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Studies on seed germination and seedling growth in Jackfruit (*Artocarpus heterophyllus* Lam.) as influenced by media

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Abstract
The effect of growing media on seed germination and seedling growth in Jackfruit (*Artocarpus heterophyllus* Lam.) was under taken during the year 2016-17 and 2017-18 at College of Horticulture, Mulde Tal: Kudal Dist: Sindhudurg. Healthy, thoroughly washed seeds of more than 3 g weight from ripe soft fleshy jackfruits were collected. Such seeds were treated with Carbendazim solution for 5 minutes and sown in polybags of size 6'' X 8" containing five different experimental growing media for testing germination and growth of seedling. Growing media *viz*., M_1- Soil + FYM (3:1), M_2- Soil + Vermicompost + Rice husk (2:1:1), M_3- Soil + Vermicompost + Saw dust (2:1:1), M_4- Soil + Vermicompost + Cocopeat (2:1:1) and M_5 - Soil + Vermicompost + Rice husk + Cocopeat (1:1:1:1) were assessed for seed germination and seedling vigour in randomized block design with four replications.
The results revealed that a mixture of media having Soil + Vermicompost + Rice husk + Cocopeat (1:1:1:1) were exhibited higher germination index (33.72), higher germination value (18.58), maximum seedling vigour index (4.60), showed more percentage of graftable seedlings (91.13%), the highest seed vigour (97.08). The inclusion of saw dust in media was found inhibitory effect for all the aspects under study.

Keywords: Growing media, soil, rice husk, saw dust, seed vigour and seedling vigour

Introduction
The coastal warm and humid climate of the Konkan region is favourable for jackfruit (*Artocarpus heterophyllus* Lam.) cultivation. There is a great potential for increasing the area under jackfruit in the Konkan region. A success of a fruit nursery depends on raising healthy rootstock for grafting. Preparation of potting mixture plays an important role in the production of seedling. Propagation media also plays an important role in seed germination. Media not only acts as a growing place but also as a source of nutrient for plant growth (Ramteke *et al*., 2015) [27]. Hence, it is of prime importance to standardize the suitable media composition for commercial production of jackfruit seedling for grafting.
Generally soil + FYM are used as a potting mixture for production of seedling as a rootstock. However, requirement of soil is huge which seriously affect the farming in this region. On this background a search for alternatives for replacement of soil by some other easily available components as a growing media constitute an immediate requirement.
In view of this, the present investigation was undertaken to find out alternate media ingredients which can replace the quantum of soil to certain extent.

Materials and Methods
The experiment was carried out at College of Horticulture, Mulde Tal: Kudal Dist: Sindhudurg under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (Maharashtra) during the season of 2016-17 and 2017-18. Five different combinations *viz*., M_1- Soil + FYM (3:1), M_2- Soil + Vermicompost + Rice husk (2:1:1), M_3- Soil + Vermicompost + Saw dust (2:1:1), M_4- Soil + Vermicompost + Cocopeat (2:1:1) and M_5 - Soil + Vermicompost + Rice husk + Cocopeat (1:1:1:1) of growing media were tried in randomized block design with four replications.
The treatments were prepared in required quantities on volume basis. Polythene bag of 200 gauge with size 15 X 20 cm were used for filling the potting mixtures.

Only fresh, healthy and cleaned seeds weighing more than 3 g from ripe soft flesh type jackfruits were used for sowing as suggested by Doijode (2001) [6]. Daily watering was done immediately after sowing the seeds until seedling emergence take place. After germination, the seedlings were irrigated on every alternate day.

Germination parameters were studied from the date germination till the end of last germination at every alternate day and seedling vigour was measured by using different formulas as given below

Germination percentage (GP)

Germination percentage was calculated by dividing the total number of germinated seeds by the total number of seeds sown and multiplied by 100 as given below.

$$\text{Germination percentage (\%)} = \frac{No.\ of\ seeds\ germinated}{Total\ number\ of\ seeds\ sown}\ X\ 100$$

Germination index (GI)

Germination index was calculated as described in the Association of Official Seed Analysts (AOSA, 1983) by following formula

$$\text{Germination index (GI)} = \frac{No.\ of\ germinated\ seed}{Days\ of\ first\ count} + \frac{No.of\ germinated\ seed}{Days\ of\ second\ \ count} + \ldots\ldots + \frac{No.of\ germinated\ seed}{Days\ of\ final\ or\ last\ count}$$

Germination value (GV)

Germination value was calculated according to Hossain *et al*., (2005) by the following formula Germination value (GV) = ($\sum DGs/N)\ X\ GP/10$) Where (GP) is the germination percentage at the end of experiment. (DG) is the daily germination speed obtained by dividing the cumulative germination percentage by the number of days since sowing. (Σ DGs) is the total germination obtained by adding every DGs value obtained from the daily counts (N) is the total number of daily counts starting from the first germination and 10 is constant.

