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Aasif M
Department of Agronomy, Agricultural College and Research Institute, Madurai, Tamil Nadu, India

Paulpandi VK
Department of Agronomy, Agricultural College and Research Institute, Madurai, Tamil Nadu, India

Durai Singh R
Department of Agronomy, Agricultural College and Research Institute, Madurai, Tamil Nadu, India

Saravanapandian P
Department of Soils and Environment, Agricultural College and Research Institute, Madurai, Tamil Nadu, India

T Sivakumar
Department of Seed Science and Technology, Agricultural College and Research Institute, Madurai, Tamil Nadu, India

Corresponding Author:
Aasif M
Department of Agronomy, Agricultural College and Research Institute, Madurai, Tamil Nadu, India

Performance of sesame seedlings (*Sesamum indicum* L.) influenced by different media composition

Aasif M, Paulpandi VK, Durai Singh R, Saravanapandian P and T Sivakumar

Abstract
The world's most traditional oilseed crop sesame (*Sesamum indicum* L.) is often known as the "Queen of oilseeds." Field experiment was conducted during 2019 at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, to study the effect of various media composition on performance of sesame seedlings grown under various media compositions suitable for transplanting. The experiment was laid out in randomized block design with six treatments and four replications. Observations such as seed germination percentage, shoot length, number of leaves, root length, root volume and vigour index are recorded. Among the media combination, results shows that (T_5) red soil: sand: vermicompost: composted coir pith (2:1:1:1) recorded higher seed germination percentage (88.30 %), shoot length (15.26 cm), number of leaves (6.20), root length (3.70 cm), root volume (0.18 cc) and vigour index (1674) and the lowest were recorded under control without any media application.

Keywords: Composted coir pith, farm yard manure (FYM), sesame, seed germination, vermicompost, vigour index

Introduction
Sesamum is one among the major oil seed, belonging to the Pedaliaceae family and commonly cultivated in various regions of the world, and it ranks fourth among widely cultivated oil seeds**.** Sesame commonly known as “poor man’s substitute for ghee” because of its higher amount of fat, proteins, carbohydrates, fiber and essential minerals present in seed with exhibit both nutritive and pharamaceutical properties (Zebib *et al*., 2015) [11]. Due to early senescence and the crop's vulnerability to biotic and abiotic factors, sesame has a much lower yield potential than other oil seed crops and it is mainly cultivated by small and marginal farmers under rainfed conditions, mechanisms for reaching out and demonstrating improved technologies under actual farm conditions are required. In general line sowing and broadcasting were commonly used to cultivate the sesame. Thinning and gap filling seem to be most crucial intercultural actions in these approaches. It takes a large labour force to keep the plant population at its peak. Thinning in sesame requires time and also involves high cultivation cost. As a result of these effects, transplanting in sesame has been recognized as a potential measure to reduce labour hours (Sindhuja *et al*., 2019) [8]. In recent days transplanting in crops becoming popular due to its healthy and uniform disease free seedlings, early and synchronizing crop maturity, effective utilization of land, energy, time and seed material and ultimately reduction in main field duration of the crop (Agarwal *et al.,* 2021) [2]. In order to investigate the benefits of transplanting system, researchers expanded its applications to wide range of crops (Banach *et al*., 2020) [3]. The use of appropriate growing media for seed sowing has a wide impact on seed germination, development and profused root system. Raising sesame seedlings and medium requirements for improved growth and development are determined to be essential in this regard. Further, transplanting in sesame is a new innovative technique that serves to enhance yield with lowering costs of production. As a result, the media requirement for sesame must be optimised and prioritised.

Materials and Methods
The experiment was conducted at Central Farm, Department of Agronomy in Agricultural college and Research Institute, Tamil Nadu Agricultural University, Madurai. The soil of the experimental field was sandy clay loam and taxonomically known as Typic udic Haplustalf. The soil was slightly high in pH (8.1), normal EC (0.24), low in available N (228 kg ha^{-1}), medium in available P (16.7 kg ha^{-1}) but high in available K (327 kg ha^{-1}).

The experiment was laid out in randomized block design with 4 replications. Sesame variety TMV – 7 released from Oilseed research station, Tindivanam was used as a seed material. The various media compositions like FYM, vermicompost, composted coir pith, red soil and sand were used. The raised bed was formed at the size of 2 m × 2 m with 15 cm height. Drainage and irrigation channels were also created to irrigate as well as drain any excess water that may have accumulated due to rain. The top 10 cm of soil in the raised bed was removed, and the seedlings were raised using a mixture of different nursery medium depending on the treatment. The treatment sechdule includes T_1 – Red Soil: Sand: FYM (2:1:1), T_2 – Red Soil: Sand: Vermicompost (2:1:1), T_3 – Red Soil: Sand: Composted Coir pith (2:1:1), T_4 – Red Soil: Sand: FYM: Composted Coir pith (2:1:1:1), T_5 – Red Soil: Sand: Vermicompost: Composted Coir pith (2:1:1:1), T_6 – Control (No media application). Nutrient content of different media composition were analysed and present in Table 1. Red soil and sand in required propotion were thoroughly mixed with FYM, vermicompost and composted coir pith as per the treatment schedule. Growth parameters such as germination percentage, shoot length (cm), Number of leaves, root length (cm), root volume (cc) and vigour index are recorded at 20 days old seedlings. The vigour index of the seedlings was calculated using the formula proposed by Abdul – Baki and Anderson (1973) [1].

