Madras Agric. J., 2021; https://doi.org/10.29321/MAJ.10.000568

RESEARCH ARTICLE

Assessing Different Media Composition on Germination, Growth and Yield of Transplanted Sesame (*Sesamum indicum* L.)

Aasif M[1]*, Paulpandi V K[1], Durai Singh R[1], Saravanapandian P[2] and Sivakumar T[3]

[1] Department of Agronomy, Agricultural College and Research Institute, Madurai - 625 104
[2]Department of Soils and Environment, Agricultural College and Research Institute, Madurai - 625 104
[3]Department of Seed Science and Technology, Agricultural College and Research Institute, Madurai - 625 104

ABSTRACT

Sesamum, a traditional oilseed crop, is susceptible to poor plant establishment due to various biotic and abiotic factors for which transplanting is a suitable option. Still, suitable media for promoting the growth and establishment of sesame seedlings have not yet been exploited. Therefore, a preliminary field experiment was conducted in 2019 at Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, India, to study the effect of various media compositions on the performance of transplanted sesame. Media compositions such as red earth, FYM, vermicompost and composted coir pith were used. The experiment was laid out in randomized block design with four replications. Results revealed that higher seed germination percentage (88), establishment percentage (94), vigor index (1674), seedling height (15 cm), capsules plant^{-1}(83), seeds capsule^{-1} (58), and seed yield (839 kg ha^{-1}) were recorded in media comprising red earth: sand: vermicompost: composted coir pith (2:1:1:1) followed by red earth: sand: vermicompost (2:1:1). Therefore, the media composition of red earth: sand: vermicompost: composted coir pith is highly suitable for promoting growth, seedling vigor, and yield enhancement in transplanted sesame.

Keywords: *Composted coir pith; Sesame; Seed germination; Vermicompost; Vigor index; Yield*

INTRODUCTION

Sesamum (*Sesamum indicum*L.) is one of the major oilseeds belonging to the Pedaliaceae family and is cultivated in various regions of the globe. It ranks fourth among widely cultivated oilseeds in India (Shamsuzzoha *et al.*, 2019). Sesame is commonly known as “poor man’s substitute for ghee” because of its higher amount of fat (4.46 – 6.19%), proteins(22.58 – 24.27 %), carbohydrates (8.3 – 11.69%), fibre (5.60 – 6.26%) and essential minerals present in the seed which exhibit both nutritive and pharmaceutical properties (HaftomZebib *et al*., 2015).

Due to early senescence and the crop’s vulnerability to biotic and abiotic factors, sesame has a much lower yield potential than other oilseed crops and small and marginal farmers mainly cultivate it under rainfed conditions. The primary reason for the decrease in Yield is the poor plant establishment under line sowing (or) broadcasting methods (Kushahwah *et al.*, 2018). Moreover, thinning and gap-filling seem to be the most crucial intercultural operations but are laborious and uneconomical. As a result of these effects, transplanting in sesame has been recognized as a potential measure to reduce labor hours (Sindhuja *et al*., 2019).

Recently, transplanting in crops has become 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). Appropriate growing media for seed sowing has a wide impact on seed germination, development and profuse root system. The quality of seedlings is influenced by media composition, which acts as a source of nutrients for plant growth (Wilson *et al*., 2001). Past studies were undertaken on growth medias in different crops.

The suitable transplanting media plays a vital function in enhancing the growth and development of seedlings, resulting in a higher yield in the right environment (Jaiswal *et al.*, 2017). The appropriate media for transplanting seedlings into the main field with saturated field conditions aids seedlings in escaping transplant shock and continuing to grow. The soil and ideal moisture content are also crucial in transplanted crops because this aids the

*Corresponding author’s e-mail: aasifagri001@gmail.com

roots put forth the development and establishment of the crop. Kademani *et al*. (2017) revealed that germination percent, seedling height, seedling vigor, root length, and total biomass were recorded higher in media having red soil + sand + vermicompost + *Rhizobium*+ PSB + *Pseudomonas fluorescence*. Growing media with composted coir pith influenced higher seed germination percent and germination index when compared to other growing media (Raj and Krishnasamy 2015).

Transplanting in sesame is a new innovative technique that enhances Yield by lowering the cost of production, but a suitable growing media requirement is the need of the hour for which the research was conducted.