Speed or rate of emergence (RE)

Speed of emergence was calculated according to Islam *et al*., (2009) [11] using formula

Speed of emergence =

$$\frac{No.of\ seedling\ emerge\ at\ 14\ days\ after\ sowing}{No.of\ seedlings\ emerge\ at\ 41\ days\ after\ sowing}\ X\ 100$$

Seedling vigour index (SVI)

Seedling vigour index was calculated according to Islam *et al*., (2009) [11] using formula, Seedling vigour index (SVI) =

$$\frac{Seedling\ length\ (Height\ cm)at\ 30\ days}{100}\ X\ Germination\ \%$$

Percentage of graftable seedlings

Out of total germinated seedlings healthy vigorous seedling which used for grafting were considered for calculating percentage of graftable seedling. The percentage was calculated by using following formula

Percentage of graft able seedling (%) =

$$\frac{Total\ number\ of\ healthy\ seedlings}{Total\ number\ ofseeds\ sown}\ X\ 100$$

Seed vigour

The seed vigour index was calculated as described in the Association of Official Seed Analysts (AOSA, 1983) by following formula

$$\text{Seed vigour} = \frac{Total\ no.\ of\ healthy\ seedlings}{Number\ of\ total\ seedlings}\ X\ 100$$

The seedling height (cm) was measured with scale from the level of the soil surface to the tip of the plant at 60 days after germination. The girth (mm) was measured by digital vernier Caliper's at 5cm above the soil surface at 60 days after germination and the numbers of all leaves per plant were counted visually at 60 days after germination.

For statistical analysis, the data on percentage was transformed to arcsine √(100/ X) and actual percentage are shown. The statistical analysis of the data was done by the standard method known as 'Analysis of Variance' described by Panse and Sukhatme, (1995) [19]. The standard error (SE) of mean and critical difference (CD) at 5 per cent level were work out, wherever the results were significant.

Results and Discussion

Effect of growing media on germination percentage

The data on germination percentage, germination index and germination value as influenced by growing media in jackfruit are presented in Table 1. Data revealed that during the first year of experimentation (2016-17), the germination percentage was significantly influenced by various media combinations. It was maximum in M_5 (93.0%) where the seeds were sown in Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion. It was followed by treatment M_2 (84.00%) which was at par with M_1 (83.50%). Treatment M_4 recorded 77.50 per cent germination. Minimum germination was recorded in M_3 (69.00%) i.e. Soil + Vermicompost + Saw dust at 2:1:1 proportion.

During second year also the maximum germination was obtained with treatment M_5 (94.25%) which was significantly superior over rest of the treatments. The successively higher germination was noticed in M_2 (81.25%) followed by M_1 (80.00%) and M_4 (77.75%) which were at par. The lowest germination i.e. 68.50 per cent was found in M_3 (Soil + Vermicompost + Saw dust at 2:1:1 proportion).

The pooled data on germination indicated that the highest germination was noticed in M_5 (93.63%) i.e. in media having Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion. It was followed by M_2 (82.60%) and was at par with M_1 (81.75%). Treatment M_3 (Soil + Vermicompost + Saw dust at 2:1:1 proportion) recorded lower germination percentage i.e. 68.75 per cent. Geetha *et al.*, (2007) [8] tried different media for growing seedling of two varieties of mango and found that among the growing media, potting mixture + coir pith was superior with regards to the mean germination percentage (40%). Rice husk and cocoapeat are the sources of high organic carbon whereas vermicompost provides rather balanced nutrient to the growing crop. The mixture had neutral pH, low EC value, high OC, High N, P and K contain. Moreover such a mixture has adequate porosity, low bulk density which is ideal for germination of jackfruit seed. Panchal *et al.*, (2014) [18], Meena *et al*., (2014)

[15] and Purwantoro, (2016) [24] reported that use of vermicompost and rice husk was useful as they had components which favour the nutritional status, pH levels and organic carbon content. It is to be noted that inclusion of saw dust in growing media has adverse effect on germination. The saw dust used in investigation was of nondescript nature of timber source from which the dust derived is unknown. Rice, (1979) has explained that exudate from any part of certain tree can hamper germination and growth of other plants growing nearby it. This is called "allelopathic effect". The adverse effect of saw dust on germination in current investigation could be therefore due to allelopathic nature of the material.