Vigour index = Germination percentage × (shoot length + root length)

Table 1: Nutrient content of different media composition

	Total N (%)	Total P (%)	Total K (%)
FYM	0.81	0.30	0.41
Vermicompost	1.6	0.77	1.29
Composted Coir pith	1.34	0.12	1.35
Red Sand	0.40	0.06	0.35

Results and Discussion

Germination percentage

Many factors influence seed germination, type of medium utilized is one of the major factors followed by environmental conditions such as oxygen, water and temperature. Seed germination rate, shoot and root length, number of leaves and vigour index were all significantly influenced by different media compositions are presented in Table 2. The experimental findings revealed that sesame seed germination occurs on the fifth day with two cotyledon leaves. Among the various treatments, the highest germination percentage (88.30) was recorded with red soil: sand: vermicompost: composted coir pith (T_5) and it was statistically at par with red soil: sand: vermicompost (T_2) whereas least germination percentage (57.50) was observed in control (T_6). The same result was revealed by Gohil *et al*., (2018) [4]. Maximum seed germination is obtained mainly due to integrated application of vermicompost with composted coir pith. The organic nature of medium helps primarily by increasing porosity and decreasing compactness. As well as growth regulators in vermicompost such as auxin and gibberlins regulate seed germination process (Meena *et al*., 2017) [7].

Shoot Length and Root Length

The emergence of sesame seedlings was very slow in early days after germination. Different media composition had a significant effect on seedling height and root length. The highest seedling height (15.26 cm) was recorded in the media combination of vermicompost along with composted coir pith (T_5) and it was statistically at par with (T_2). Control treatment (T_6) without application of any media registered lower seedling height (11.40 cm). Gawankar *et al*. (2019) [5] tested various media for growing jack seedlings and discovered that the growing media containing vermicompost along with coir pith was superior in terms of seedling height (54.1 cm). Vermicompost and composted coir pith applied in combination seems to provide a good source of nutrient media mixture for better seedling establishment.

The root length was found to be highest of 3.70 cm with a media composition of red soil: sand: vermicompost: composted coir pith (2:1:1:1) and it was comparable with a media proportion of red soil: sand: vermicompost (2:1:1). Least root length was recorded with the control 1.80 cm (T_6). This might be due to synthesis of hydrolytic enzymes, which release nutrients in the basal medium for nutrient absorption and root system enhancement. The physical environment conditions in coirpith and vermicompost had a good influence on root proliferation, resulting in a higher percentage of seedling survival in the main field following transplantation. This same result was reported by Ishwarya *et al*., (2021) [6].

Number of leaves

In nature, sesame leaves are paired and alternate. The more number of leaves (6.20) are recorded with media combination of red soil: sand: vermicompost: composted coir pith (T_5) followed by red soil: sand: vermicompost (2:1:1). The least number of leaves (3.80) are registered under control (T_6). Combined application of vermicompost with coir pith induces the favourable hormones which involves in cell multiplication and cell division is responsible for more number of leaves (Surakshitha and Sharath Kumar 2015) [9]. Similar outcomes were obtained by sujitha *et al*., (2019) [10] who revealed that vermicompost with coir media proportion of 3:1 registered higher growth attributes in tomato.

Vigour Index and Root Volume

The reason of poor establishment is due to low seed vigour, which ultimately results in yield decrease. Highest vigour index (1674) was recorded with media combination of (T_5) and it was followed by 1471 (T_2). The lowest vigour index was registered under control (759) without any media application. The media composition of sesame seedlings shows significant variation in root volume on 20 DAS. Media combination of red soil: sand: vermicompost: composted coir pith (2:1:1:1) registered highest root volume of (0.18 cc) and it was statistically at par with red soil: sand: vermicompost (2:1:1).Whereas, control (No media application) recorded lowest root volume of 0.13 cc. The optimum pH and nutritional status of the growing medium enhances the improved seedling development and survival. This corroborates with the findings of Sindhuja *et al*., (2019) [8].

Table 2: Effect of different nursery media on seed germination, seedling height, number of leaves, root length, root volume and vigour index of sesame seedlings.

Treatment	Germination (%)	Seedling Height (cm)	Number of Leaves	Root Length (cm)	Vigour Index	Root volume (cc)
T_1	72.70	12.86	4.20	2.20	1095	0.15
T_2	83.50	14.32	5.70	3.30	1471	0.17
T_3	79.20	13.78	5.00	2.80	1313	0.16
T_4	77.40	13.43	4.60	2.50	1233	0.15
T_5	88.30	15.26	6.20	3.70	1674	0.18
T_6	57.50	11.40	3.80	1.80	759	0.13
SE.d	3.59	0.51	0.12	0.08	67.12	0.01
CD (P = 0.05)	7.49	1.08	0.24	0.16	140.23	0.02

Conclusion

From this study, it may be concluded that integral application of vermicompost with composted coir pith is the effective media combination for better establishment of seedlings when compared to sole application of vermicompost or coir pith. Media combination of red soil: sand: vermicompost: composted coir pith (2:1:1:1) is the most suitable growing media for higher seed germination, seedling height, root length, root volume, number of leaves and vigour index of TMV 7 sesame seedlings for transplanting.

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