



Effect of Potting Media on Seed Germination and Seedling Vigour of Jackfruit (*Artocarpus heterophyllus* Lam.) under the Konkan Region of Coastal Maharashtra

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An experiment was carried out to assess the effect of potting media on seed germination and seedling growth for obtaining the vigorous rootstock for softwood grafting in jackfruit (*Artocarpus heterophyllus* Lam.). Healthy seeds of more than 3 g weight were thoroughly washed and treated with Carbendazim (50% WP @ 2 g L⁻¹) for 5 minutes and sown in polybags having size 15 × 20 cm containing five different growing media viz., M₁ - soil + FYM (3:1), M₂ - soil + vermicompost + rice husk (2:1:1), M₃ - soil + vermicompost + sawdust (2:1:1), M₄ - soil + vermicompost + cocopeat (2:1:1) and M₅ - soil + vermicompost + rice husk + cocopeat (1:1:1:1). The potting mixture containing soil, vermicompost, cocopeat and rice husk in 1:1:1:1 proportion was found to be best for obtaining the highest germination percentage (93.0 %), 11.88 days for initiation of germination, 22.88 days for 50% germination and 24.25 days for total germination. The inclusion of sawdust in media showed an inhibitory effect for all the aspects under study.

(**Key words:** Graft success, Graft survival, Growing media, Rice husk, Saw dust, Soil)

Jackfruit (*Artocarpus heterophyllus* Lam.) is an important and remunerative crop commercially cultivated in eastern and southern parts of India. Despite the commercial importance and remunerative nature of jackfruit, its organized orchards are scanty in India. The coastal warm and humid climate of the Konkan region is favourable for jackfruit cultivation. The exact recent area under jackfruit in Maharashtra is not available however, it was estimated that about 312 ha area is under this fruit crop with an annual production of about 12000 tonnes (Phutankar, 2013). It is rarely grown in organized form like mango, banana or citrus. Mostly it is found in homesteads and as a shade tree or a mixed crop. In India, it is widely distributed in Assam, Tripura, Bihar, Uttar Pradesh, Maharashtra and south Indian states of Kerala, Tamil Nadu and Karnataka. In Maharashtra, jackfruit cultivation is confined to the Konkan region in general and Ratnagiri and Sindhudurg districts in particular. As the coastal warm and humid climate is suitable for jackfruit cultivation, the available cultivable wasteland in the region is a potential site for jack fruit planting. Hence, there is a great potential for increasing the area under jackfruit in the Konkan region of coastal Maharashtra.

Commercially softwood grafting technique is being followed for the production of jackfruit sapling in the Konkan region. As there is a huge demand for jackfruit grafts from the coastal region of Maharashtra, there is a need to enhance the production of healthy and vigorous jackfruit graft by standardizing growing media. Preparation of potting mixture plays an important role in the production of healthy rootstock for grafting. There are several types of media which include fine sand mixed in varying proportions with materials such as soil, coir pith, peat moss, sawdust, rice hull etc. Nowadays, vermicompost and cocopeat are also used in various media combinations. However, there is a need for standardizing the proportion of different components for the production of healthy and vigorous rootstock which is a prerequisite for softwood grafting in jackfruit.

Generally, soil + farmyard manure (FYM) is used as a potting mixture for the production of seedlings as a rootstock. For this purpose, a huge quantity of costly soil from cultivable land is used. This can 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

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constitute an immediate requirement. In view of this, the present investigation entitled studies on the effect of growing media on seed germination and seedling vigour of Jackfruit (*Artocarpus heterophyllus* Lam.) was undertaken.

MATERIALS AND METHODS

The experiment was conducted at College of Horticulture, Mulde under Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India during the monsoon season of 2017 and 2018 to study the effect of different potting media on germination percentage and further growth of jackfruit seedlings. The experimental site in the Konkan region of Maharashtra is located at 16°2' N latitude, 73°42' E longitude and 17 m elevation above mean sea level. The region receives an annual rainfall of 3500 mm and the minimum temperature ranges from 12°C to 24°C and maximum temperature from 26°C to 38°C with an average relative humidity of 80%.