Table 1: Germination percentage, germination index and germination value as influenced by growing media in jackfruit

Treatments	Germination percentage (%)			Germination index (GI)			Germination value (GV)		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
M_1 - Soil + FYM (3:1) (Control)	83.50 (66.08)	80.00 (63.44)	81.75 (64.76)	31.50	31.68	31.59	14.54	11.79	13.17
M_2- Soil + Vermicompost + Rice husk (2:1:1)	84.00 (66.49)	81.25 (64.35)	82.63 (65.42)	28.77	29.41	29.09	15.16	11.50	13.33
M_3 - Soil + Vermicompost + Saw dust (2:1:1)	69.00 (56.35)	68.50 (55.95)	68.75 (56.15)	37.48	23.13	30.30	7.94	7.96	7.95
M_4 - Soil + Vermicompost + Cocopeat (2:1:1)	77.50 (61.74)	77.75 (61.87)	77.63 (61.80)	17.73	24.96	21.35	17.78	9.46	13.62
M_5 – Soil + Vermicompost + Rice husk + Cocopeat (1:1:1:1)	93.00 (75.39)	94.25 (76.59)	93.63 (75.99)	32.47	34.97	33.72	21.66	15.50	18.58
S. Em ±	1.48	1.36	0.98	1.94	0.94	1.82	0.82	0.53	0.75
CD at 5 %	4.38	4.04	2.84	5.67	2.77	5.27	2.43	1.57	2.19
Figures in parenthesis are arcsine transformed values									

Effect of growing media on germination index

The results obtained during the year 2016-17, revealed that germination index was higher in M_3 (37.48) which was at par with M_5 (32.47). Treatment M_1 had germination index of 31.50 followed by M_2 (28.77) which were at par with each other. The lowest germination index was registered in M_4 (17.73) i.e. Soil + Vermicompost + Cocopeat at 2:1:1 proportion.

During second year, treatment M_5 (34.97) showed significantly highest germination index followed by M_1 (31.68) and M_2 (29.41). The lowest germination index was noticed in M_3 (23.13) followed by M_4 (24.96). Both were at par with each other.

Pooled analysis indicated that treatment M_5 (Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion) exhibited significantly higher germination index 33.72. It was at par with treatment M_1 (31.59), M_3 (30.30) and M_2 (29.09). The lowest germination index was noticed in treatment M_4 (21.35) i.e. Soil + Vermicompost + Cocopeat in 2:1:1 proportion. Higher value of germination index indicated the earlier germination and lower value indicated late germination. This might be due to fresh seed with good vigour and moisture in early stage and media provided good moisture, aeration and moisture supply as well as sufficient porosity which permit gaseous exchange between media and seed. The results are in accordance with the findings of Prajapati *et al*., (2017) in acid lime Arvind, (2014) in papaya.

Effect of growing media on germination value

In the first year of study, germination value was significantly influenced by the media which was higher in M_5 (21.66) followed by M_4 (17.78). Treatment M_2 (Soil + Vermicompost + Rice husk at 2:1:1 proportion) registered 15.16 germination value and was at par with M_1 (14.54). Minimum germination value was observed in M_3 (7.94).

During the second year, higher germination value was seen in treatment M_5 (15.50) followed by M_1 (11.79). Treatments M_1 (11.79) and M_2 (11.50) were at par. Treatment M_4 had germination value of 9.46. The minimum germination value was found in M_3 (7.96).

The pooled germination value was higher in treatment M_5 (18.58) and was minimum in M_3 (7.95). Other treatments were at par with each other where germination value ranged from 13.62 (M_4) to 13.17 (M_1).