MATERIALS AND METHODS

The experiment was conducted at Central Farm, Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, India. The experimental site is located 9° 58´ N and 78° 12´ E and 147 m above mean sealevel. The climate of the location is semi-arid type. The soil of the experimental field was sandy clay loam and taxonomically known as TypicudicHaplustalf. The soil was slightly high in pH (8.1), normal EC (0.24), low in available N (228 kg ha^{-1}), media in available P (16.7 kg ha^{-1}), but high in available K (327 kg ha^{-1}).

The various media compositions like FYM, vermicompost, composted coir pith, red earth, and sand were thoroughly mixed as per the treatment. The treatment schedule included T_1 – Red Earth: Sand: FYM (2:1:1), T_2 – Red Earth: Sand: Vermicompost (2:1:1), T_3 – Red Earth: Sand: Composted Coir pith (2:1:1), T_4 – Red Earth: Sand: FYM: Composted Coir pith (2:1:1:1), T_5 – Red Earth: Sand: Vermicompost: Composted Coir pith (2:1:1:1), T_6 – Control (No media application). The experiment was laid out in randomized block design with six treatments with four replications. Sesame variety TMV – 7 released from Oilseed research station, Tindivanam, India, was used as a seed material.

The raised bed was formed at 2 × 2 m with 15 cm height. Drainage and irrigation channels were also created to irrigate and 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 media depending on the treatment. Nutrient content of different media compositions was analyzed,and presented in Table 1. Growth parameters such as germination percentage (%), shoot length (cm), number of leaves, root length (cm), root volume (cc), and vigor index are recorded at 20 days old seedlings in the nursery. The vigor index of the seedlings was calculated using the formula proposed by Abdul-Baki and Anderson (1973).

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

In addition, the transplanted sesame seedlings were evaluated for the establishment percentage (%), yield attributes *viz.*, capsules $plant^{-1}$, seeds $capsule^{-1}$ and Yield (kg ha^{-1}) are recorded in 20 days old seedlings transplanted into the main field.

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

STATISTICAL ANALYSIS

The data recorded were statistically analyzed under Randomized Block Design (RBD) for analysis of variance (ANOVA) at 5% level of significance using the Star package from IRRI, Philippines.

RESULTS AND DISCUSSION

Germination percentage

Among the significant factors influencing seed germination, the type of media utilized is one of the major factors responsible, followed by environmental conditions such as oxygen, water, and temperature. Different media compositions showed a significant difference in the seed germination rate, shoot and root length, number of leaves and vigor index (Table 2). The experimental findings revealed that sesame seed germination occurs on the fifth day with two cotyledon leaves. Among the various treatments, the higher germination percentage (88) was recorded with red earth: sand: vermicompost: composted coir pith (T_5) and it was on par with red earth: sand: vermicompost (T_2) whereas lower germination percentage (58) was observed in control (T_6). Similar results were revealed from the findings of Gohil *et al*. (2018) wherein maximum seed germination was obtained mainly due to integrated application of vermicompost with composted coir pith. The organic nature of the media might have helped primarily by increasing porosity and decreasing compactness. In addition, growth regulators in vermicompost such as auxin and gibberellins could have regulated the seed germination process (Vivek and Duraisamy, 2017).

Shoot Length and Root Length

The emergence of sesame seedlings was very slow in the early days after germination. Different media compositions significantly affected seedling height and root length (Table 2). The higher seedling height (15) was recorded in the media combination

of vermicompost along with composted coir pith (T_5) and was followed by red earth: sand: vermicompost (2:1:1) and red earth: sand: composted coir pith (2:1:1). Control treatment (T_6) registered lower seedling height (11.4 cm). Similarly, in a study conducted by Gawankar *et al*. (2019) on various media for growing jack seedlings, it was observed that the growing media containing vermicompost + coir pith was superior in seedling height (54.1 cm). Vermicompost and composted coir pith applied in combination seem to provide a good source of nutrient media mixture for better seedling establishment.

The root length was found to be most significant (3.70) with a media composition of red earth: sand: vermicompost: composted coir pith (2:1:1:1), and it was onpar with a media proportion of red Earth: sand: vermicompost (2:1:1). Minimum root length was recorded with the control 2.20 cm (T_6). This might be because of hydrolytic enzyme synthesis, which releases nutrients in the basal media for nutrient absorption and root system enhancement. The physical and biological conditions in coirpith and vermicompost had a good influence on root growth, resulting in a higher percentage of seedling survival in the main field followed by transplantation (Malar *et al*., 2020). This was following the findings of Ishwarya *et al*. (2021) in *Gymnema sylvestre* (L.).

