6.75	98	50	127
T_4 -Soil + Sand+ Cocopeat (2:1:1)	1.20	5.44	95	6.4	300
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	2.64	6.45	112	28	400
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	1.58	7.15	146	50	393
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	1.70	7.26	123	14.2	405
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	2.62	6.13	134	42.	400
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	2.42	5.87	123	50.	393
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	1.42	6.53	146	50.	312
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	2.08	6.40	146	50	400

Table.2 Observations on various bio metrical characteristics on seedlings at 30 DAS

Details of treatment	Commencement of germination in days	Days for 50% germination	Total germination %	Seedling height cm	Stem girth mm
T_1 -Soil + Sand+ FYM (2:1:1)	13.00	28	78.00	5.17	5.67
T_2 -Soil + Sand+ Poultry manures (2:1:1)	13.00	23	96.00	5.47	5.67
T_3 -Soil + Sand+ Vermicompost (2:1:1)	13.67	23	92.00	5.00	5.00
T_4 -Soil + Sand+ Cocopeat (2:1:1)	13.00	24	78.00	6.07	4.67
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	13.00	29	72.00	5.27	4.67
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	16.00	32	66.00	5.33	4.33
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	13.00	27	72.00	4.87	4.33
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	13.67	25	86.00	6.00	5.00
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	13.00	26	82.00	5.80	4.67
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	13.00	22	98.00	5.73	4.00
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	13.00	24	98.67	5.63	4.67
CD@0.05%	**N.S**	**2.827**	**3.548**	**N.S**	**N.S**
CD@0.01%	**-**	**3.855**	**4.839**	**-**	**-**
C.V	**12.185**	**6.451**	**2.494**	**18.175**	**22.793**

Table.2a Observations on various bio metrical characteristics on seedlings at 30 DAS – Contd;

Details of treatment	No. of leaves / seedling	No. of roots / seedling	Root length cm	Fresh wt. of seedling mg	Dry wt. of seedling mg
T_1 -Soil + Sand+ FYM (2:1:1)	6.33	8.67	5.7	211.87	65.87
T_2 -Soil + Sand+ Poultry manures (2:1:1)	7.33	7.00	6.3	248.07	79.37.
T_3 -Soil + Sand+ Vermicompost (2:1:1)	6.67	6.67	6.2	183.50	62.50
T_4 -Soil + Sand+ Cocopeat (2:1:1)	7.66	14.00	10.3	177.47	76.79
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	7.66	10.33	5.8	186.67	24.87
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	8.33	13.67	9.3	193.10	69.10
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	8.66	15.33	7.7	394.33	86.67
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	6.66	14.00	5.9	226.60	79.90
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	6.33	8.00	7.6	187.03	68.57
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	6.66	10.67	10.6	195.03	71.23
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	7.66	11.67	8.1	223.83	73.00
CD@0.05%	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**
CD@0.01%	**-**	**-**	**-**	**-**	**-**
C.V	**30.371**	**41.620**	**31.725**	**45.331**	**33.488**

Table.3 Observations on various bio metrical characteristics on seedlings at 60 DAS

Details of treatment	Seedling height cm	Stem girth mm	No. of leaves / seedling	No. of roots / seedling	Root length cm	Fresh wt. of seedling mg	Dry wt. of seedling mg
T_1 -Soil + Sand+ FYM (2:1:1)	13.3	0.74	13.34	28.00	12.30	1.44	0.88
T_2 -Soil + Sand+ Poultry manures (2:1:1)	21.04	1.00	16.00	50.67	20.80	1.61	0.85
T_3 -Soil + Sand+ Vermicompost (2:1:1)	17.37	0.90	17.67	37.34	17.64	1.93	0.85
T_4 -Soil + Sand+ Cocopeat (2:1:1)	20.24	1.07	18.67	52.33	21.07	2.65	1.00
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	14.40	0.87	14.34	35.34	13.17	1.44	0.42
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	17.77	1.04	20.34	53.00	22.20	2.60	1.02
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	18.20	1.04	17.67	45.00	18.27	2.59	0.86
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	17.70	1.00	18.67	34.67	17.34	2.77	0.89
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	21.37	1.07	20.34	50.67	17.74	3.74	1.37
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	18.50	0.84	17.67	47.67	24.00	2.47	0.77
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	23.97	1.20	25.00	57.00	24.77	3.99	1.83
CD@0.05%	**5.160**	**0.174**	**3.776**	**NS**	**6.016**	**1.350**	**0.582**
CD@0.01%	**-**	**0.238**	**5.150**	**NS**	**8.205**	**1.841**	**0.794**
C.V	**16.351**	**10.494**	**12.214**	**31.759**	**18.566**	**32.009**	**35.026**

Table.4 Observations on various bio metrical characteristics on seedlings at 90 DAS – Contd;