Study revealed that in different treatments germination value was remarkably influenced by media and Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion (M_5) showed higher germination value. This might be because of the better physical properties and enhanced nutrient level of media. Bhardwaj, (2014) [4] found the media with vermicompost and cocoapeat was more suitable than vermicompost alone.

Effect of growing media on speed of emergence

Speed of emergence is an important criterion to measure seed vigour. The data on speed of emergence, seedling vigour index, percentage of graftable seedlings and seed vigou***r*** as influenced by growing media in jackfruit are presented in Table 2.

During the first year (2016-17), speed of emergence was higher in the treatment M_4 (14.15) i.e. Soil + Vermicompost + Cocopeat at 2:1:1 proportion followed by M_5 (8.03). Treatment M_1 had 4.37 speed of emergence whereas, it was lower in M_2 (1.79). Treatment M_3 (Soil + Vermicompost + Saw dust at 2:1:1 proportion) showed 3.45 speed of emergence and was at par with M_2 (Soil + Vermicompost + Rice husk at 2:1:1 proportion).

During the year 2017-18, there was no significant difference observed in different media treatments with respect to speed of emergence. However, the observed values were numerically higher in M_3 (2.24) i.e. Soil + Vermicompost + Saw dust at 2:1:1 proportion and the lowest in M_2 (1.54) i.e. Soil + Vermicompost + Rice husk at 2:1:1 proportion.

Thus, during the period of investigation treatment M_4 (Soil + Vermicompost + Cocopeat at 2:1:1 proportion) exhibited higher speed of emergence while treatment M_2 (Soil + Vermicompost + Rice husk at 2:1:1 proportion) had lower speed of emergence. This is in accordance with the earlier findings of Dayeswari *et al*., (2017) [5] and Bhardwaj, (2014) [4] in papaya.

Table 2: Speed of emergence, seedling vigour index, percentage of graftable seedlings and seed vigour as influenced by growing media in jackfruit

Treatments	Speed of emergence			Seedling vigour index (SVI)			Graftable seedlings (%)			Seed vigour		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
M_1 - Soil + FYM (3:1) (Control)	4.37	1.56	2.96	26.26	39.73	32.99	79.50 (63.13)	76.50 (61.01)	78.00 (62.07)	95.10	95.63	95.37
M_2 - Soil + Vermicompost + Rice husk (2:1:1)	1.79	1.54	1.66	25.67	43.10	34.38	74.00 (59.46)	74.00 (59.36)	74.00 (59.41)	88.05	91.07	89.56
M_3 - Soil + ermicompost + Saw dust (2:1:1)	3.45	2.24	2.84	23.90	32.25	28.08	54.50 (47.61)	59.25 (50.39)	56.88 (49.00)	79.12	86.46	82.79
M_4 - Soil + Vermicompost + Cocopeat (2:1:1)	14.15	1.92	8.04	26.21	40.22	33.22	70.50 (57.11)	71.50 (57.74)	71.00 (57.42)	86.75	91.97	89.36
M_5 - Soil + Vermicompost + Rice husk + Cocopeat (1:1:1:1)	8.03	1.85	4.94	30.14	51.06	40.60	92.00 (74.19)	90.25 (71.91)	91.13 (73.05)	98.38	95.78	97.08
S.Em ±	0.68	0.38	0.98	0.78	1.79	1.26	2.12	1.31	1.02	1.42	1.45	1.19
CD at 5 %	2.01	NS	2.85	2.32	5.31	3.67	6.28	3.88	2.97	4.21	4.30	3.46

Figures in parenthesis are arcsine transformed values

Effect of growing media on seedling vigour index (SVI)

During the year seedling vigour index was higher (30.14) in M_5 (Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1) followed by 26.26 in M_1. Treatment M_1, M_2 and M_4 were at par with each other having seedling vigour index of 26.26, 26.21 and 25.67 respectively. The lowest seedling vigour index (23.90) was noticed in M_3 (Soil + Vermicompost + Saw dust at 2:1:1 proportion).

During the year seedling vigour index was significantly highest in M_5 (51.06) (Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1) followed by M_2 (43.10). Treatment M_2, M_4 and M_1 were at par and recorded 43.10, 40.22 and 39.73 seedling vigour index respectively. M_3 (Soil + Vermicompost + Saw dust at 2:1:1) produced significantly lower seedling index (32.25).