Number of leaves

Sesame leaves are paired and alternate in orientation. The treatment effect revealed more number of leaves (6.20) recorded with media combination of red earth: sand: vermicompost: composted coir pith (T_5) which is on par with red earth: sand: vermicompost (2:1:1) while lower number of leaves (3.80) was registered under control Table 2). The combined application of vermicompost with coir pith induces the favourable hormones involved in cell multiplication and cell division could have been more responsible for producing a higher number of leaves (Surakshitha and Kumar, 2015). A similar outcome was obtained by Sujitha *et al*. (2019), who revealed that vermicompost with coir media proportion of 3:1 registered higher growth attributes in tomatoes.

Table 2. Effect of different nursery media on seed germination percentage, 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)	Root volume (cc)	Vigor Index
RE: S: FYM (2:1:1)	72.7±28.7^{b}	12.9±5.1^{bc}	4.20±1.66^{bc}	2.50± 0.99^{bc}	0.15±0.06^{b}	1095±433^{b}
RE: S: VC (2:1:1)	83.5±33.0^{a}	14.3±5.7^{b}	5.70±2.25^{a}	3.30±1.30^{a}	0.17±0.07^{a}	1471±582^{a}
RE: S: CCP (2:1:1)	79.2±31.3^{ab}	13.8±5.5^{b}	5.00± 1.98^{b}	2.80±1.11^{b}	0.16±0.06^{ab}	1313±519^{ab}
RE: S: FYM: CCP (2:1:1:1)	77.4±30.6^{ab}	13.4±5.3^{b}	4.60±1.82^{b}	2.63± 1.04^{bc}	0.15±0.06^{b}	1233±487^{b}
RE: S: VC: CCP (2:1:1:1)	88.3±34.9^{a}	15.3±6.0^{a}	6.20±2.45^{a}	3.70±1.46^{a}	0.18±0.07^{a}	1674±662^{a}
Control (No media)	57.5±22.7^{c}	11.4±4.5^{c}	3.80±1.50^{c}	2.20± 0.87^{c}	0.15±0.06^{b}	806±319^{c}
LSD @ 5%	7.36	0.91	0.63	0.38	0.014	206.9

RE – Red Earth; S – Sand; FYM – Farm Yard Manure; VC – Vermicompost; CCP – Composted Coir Pith

Vigour Index and Root Volume

The poor establishment in sesame is due to low seed vigor, which ultimately results in a yield decrease. Results indicated higher vigor index (1674) was recorded with media combination of (T_5), and it was on par with T_2 (1471) (Table 2). The lower vigor index was registered under control (806) without any media application. The media composition of sesame seedlings shows significant variation in root volume on 20 DAS. Media combination of red earth: sand: vermicompost: composted coir pith (2:1:1:1) registered maximum root volume of (0.18 cc) and was statistically on par with red earth: sand: vermicompost (2:1:1) whereas control (No media application) recorded lower root volume of 0.15 cc. The optimum pH and nutritional status of the growing media could have enhanced the seedling development and survival. This corroborates with the findings of Sindhuja *et al*. (2019).

Establishment Percentage

Growing media significantly influenced the establishment percent of sesame seedlings at 7 days after transplanting in the main field (Table 3). The maximum establishment percent 93.5 was recorded under red earth: sand: vermicompost: composted coir pith (2:1:1:1), while a minimum 77.0 was registered under control (no media application). These findings are in accordance with that of Abirami *et al.* (2010). The media, including vermicompost and coir pith was much more suited for root development and also had a water retention capacity than red earth and vermicompost alone. Favorable physical and biological conditions in composted coir pith and vermicompost positively influenced root growth, which aids in enhanced seedling establishment percentage in the main field after transplantation (Meena *et al*., 2017).

Yield attributes and Yield

Different yield parameters such as a number of capsules hill^{-1} and the number of seeds capsule^{-1} influenced the seed yield of transplanted sesame (Table 3). Media composition had a significant effect on the yield attributes of sesame.Red earth: sand: vermicompost: composted coir pith (2:1:1:1) produced more number of capsules per plant (82.5), number of seeds per capsule (57.8) and higher seed (839) and stalk yield (2879) followed by red earth: sand: vermicompost (2:1:1). This may be because well-developed root system in vermicompost and composted coir pith had resulted in higher water uptake and translocation along with nutrients from the rhizosphere and also a continuous transfer of sink during the reproductive phase resulted in more seeds per capsule (Elakiya and Arulmozhiselvan 2021). Therefore, effective resource utilization leads to increased plant height and yield parameters, resulting in higher seed yield. This is in accordance with the findings of Abbey *et al.* (2012).