Five different combinations of components *viz.*, M₁- soil + FYM (3:1), M₂- soil + vermicompost + rice husk (2:1:1), M₃- soil + vermicompost + sawdust (2:1:1), M₄- soil + vermicompost + cocopeat (2:1:1) and M₅ - soil + vermicompost + rice husk + cocopeat (1:1:1:1) were tried in randomized block design with four replications. Different components as per the treatments were mixed in required quantities on a volume basis. Black polythene bag of 200 gauge and 15 x 20 cm size was used for filling the potting mixtures. Polybags were placed in polyshed of size 60 × 20 feet covering with silpaulin (UV stabilized with 120 GSM) for raising the seedlings. Only fresh, healthy and cleaned seeds weighing more than 3 g of ripe soft flesh type jackfruits as suggested by Doijode (2001) were used for experimentation. Daily watering was done immediately after sowing the seeds until seedling emergence took place. After germination, the seedlings were irrigated on every alternate day. Seed germination was studied from the date of sowing till the end of last seed 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.

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

Number of days required for initiation of germination

The days taken for first germination were calculated from the date of sowing upto the germination of the first seedling.

Days required for 50% germination

The days taken for 50% germination was calculated from the date of sowing upto 50% germination of seedlings.

Germination period

The germination period is the days between the first germination to germination of the last seed.

For statistical analysis, the data on percentage was transformed to arcsine $\sqrt{(100/X)}$ and the actual percentage is shown. The statistical analysis of the data was done by performing the analysis of variance as described by Panse and Sukhatme, (1995). The standard error (SE) of mean and critical difference (CD) at 5% level worked out, wherever the results were significant.

RESULTS AND DISCUSSION

The data for two years (2017 and 2018) on germination percentage, days required for germination, days required for 50% germination and germination period are presented in Table 1 and depicted in Figure 1.

Effect of potting media on germination

During the first year of experimentation (2017), the germination percentage was significantly influenced by various media combinations. Seed germination was maximum (93.0%) with soil + vermicompost + rice husk + cocopeat at 1:1:1:1 proportion followed by soil + vermicompost + rice husk (2:1:1) whereas, minimum germination was recorded in M₃ (69.00%) *i.e.*, soil + vermicompost + saw dust at 2:1:1 proportion.

During second year (2018), also the maximum germination was obtained with treatment M₅ (94.25%) which was significantly superior over rest of the treatments. The successively higher germination was noticed in soil + vermicompost + rice husk at 2:1:1 proportion (81.25%) followed by soil + FYM at 3:1 proportion (80.00%) and soil + vermicompost + cocopeat at 2:1:1 proportion (77.75%) which were at par. The lowest germination *i.e.*, 68.50 % was found in soil + vermicompost + saw dust at 2:1:1 proportion.

The pooled data on germination age indicated that the highest germination was noticed in M₅ (93.63%)

Table 1. Germination percentage, days required for germination, days required for 50% germination and germination period of jackfruit seeds as influenced by different media

Treatments	Germination percentage (%)			Days required for germination			Day require for 50% germination			Germination period (Days)		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
M ₁ - Soil + FYM (3:1) (Control)	83.50 (66.08)	80.00 (63.44)	81.75 (64.76)	13.75	11.00	12.38	24.00	24.75	24.38	26.50	28.00	27.00
M ₂ - Soil + vermicompost + rice husk (2:1:1)	84.00 (66.49)	81.25 (64.35)	82.63 (65.42)	13.75	11.00	12.38	21.50	24.25	22.88	24.50	27.25	25.88
M ₃ - Soil + vermicompost + Saw dust (2:1:1)	69.00 (56.35)	68.50 (55.95)	68.75 (56.15)	13.75	13.00	13.38	26.00	27.50	26.75	23.75	25.50	24.88
M ₄ - Soil + vermicompost + cocopeat (2:1:1)	77.50 (61.74)	77.75 (61.87)	77.63 (61.80)	11.25	13.00	12.13	20.50	28.00	24.25	27.50	23.50	27.00
M ₅ - Soil + vermicompost + rice husk + cocopeat (1:1:1:1)	93.00 (75.39)	94.25 (76.59)	93.63 (75.99)	12.75	11.00	11.88	20.00	25.75	22.88	21.50	21.25	24.25
SEm ±	1.48	1.36	0.98	0.26	0.18	0.38	0.54	0.71	0.68	0.55	1.10	0.65
CD at 5 %	4.38	4.04	2.84	0.76	0.54	1.15	1.60	2.09	1.97	1.62	3.26	1.90