Pooled analysis showed that treatment M_5 (Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion) registered maximum seedling vigour index (40.60) followed by M_2 (34.38). Treatment M_2, M_4 and M_1 were at par having seedling vigour index of 34.38, 33.32 and 32.99 respectively. Significantly lowest seedling vigour index (28.08) was noticed in treatment M_3 (Soil + Vermicompost + Saw dust at 2:1:1 proportion).

Thus, the seedling vigour index was maximum in treatment M_5 (Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion) while it was the lowest in M_3 (Soil + Vermicompost + Saw dust at 2:1:1 proportion) during the period of experimentation. This is obviously due to gradually decomposing organic component like cellulose, lignin which ultimately released humic substance along with high content of silicon in growing media. On this background Siddiqui and Al-Whaibi, (2014) [29] recommended use of rice husk in growing media.

Effect of growing media on graftable seedlings

Obtaining healthy, vigorous seedling which is further utilized for grafting purpose is the important aspect in any nursery programme.

The data pertaining to percentage of graftable seedlings as influenced by different media combinations are presented in Table 2 revealed that during first year (2016-17) revealed that the percentage of graftable seedlings was the highest in M_5 (92.0%) (Soil + Vermicompost + Rice husk + Cocopeat 1:1:1:1) followed by M_1 (79.50%). Treatment M_2 and M_4 produced 74.00 and 70.50 per cent graftable seedling respectively which were at par with treatment M_1. The lower percentage of graftable seedlings was obtained in M_3 (54.50%) (Soil + Vermicompost + Saw dust 2:1:1).

During the second year (2017-18), the highest percentage of graftable seedlings was seen in the treatment M_5 (90.25%) followed by M_1 (76.50%). Treatment M_2 (74.00%) and M_4 (71.50%) were at par with M_1. Lower percentage of graftable seedlings was observed in M_3 (59.25%).

Pooled data showed that treatment M_5 (Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion) showed significantly higher percentage of graftable seedlings (91.13%) followed by M_1 (78.00%). Treatment M_2 (74.0%) and M_4 (71.00%) were at par with M_1. Treatment M_3 (Soil + Vermicompost + Saw dust at 2:1:1) produced lowest percentage of graftable seedlings (56.88%).

Effect of growing media on seed vigour

During the year significantly higher seed vigour was obtained in M_5 (98.38) which was at par with M_1 (95.10). Treatment M_2 recorded seed vigour of 88.05 and was at par with M_4 (86.75). The lowest seed vigour was found in M_3 (79.12).

During second year significantly greater seed vigour was noticed in M_5 (95.78) which was at par with M_1 (95.63) and M_4 (91.97). Treatment M_2 (Soil + Vermicompost + Rice husk 2:1:1) exhibited seed vigour of 91.07. The minimum seed vigour was observed in M_3 (86.46).

The treatment M_5 (Soil + Vermicompost + Rice husk + Cocopeat at 1:1:1:1 proportion) produced maximum pooled seed vigour (97.08) which was at par with M_1 (95.37). Seed vigour in treatment M_2 and M_4 were 89.56 and 89.36 respectively and both were at par. The lowest seed vigour (82.79) was noticed in M_3 (Soil + Vermicompost + Saw dust at 2:1:1 proportion).

The data suggested that speed of emergence, seed vigour and seedling vigour index were favourably influenced by a mixture of Soil + Vermicompost + Rice husk + Cocopeat. Similar results were reported by Qayom, (2011) [25] in Nekkare cultivar of mango where Soil: Sand: Compost: Coir pith (1:1:1:1) recorded early germination, Arvind, (2014), Meena, (2015) [16], Ramteke *et al*., (2015) [27] and Jyoti and Beniwal, (2016) [14] in Papaya.

The vermicompost is reported to bring the pH of media as neutral level, moderate in electrolyte conductivity, favour aeration due to increase in porosity and support the availability of micro and macro nutrients (Talashilkar *et al*., 1999). Role of vermicompost was elaborated by Ramteke *et al.,* (2015) [27] which provides sufficient levels of oxygen to

roots, adequate storage of water and nutrient for the plants: humic substances significantly increase nutrients availability and consequently affect growth. Montano *et al*., (1997) [17] have reported that saw dust greatly exceed the soil inability to hold and release applied nutrients to growing plant. The cation exchange capacity is also less. The microorganisms involved in decomposition of old residue are more efficient than higher plant in nitrogen absorption and assimilation. James Green, (1977) [13] has reported that saw dust can also exudate toxic substances and hence can be phytotoxic to the plant species under consideration. Further the saw dust is expected to elevate pH from acidic level. Some microorganism are involved in the breakdown of particle which generate heat and can also affect the critical process in germination.