Details of treatment	Seedling height cm	Stem girth mm	No. of leaves / seedling	No. of roots / seedling	Root length cm	Fresh wt. of seedling mg	Dry wt. of seedling mg
T_1 -Soil + Sand+ FYM (2:1:1)	22.70	1.10	20.33	57.66	27.06	3.66	2.25
T_2 -Soil + Sand+ Poultry manures (2:1:1)	22.33	1.03	21.66	54.33	27.06	3.24	1.92
T_3 -Soil + Sand+ Vermicompost (2:1:1)	24.53	1.06	24.33	60.66	23.00	3.36	2.25
T_4 -Soil + Sand+ Cocopeat (2:1:1)	21.23	1.13	21.00	53.00	21.16	2.82	1.39
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	20.77	1.13	22.00	54.66	22.53	2.84	1.62
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	23.03	1.20	24.33	56.00	23.83	2.74	1.49
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	25.00	1.30	25.33	60.33	24.90	3.90	2.04
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	24.77	1.13	19.33	61.33	25.23	3.36	2.03
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	24.40	1.30	23.66	61.33	25.00	3.76	1.48
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	25.00	1.23	25.00	60.66	25.00	3.54	2.26
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	25.44	1.26	26.00	61.66	28.13	4.23	2.39
CD@0.05%	**NS**	**0.148**	**NS**	**NS**	**NS**	**NS**	**0.663**
CD@0.01%	**NS**	**0.201**	**NS**	**NS**	**NS**	**NS**	**NS**
C.V	**8.487**	**7.392**	**12.406**	**10.760**	**11.018**	**20.442**	**20.271**

Table.5 Observations on various bio metrical characteristics on seedlings at 120 DAS – Contd;

Details of treatment	Seedling height cm	Stem girth mm	No. of leaves / seedling	No. of roots / seedling	Root length cm	Fresh wt. of seedling mg	Dry wt. of seedling mg
T_1 -Soil + Sand+ FYM (2:1:1)	26.86	1.33	24.66	62.33	27.66	5.23	2.40
T_2 -Soil + Sand+ Poultry manures (2:1:1)	29.63	1.16	22.33	67.66	30.43	6.10	2.74
T_3 -Soil + Sand+ Vermicompost (2:1:1)	32.23	1.46	24.66	82.00	35.40	6.52	2.68
T_4 -Soil + Sand+ Cocopeat (2:1:1)	30.73	1.30	25.33	65.33	26.13	6.12	2.18
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	23.63	1.26	22.33	61.66	26.66	5.41	2.23
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	31.33	1.46	28.33	85.66	31.50	6.17	3.00
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	38.00	1.76	29.66	84.00	30.66	7.53	3.33
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	30.80	1.56	26.33	62.33	27.53	6.77	2.78
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	33.13	1.83	21.33	62.66	27.16	6.89	3.33
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	33.56	1.86	33.00	86.33	35.63	8.58	4.27
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	40.93	2.00	35.00	89.00	36.93	11.58	5.45
CD@0.05%	**4.758**	**0.227**	**4.709**	**11.176**	**5.260**	**1.957**	**0.893**
CD@0.01%	**6.489**	**0.310**	**6.423**	**15.243**	**7.174**	**2.669**	**1.218**
C.V	**8.757**	**8.613**	**10.038**	**8.922**	**10.119**	**16.573**	**16.764**

Table.6 Observations on various bio metrical characteristics on seedlings at 150 DAS – Contd;

Details of treatment	Seedling height cm	Stem girth mm	No. of leaves / seedling	No. of roots / seedling	Root length cm	Fresh wt. of seedling mg	Dry wt. of seedling mg
T_1 -Soil + Sand+ FYM (2:1:1)	34.00	1.40	25.33	73.66	30.17	7.12	3.71
T_2 -Soil + Sand+ Poultry manures (2:1:1)	35.23	1.40	23.00	82.33	35.84	6.72	3.29
T_3 -Soil + Sand+ Vermicompost (2:1:1)	35.06	1.5	26.33	89.33	38.57	6.76	3.19
T_4 -Soil + Sand+ Cocopeat (2:1:1)	32.40	1.50	28.00	66.00	27.00	6.60	3.24
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	27.86	1.40	25.66	64.00	29.24	5.60	2.77
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	37.36	1.60	29.00	87.66	34.54	8.40	4.05
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	40.30	1.80	30.00	86.66	31.07	7.82	3.63
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	40.53	1.70	31.00	83.66	33.00	9.37	4.97
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	43.06	1.90	32.66	94.66	30.07	10.85	5.53
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	46.26	1.90	35.66	100.33	36.86	10.87	5.79
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	47.20	2.03	38.00	107.00	37.80	11.97	5.94
CD@0.05%	**6.348**	**0.256**	**5.150**	**6.076**	**NS**	**2.318**	**0.935**
CD@0.01%	**8.657**	**0.349**	**7.024**	**8.287**	**NS**	**3.161**	**1.275**
C.V	**9.777**	**9.019**	**10.234**	**4.196**	**21.999**	**16.245**	**13.375**