Figures in parenthesis are arcsine transformed values

i.e., in media having soil + vermicompost + rice husk + cocopeat at 1:1:1:1 proportion. It was followed by M₂ (82.60%) and was at par with M₁ (81.75%). Treatment M₃ (soil + vermicompost + saw dust at 2:1:1 proportion) recorded lower germination percentage *i.e.*, 68.75%. Thus, the pooled data indicated that treatment M₅ *i.e.*, soil + vermicompost + rice husk + cocopeat (1:1:1:1 proportion) was found to be the best for obtaining highest germination of jackfruit seeds. Geetha *et al.* (2007) 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 cocopeat 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 content. Moreover, such a mixture has adequate porosity, low bulk density which is ideal for germination of jackfruit seed. Meena *et al.* (2014), Panchal *et al.* (2014) and Purwantoro (2016) 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.

The pooled data on days required for germination indicated that treatment (soil + vermicompost + rice husk + cocopeat at 1:1:1:1 proportion) showed significant results and required 11.88 days for initiation of germination after sowing seeds. However, this treatment was at par with M₁, M₂ and M₄. Seeds sown in treatment M₃ (soil + vermicompost + sawdust at 2:1:1 proportion) took more days (13.38 days) for initiation of germination. This might be because of media containing organic manures, which possess organic acid within them. Therefore, high available moisture and some acids may have helped to reduce the germination time. The findings are in accordance with the earlier findings of Arvind (2014), Ramteke *et al.* (2015) and Jyoti and Beniwal (2016) in papaya.

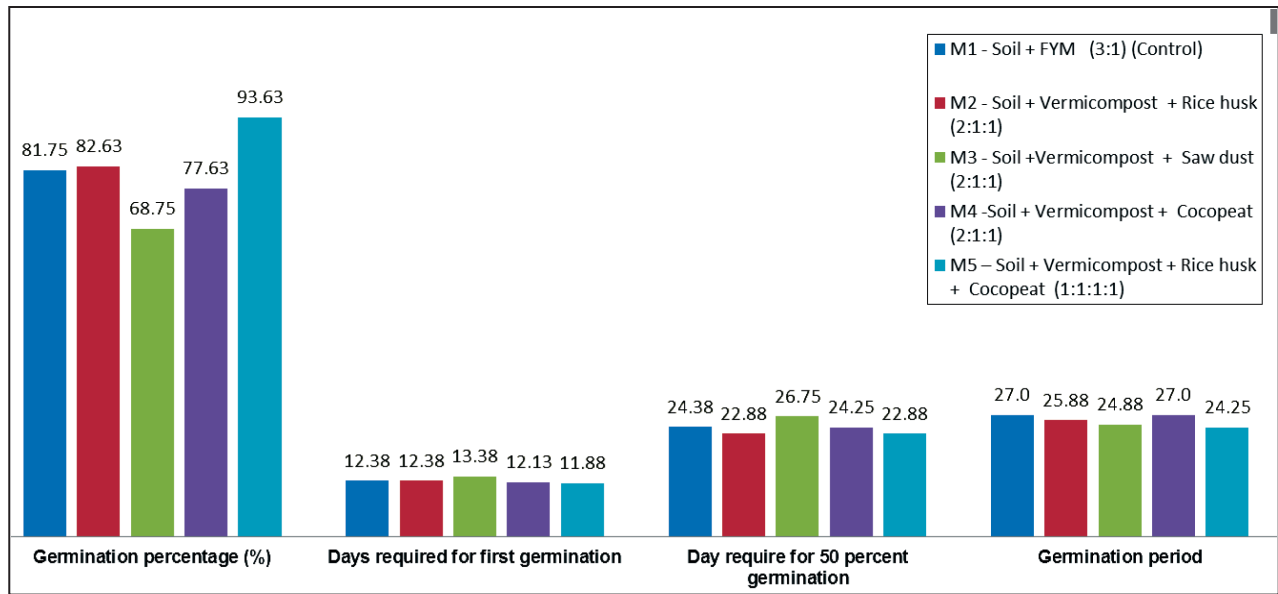


Fig. 1. Effect of different growing media on germination percentage, days required for germination, days required for 50 % germination and germination period on jackfruit seeds