Table 3. Effect of different nursery media on seedling establishment percentage, capsules plant^{-1}, Seeds capsules^{-1}, seed yield and stalk yield of transplanted sesame

Treatment	Establishment (%)	Capsules plant^{-1}	Seeds capsules^{-1}	Seed Yield (kg ha^{-1})	Stalk Yield (kg ha^{-1})
RE: S: FYM (2:1:1)	78.9± 31.2^{cd}	69.7± 27.6^{cd}	47.6±18.8^{c}	701± 277^{cd}	2404± 950^{cd}
RE: S: VC (2:1:1)	88.5±34.9^{b}	78.1±30.9^{b}	54.9±21.6^{b}	791±313^{b}	2713±1073^{b}
RE: S: CCP (2:1:1)	83.9±33.2^{c}	74.1±29.3^{c}	51.9±20.5^{b}	747±295^{c}	2565±1014^{c}
RE: S: FYM: CCP (2:1:1:1)	82.0±32.4^{c}	72.4±28.6^{c}	50.7±20.0^{bc}	729±288^{c}	2503±989^{c}
RE: S: VC: CCP (2:1:1:1)	93.5±36.9^{a}	82.6±32.6^{a}	57.8±22.7^{a}	839±332^{a}	2879±1138^{a}
Control (No media)	77.0± 30.5^{d}	67.9± 26.9^{d}	45.7±18.1^{c}	682± 270^{d}	2341± 925^{d}
LSD @ 5%	4.23	3.73	3.07	40.2	137.8

RE – Red Earth; S – Sand; FYM – Farm Yard Manure; VC – Vermicompost; CCP – Composted Coir Pith

CONCLUSION

Integral application of vermicompost with composted coir pith is the effective media combination for better establishment of seedlings compared to sole application of vermicompost or coir pith. Media combination of red earth: Sand: vermicompost: composted coir pith (2:1:1:1) is the most suitable growing media for higher seed germination, vigor index, establishment percentage, yield attributes and Yield of TMV 7 sesame seedlings for transplanting.The transplanting ability of several genotypes of black, brown, and white sesame may be investigated in the future with nutrient and weed management.

ACKNOWLEDGEMENT

The authors thank the FIST scheme from the Department of Science and Technology, Government of India, for laboratory and equipment support at the Department of Agronomy, Agricultural College and Research Institute, Madurai, Tamil Nadu.

Conflict of interest

The authors here by declare no conflict of interest.

Ethics statement

No specific permits were required for the described field studies because no human or animal subjects were involved in this research.

Consent for publication

All the authors agreed to publish the content.

Competing interests

There were no conflict of interest in the publication of this content.

Author contributions

Aasif M – Idea conceptualization, Experiment, Writing original draft; Paulpandi V K - Idea conceptualization, Guidance, Writing- reviewing & editing; Durai Singh R - Idea conceptualization, Guidance, Writing- reviewing & editing; Saravanapandian P - Guidance, Writing- reviewing & editing; Sivakumar T - Guidance, Writing- reviewing & editing

REFERENCES

Abdul Baki, A. A. and J. D. Anderson. 1973. Vigor determination in soybean seed by multiple criteria 1. *Crp. sci.,* **13(6):** 630-633.

Abbey, L., Young, C., Teitel-Payne, R. and K. Howe. 2012. Evaluation of proportions of vermicompost and coir in a medium for container-grown Swiss chard. *Int. j.veg. sci.*, **18(2):** 109-120.

Abirami, K., Rema, J., Mathew, P. A. Srinivasan, V. and S. Hamza. 2010. Effect of different propagation media on seed germination, seedling growth and vigour of nutmeg (*Myristica fragrans* Houtt.). *J. med. pl. res.*, **4(19):** 2054- 2058.

Agarwal, P., Saha, S. and P. Hariprasad. 2021. Agro-industrial-residues as potting media: physicochemical and biological characters and their influence on plant growth. *Bio. con. and bio.*, 1-24.

Elakiya, N. and K. Arulmozhiselvan. 2021. Effect of salinity and composition of growing media on growth and Yield of ribbed gourd in soilless culture under matric suction irrigation. *The Pharma Inno. J.,***10(10):** 578-585.

Gohil, P., Gohil, M., Rajatiya, J., Halepotara, F., Solanki, M., Malam, V. R. and R. Barad. 2018. Role of Growing Media for Ornamental Pot Plants. *Int. J. Pure App. Biosci.,* **6(1):** 1219-1224.