Table.7 Observations on various bio metrical characteristics on seedlings at 180 DAS – Contd;

Details of treatment	Seedling height cm	Stem girth mm	No. of leaves / seedling	No. of roots / seedling	Root length cm	Fresh wt. of seedling mg	Dry wt. of seedling mg
T_1 -Soil + Sand+ FYM (2:1:1)	47.23	1.93	28.36	76.66	35.30	9.79	3.95
T_2 -Soil + Sand+ Poultry manures (2:1:1)	42.90	1.93	27.33	83.00	38.63	8.25	3.97
T_3 -Soil + Sand+ Vermicompost (2:1:1)	43.20	2.10	28.33	91.00	41.03	10.07	4.51
T_4 -Soil + Sand+ Cocopeat (2:1:1)	42.90	2.03	30.33	85.00	31.73	9.89	4.09
T_5-Soil + Sand + FYM + Poultry manure (1:1:1:1)	33.12	2.03	27.66	66.33	34.73	7.31	3.05
T_6 -Soil + Sand + FYM + Vermicompost (1:1:1:1)	40.60	2.03	29.66	88.00	42.13	13.76	6.11
T_7- Soil + Sand + FYM + Cocopeat (1:1:1:1)	42.80	1.96	31.00	87.66	44.73	11.83	4.59
T_8-Soil + Sand + Poultry manure + Vermicompost (1:1:1:1)	43.10	1.76	32.66	85.33	43.46	9.73	5.01
T_9 -Soil + Sand + Poultry manure + Cocopeat (1:1:1:1)	48.26	1.96	32.00	97.66	48.16	12.07	5.83
T_{10} -Soil + Sand + Vermicompost + Cocopeat (1:1:1:1)	54.30	2.10	41.00	105.00	48.56	12.14	6.15
T_{11} -Soil + Sand + FYM +Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1)	54.70	2.20	42.00	109.00	54.33	13.87	6.58
CD@0.05%	**4.057**	**NS**	**5.141**	**8.889**	**3.847**	**3.536**	**1.627**
CD@0.01%	**5.533**	**NS**	**7.012**	**12.124**	**5.247**	**NS**	**2.219**
C.V	**5.312**	**7.795**	**9.442**	**5.910**	**5.369**	**19.233**	**19.728**

Root parameters

The application of different media combination had significant effect on root parameters also at 120 and 180 DAS. The treatments had not exerted significant influence on root parameters at 90 DAS. The medium consisting of soil + sand + FYM + Poultry manure + Vermicompost + Cocopeat (1:1:1:1:1:1) showed maximum no. of roots/seedling(109) and root length(54.33 cm)and minimum no. of roots/seedling(66.33) and root length(31.73 cm) was observed in medium soil + sand + FYM + poultry manure 1:1:1:1 and soil + sand + cocopeat 2:1:1, respectively. The beneficial effect on root growth parameters due to application of the medium treatment consisting of soil + sand + FYM + Poultry manure + Vermicompost + Cocopeat (1:1:1:1:1:1) might be due to improved soil texture, structure, porosity, water holding capacity, activity of useful soil organism and nutrient status of medium (Hartmann and Kester, 1997). Further, the vermicompost also provide close contact between seed and media; increases steady moisture supply facilitates root respiration and encourages overall root growth, as reported by Chatterjee and Choudhuri (2007).

Biomass

Similarly, with respect to fresh weight of seedling and dry weight of seedling treatment T11 viz; soil + sand + FYM + Poultry manure + Vermicompost + Cocopeat(1:1:1:1:1:1) recorded maximum (13.87 mg and 6.58 mg) and Treatment *viz*; soil + sand + FYM + Poultry manure (1:1:1:1) recorded minimum values of fresh and dry weight of seedling (7.31 mg and 3.05 mg), respectively. There was no significant difference in biomass weight at 30 DAS. The increase in biomass weight might be due to high moisture content and vigour of seed and may be due to the media *viz;* vermicompost which have growth regulating substances such as humic acid, auxin, gibberellin as well as due to more supply of nutrients to seedling. Similar results were also obtained by Bhardwaj (2014), Ramteke *et al.,* (2015) in papaya and Abirami *et al.,* (2010) in nutmeg.

Better germination of acid lime seed can be obtained by sowing the seed immediately after extraction in growing media containing soil + sand + FYM +vermicompost in equal proportion. Further, the growth parameters of seedling viz. height of seedling, stem girth, no. of leaves per seedling, no. of roots per seedling, root length, seedling fresh weight, dry weight of seedling were also found to have higher values in the media having soil + sand + FYM + Poultry manure + Vermicompost + Cocopeat in 1:1:1:1:1:1 ratio.

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