From the data it was noticed that except treatment M_3 (soil + vermicompost + sawdust at 2:1:1 proportion) all other treatments initiated early germination of jackfruit seeds. The results are in line with the findings of Rice (1979) who explained the allelopathic effect of saw dust in growing media. During the year 2017, early 50% germination was recorded at 20.0 days after sowing in the treatment M_5 (soil + vermicompost + rice husk + cocopeat at 1:1:1:1 proportion) and followed by M_4 (20.5 days) and M_2 (21.5 days). Treatment M_1 recorded 24.0 days to attain 50% germination. While treatment M_3 (soil + vermicompost + sawdust at 2:1:1 proportion) took more days *i.e.*, 26.0 days to attain 50% germination.

During the second year, M_2 (soil + vermicompost + rice husk at 2:1:1 proportion) attained 50% germination at earlier (24.25 days) and was at par with M_1 (24.75 days) and M_5 (25.75 days). In the treatment M_3 (soil + vermicompost + sawdust at 2:1:1 proportion) 50% germination was completed at 27.50 days after sowing while M_4 took more days (28.00 days) to attain 50% germination.

The pooled data on days required for 50% germination indicated that treatment M_2 and M_5 had 50% germination at 22.88 days followed by M_4 (24.25 days) and M_1 (24.38 days). It might be due to media having good water holding capacity and moisture supply, organic manures, which possess organic acid within

them. Therefore, high available moisture and some acids may have helped to reduce the germination time. Similar findings were also recorded by Prajapati *et al.* (2017) in acid lime. Treatment M_3 (soil + vermicompost + sawdust at 2:1:1 proportion) had maximum days (26.75 days) for jackfruit seeds to attain 50% germination. Allelochemical released from the saw dust might have inhibitory effect on rate of seed germination. Rice (1979) has reviewed such effect of saw dust from different tree species known as allelochemical effect.

During the first year of experimentation, treatment M_5 (soil + vermicompost + rice husk + cocopeat at 1:1:1:1 proportion) recorded shorter germination period (21.50 days) followed by M_3 (23.75 days) which was at par with M_2 (24.50 days). Treatment M_1 recorded 26.50 days of germination period while significantly long germination period (27.50 days) was recorded in M_4 . During second year, shorter germination period (21.25 days) was found in M_5 (soil + vermicompost + rice husk + cocopeat at 1:1:1:1 proportion) which was at par with M_4 (23.50 days). Significantly longer germination period (28.0 days) was seen in M_1 followed by M_2 (27.25 days) and M_3 (25.50 days) and these treatments were at par. The pooled data indicated shorter germination period in treatment M_5 (24.25 days) followed by M_3 (24.88 days). Treatments M_1 and M_2 exhibited maximum germination period *i.e.*, 27 days which was at par with M_2 (25.88 days).

Thus, data on germination period indicated that mixture containing soil + vermicompost + rice husk + cocopeat at 1:1:1:1 proportion) shortened germination period. This might be due to fresh seed having good vigour and moisture in early stage and media provided good moisture, aeration and water holding capacity which might have shorten germination duration. Vermicompost are rich in organic matter content and have bioactive principle which is considered to be beneficial for root growth as well as increases the water and nutrient holding capacity of the medium, and improve the utilization capacity of plant (Bhardwaj, 2014). Similar findings were reported by Prajapati *et al.* (2017) in acid lime, and by Ramteke *et al.* (2015) and Arvind *et al.* (2014) in papaya.

It is inferred from the present study that potting mixture containing soil + vermicompost + rice husk + cocopeat (1:1:1:1 proportion) was the best for obtaining the highest germination percentage (93.0 %) of jackfruit seeds. This mixture shortened the initiation of germination period (11.88 days) and required only 24.25 days for total seed germination. This potting mixture also facilitates to grow healthy and vigorous seedling in much less time for performing grafting.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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