Gawankar, M. S., Haldankar, P. M., Haldavanekar, P. C., Salvia, B. R. and B. M. Jamadagni. 2019. Studies on seed germination and seedling growth in Jackfruit (*Artocarpus heterophyllus* L.am.) as influenced by media. *Int. J. Chem. Studies.*, **7:** 1699-705.

Ishwarya, M. S., Ramessh, C., Singh, R. D., Palanikumar, M. and T. Samsai. 2021. Evaluating growing media and plant growth regulators on the establishment of rooting in Sirukurinjan (*Gymnema sylvestre* L.) in Southern Tamil Nadu. *The Pharma Inno. J.*,**10(10):** 1975-1978.

Jaiswal, A.K., JP singh, Tomar, S., Abhishek.and Thakur. N. 2017. Effect of Seedlings Age on Growth, Yield Attributes and Yield of Tomato (*Lycopersicon esculentum* Mill.).*Int. J. of Curr. Micro. and App. Sci.,***6:** 1521-1524.

Kademani, A. J., Mallikarjunagowda, A. P., Anilkumar, S. and Dayamani, K. J. 2017. Studies on Effect of Different Propagating Media and Plant Growth Promoting Rhizobacteria on Seed Germination and Seedling Vigour of *Rauvolfia tetraphylla* Linn. *Int. J. Pure App. Bio. sci.*, **5(6)**: 1411-1419.

Kushahwah, R. S., Rupendra, K., Sharma, U. C., Bhadauria, N. S., Kushwaha, N. K. and K. Chandan, 2018.Impact of frontline demonstration technologies on sesame crop yield in Bhind district (MP). *In. Res. J. of Ext. Edu.*, **18(2)**: 97-100.

Malar, A., Suresh, J., Rajamani, K. and M. Boomiga, 2020.Effect of different growing media on growth and development of rooted cuttings of Indian sarsaparilla (*Hemidesmus indicus* L.). *Med. Plants-Int. J. of Phy. and Rel. Ind.*, **12(1)**: 11-14.

Meena, A. K.,Garhwal, O. P., Mahawar, A. K. and S. P. Singh. 2017. Effect of different growing media on seedling growth parameters and economics of papaya (*Carica papaya* L) cv. Pusa delicious. *Int J Curr. Micr. Appl Sci.*, ***6*(6):** 2964-2972.

Raj, S. B. and S. Krishnasamy. 2015. Effect of nursery media on seed germination percentage, vigour index, germination index and rate of emergence of pigeonpea seedlings under open and shade net conditions. *Int. J. of Agri. Sci. and Res.*, **5(4)**: 263-268.

Sindhuja, S., Ragavan, T., Venkataraman, N.S., and T. Sivakumar. 2019. Effect of media composition on seed germination, shoot length and vigour index of sesame (*Sesamum indicum* L.). *Int J Chem Stud.*, **7(3):** 3263-3265.

Shamsuzzoha, M., Kundu, P. K., Rouf, M. A., Afrose, R. and M. Mostofa. 2019. Effect of combined application of nitrogen and boron on Yield contributing characters and Yield of sesame (*Sesamum indicum* L.). *Annual Res. and Rev in Bio.*, 1-12.

Surakshitha, N. C. and M. S. KUMAR. 2015. Growing Media Supplemented with Vermicompost and Glomusfasciculatum Acts as Gestation Period Reducers in Jamun (*Syzygium cuminii* L. Skeels) Seedlings. *Tren. in Biosci.,***8 (7):** 1666-1675.

Sujitha, E., Nikhil, H. G., V. Ajay, N. and K. S. Aneena. 2019. Physico-Chemical Properties and Plant Growth Characteristics of Tomatoes Grown Using Different Media. *Crnt. J. of App. Sci. and Tec.*, **38(5):** 1-6.

Vivek, P. and V. M. Duraisamy.(2017). Study of growth parameters and germination on tomato seedlings with different growth media. *Int. J. Agric. Sci. Res.*, **7(3)**: 461-470.

Wilson, S. B., Stoffella, P. J. and D. A. Graetz. 2001. Use of compost as a media amendment for containerized production of two subtropical perennials. *J. of Env. Hor.*, **19(1):**37-42.

Zebib, H., Bultosa, G. and S. Abera. 2015. Physico-chemical properties of sesame (*Sesamum indicum* L.) varieties grown in Northern Area, Ethiopia. *Agri. Sci.*, ***6*(02)**: 238.