Harmfulness or usefulness of saw dust depends on plant species of the timber from which it is derived. Rice, (1979) has reviewed such effect of tree species which are known as allelochemical effect. Inhibition of seed germination, inhibition of shoot, root growth, inhibition of nutrient uptake are some of the many adverse effect caused by allelochemical released from the saw dust on the growth of crop under consideration.

Retardation of germination noticed in current investigation could be due to allelopathic effect exerted by saw dust in the media. Patil, (1984) [20] observed lowest (59%) germination of mango stone in sawdust in polythene bag. However, these finding are contradictory with the findings of Rahman *et al*., (2007) [26] in Peach.

In recent year, cocopeat is used as a growing medium in many horticultural species. This has been considered as a good growing media as it offers acceptable pH, EC and other chemical attributes (Abad *et al,* 2002) [1]. The cocopeat also has good physical properties *viz*. high total pore spaces, high water content, low shrinkage, low bulk density and slow biodegradation (Evans *et al.*, 1996 and Prasad *et al*., 1997) [7, 22]. According to Priyadarshani *et al.,* (2006) [23] poor porosity, aeration and low water holding capacity are the limiting points in used of vermicompost. Addition of cocopeat in media increases the field capacity of media and lower down pH, EC and bulk density which are favorable for satisfactory germination.

The rice husk has many properties and hence is a potential material for use in agriculture as well as in industry. It is reported to have 40 to 50 per cent cellulose, 25 to 30 per cent lignin, 15 to 20 per cent ash and 8 to 15 per cent moisture (Hwang and Chandra, 1997) [10]. According to Purwantoro, (2016) [24] due to high organic matter and silica, rice husk could be used as natural silica fertilizer. Meena *et al*., (2014) [18] have suggested that rice husk as silica fertilizer optimizes soil fertility through improved water availability, physical and chemical soil properties and the maintenance of nutrient in available form for the plants.

In current investigation, addition of rice husk in basic media has improved soil property in terms of pH, EC, OC and N. P. K. percentage. The highest germination percentage, earliness for germination, short germination period, high germination index, high germination value and highest seedling vigour index have been noticed under the treatment Soil + Vermicompost + Cocopeat + Rice husk. This is obviously due to gradually decomposing organic component like cellulose, lignin which ultimately released humic substance along with high content of silicon in growing media. On this background, rice husk has been recommended for use in growing media (Siddiqui and Al-Whaibi, 2014) [29].

Effect of growing media on seedling height

The data in respect to seedling height, girth and number of leaves at 60 days after germination were recorded and presented in Table 3.

At 60 days M_4 (Soil + Vermicompost + Cocopeat at 2:1:1 proportion) had numerically maximum height (54.05 cm) and M_5 (Soil + Vermicompost + Rice husk + Cocopeat) showed minimum height (50.41 cm). Geetha *et al.,* (2007) [8] tried different media for growing mango seedling and found that among the growing media containing potting mixture + coir pith was superior with regards to the seedling height (15.9 cm).

Table 3: Effect of different growing media on height, girth and number of leaves of jackfruit seedling at 60 days after germination

Treatments	Height (cm)			Girth (mm)			Number of leaves		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
M_1 - Soil + FYM (3:1) (Control)	43.3	62.5	52.9	5.4	6.7	6.0	9.0	9.8	9.4
M_2 - Soil + Vermicompost + Rice husk (2:1:1)	38.0	64.5	51.6	6.1	6.6	6.3	7.9	9.7	8.8
M_3 - Soil + Vermicompost + Saw dust (2:1:1)	43.4	53.7	48.5	5.9	6.3	6.1	8.4	8.7	8.5
M_4 - Soil + Vermicompost + Cocopeat (2:1:1)	46.8	61.3	54.1	7.2	6.5	6.8	10.0	9.3	9.6
M_5 – Soil + Vermicompost + Rice husk + Cocopeat (1:1:1:1)	41.3	59.5	50.4	5.8	6.5	6.1	8.6	8.7	8.6
S. Em ±	1.0	2.2	1.6	0.1	0.2	0.2	0.2	0.3	0.2
CD at 5 %	2.9	6.4	NS	0.3	NS	0.5	0.1	NS	0.7

Effect of growing media on seedling girth

The data pertaining to seedling girth at 60 days after germination presented in table revealed that at 60 days after germination, significantly maximum girth was noticed in M_4 (6.83 mm) followed by M_2 (6.34 mm). Minimum girth was seen in M_1 (6.03 mm) and it was at par with M_3 (6.09 mm) and M_5 (6.14 mm).

Thus, studies revealed that at 60 days growth stages treatment M_4 (Soil + Vermicompost + Cocopeat 2:1:1) recorded maximum seedling girth while it was minimum in M_1 (Soil + FYM 3:1).

Effect of growing media on number of leaves

Pooled data indicated that treatment differences were significant at 60 days after germination. At 60 days, after germination treatment M_4 (9.60) recorded significantly maximum number of leaves per seedling which was at par with M_1 (9.35). Treatment M_2 recorded 8.78 leaves whereas M_5 recorded 8.63 leaves per seedling. Minimum leaves per seedling were observed in M_3 (8.51).

Thus, study revealed that the jackfruit seedling produced maximum number of leaves in treatment M_4 (Soil + Vermicompost + Cocopeat 2:1:1). While M_3 (Soil + Vermicompost + Saw dust 2:1:1) produced least number of leaves per seedling.

Emergence and expansion of leaves is occurring under the influence of soil moisture and ambient temperature (Jain, 2000) [12]. Nutrition supplied from the growth media can

influence number of leaves. In current investigation Soil + Vermicompost + Cocoapeat has favoured the maximum production of leaves. Whereas the medium containing saw dust had minimum number of leaves per seedling at all these stages of growth. Nutrients are the key factors for executing many metabolic activities and also hormonal balance within the plant. The variation in number of leaves of the seedlings on different growing media thus obviously appears to be due to different physical and chemical properties of the growing media.

Height, girth and number of leaves are simple and important attributes, which can indicate the influence of growing media on overall growth. In current investigation Soil + Vermicompost + Cocopeat favored maximum height 60 days after sowing. On the contrary Soil + Vermicompost + Saw dust showed minimum magnitudes of plant height at all above mention stages of seedling growth. Similarly girth of seedling was also highly enhanced by Soil + Vermicompost + Cocopeat. More the girth stronger is the vascular bundle of the plant which facilitates better translocation of solute within plant. Thus Soil + Vermicompost + Cocopeat has favoured longitudinal as well as horizontal growth i.e. height and girth. Such phenomenon is decided by division of cell, expansion and elongation of cell which are naturally under the influence of auxins, cytokinins and gibberellins within in the plant. The promotery effect imparted by this particular growth media i.e. Soil + Vermicompost + Cocopeat warrants that these components favour production of natural growth promoting substances like auxins, cytokines and gibberellins (Ramteke, 2015) [27]. In contrast, media having Soil + Vermicompost + Saw dust had minimum value of height and girth which indicated saw dust could be cause for producing certain allelochemical substance which inhibits the activity of auxins, cytokines and gibberellins (Rice, 1979).

Conclusion

Thus, it can be concluded that instead of raising jackfruit seedling only on soil and FYM at 3:1 proportion, it is better to use Soil + Vermicompost + Rice husk + cocopeat in 1:1:1:1 proposition as a growing media. With this media, the soil quantity could be saved by 75 per cent and the by products like cocopeat, and vermicompost developed from leaf litters or any organic material could be effectively used in nursery programme. This imparts the favourable changes in soil properties like water holding capacities, bulk density, pH, EC, OC, major and micro nutrient and most importantly silicon which confer resistance against biotic as well as abiotic stress. This inter relates in establishment of strong and vigour seedling which is a basic requirement of nursery activity. Inclusion of saw dust in growing media hamper the various aspects of germination and seedling growth which could be probably due to adverse allelochemical effect. Rice husk and cocoapeat are the sources of high organic carbon whereas vermicompost provides rather balanced nutrient to the growing crop

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