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K Harsha Vardhan
PG Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, Dr. Y.S.R. Horticultural University, Venkataramannagudem, Andhra Pradesh, India

K Ramachandrudu
Principal Scientist (Hort.), ICAR-Indian Institute of Oil Palm Research, Pedavegi, Eluru, Andhra Pradesh, India

M Kalpana
Professor (Hort.), Department of Plantation, Spices, Medicinal and Aromatic Crops, Dr. Y.S.R. Horticultural University, Venkataramannagudem, Andhra Pradesh, India

B Peda Babu
Associate Professor (Soil Science), Department of Soil Science, Dr. Y.S.R. Horticultural University, Venkataramannagudem, Andhra Pradesh, India

M Paratpara Rao
Associate Professor (Genetics and Plant Breeding), Department of Genetics and Plant Breeding, Dr. Y.S.R. Horticultural University, Venkataramannagudem, Andhra Pradesh, India

Corresponding Author:
K Harsha Vardhan
PG Scholar, Department of Plantation, Spices, Medicinal and Aromatic Crops, Dr. Y.S.R. Horticultural University, Venkataramannagudem, Andhra Pradesh, India

Influence of various growing media on morphological traits of oil palm (*Elaeis guineensis* Jacq.) seedlings raised in pro trays during primary nursery stage

K Harsha Vardhan, K Ramachandrudu, M Kalpana, B Peda Babu and M Paratpara Rao

Abstract
A study on influence of various growth media on the morphological traits of oil palm (*Elaeis guineensis* Jacq.) seedlings raised in pro trays during the primary nursery stage was conducted at ICAR-Indian Institute of Oil Palm Research, Pedavegi during 2022-23. The experiment was laid out in CRD with six treatments involving vermicompost, decanter cake, palm oil mill effluent sludge, empty fruit bunch fibre compost, coco peat compost and soil control. The results were found significant among the treatments for seedling height, leaf area and biomass except leaf production. Among the various treatments, maximum seedling height (33.18 cm), leaf area (421.15 cm^2) and total dry (3.74g) biomass were resulted in decanter cake as compared with control and conventional practice.

Keywords: Mill wastes, pro trays, biomass, nursery, oil palm

Introduction
Oil palm (*Elaeis guineensis* Jacq.) is perennial, high productive and leading vegetable oil crop globally and grown mainly in Indonesia, Malaysia and Thailand. Area under oil palm in India is picking up at faster rate and grown commercially to an extent of 3.70 lakh hectares and Andhra Pradesh leads both in area (1.63 lakh ha) and production (1.4 million tons of fruit bunches) (Anonymous, 2021-22) [3]. This crop remains productive for about 30 years and is mainly propagated by seedlings. Seedlings are raised in poly bags at nursery for 12 months *i.e.*, 4 months in primary stage under shade and 8 months in secondary stage in open condition. Soil is mainly used as a growing medium in oil palm nursery, but of late availability of good quality soil has become constraint and nursery growers are looking for some alternative medium particularly soil less medium. The choice of growing medium greatly affects growth and vigour of the seedlings in oil palm. To ensure strong growth, the medium must include a defined soil proportion or consist entirely of organic materials. Raising oil palm seedlings at the nursery and distribution of the same to farmers has been entrusted to oil palm processing companies in the country. Oil palm industry generates a lot of waste in the form of empty fruit bunch fibre, palm oil mill effluent, decanter cake, boiler ash, mesocarp fibre and nut shells. There is a good scope for using of decomposed empty fruit fibre, POME sludge and decanter cake as growing media for raising oil palm seedlings. These wastes are cost effective, organic in nature, eco-friendly and consist of valuable nutrients (Vakili *et al*., 2014) [16] for plants and right substitute for chemical fertilizers. Recently, oil palm nursery growers have started using pro trays in place of poly bags (conventional practice) for raising seedlings during the primary stage of nursery. Pro tray technology is quite cost effective and offers a scope for soil less media. Presently, coco peat and vermicompost are widely used media for raising vegetable seedlings in India. This gives oil palm processors a chance to use their own mill waste rather than purchasing media like coco peat and vermicompost. In view of richness and availability of enough oil palm mill waste, experiment was taken up to study effect of oil palm mill waste along with conventional organics on growth and vigour of oil palm seedlings in primary nursery stage.

Materials and Methods
The present experiment was conducted at the ICAR-Indian Institute of Oil Palm Research, Pedavegi, Eluru**.** Experiment was laid out in CRD with six treatments and five replications. Uniform, healthy and 65 days old oil palm seed sprouts of *Tenera* hybrid (89 CD x 74 P) was

used as a planting material for the study. Black coloured 12 cavities pro trays (42 cm L x 28 cm W) with cavity size of 10 cm x 6 cm x 4.5 cm were used for raising seedlings in primary stage under agro shade net house covered with 50 per cent UV stabilized high density poly ethylene (HDPE) shade net. The treatments included soil (T_1), vermicompost (T_2), decanter cake (T_3), palm oil mill effluent (POME) sludge (T_4), empty fruit bunch fibre (EFB) compost (T_5) and coco peat compost (T_6). The morphological parameters namely, seedling height, number of leaves, leaf area, total fresh and dry biomass of oil palm seedlings were recorded after completion of primary nursery stage (4 months) by using standard methods. Leaf area of the seedlings was calculated by measuring the length and width of the third leaf from the top by using formula by non destructive method (Hardon *et al*., 1969 and Corley *et al*. 1971) [6, 4]. Five seedlings were selected randomly from each treatment and separated into root and shoot. Roots were thoroughly washed with tap water to remove adhering soil particles and excess moisture on root surface was removed by gentle swabbing with blotting paper. Fresh root and shoot portions kept in hot air oven at 60 °C, total dry biomass was estimated by using top pan electronic balance. The data obtained were analyzed using WASP software.

Results and Discussion

The results were found significant among the treatments for all the character s except leaf production per seedling (Table 1). An examination of the data reveals a significant effect of growing media on the plant height and differences were significant among the treatments. Among the growing media tested, decanter cake (T_3) exhibited the highest seedling height, measuring at 32.57 cm and closely followed by the treatment T_2 with a height of 32.41 cm and T_5 at 32.37 cm height. Conversely, the lowest seedling height of 23.81 cm was recorded in the control (T_1). An impressive growth of seedlings in treatment T_3 must be attributed to its high nitrogen content which in turn might have enhanced vegetative growth, promoting better nutrient utilization within the growing media by the seedlings. This outcome aligns with studies conducted by Annapurna *et al*., (2013) [2] in sandalwood, Suryanto *et al*., (2015) [14] and Ramachandrudu *et al*., (2020) [13] in oil palm and Alam *et al*., (2022) [1] in Brazilian spinach.

Results for leaf production per seedlings were not significant among the treatments (Table 1 & Fig. 2). However, relatively higher number leaves per seedlings was observed with EFB compost as compared with control where in lower leaf production was noticed. This finding is corroborated by research by Lamidi and Dada (2023) [8] in cocoa and citrus and Loh *et al*., (2019) [9] in *Ipomea aquatica*.

There were significant differences among the treatments for leaf area of seedlings (Table 1 & Fig.3). The treatment T_3 (421.15 cm^2) recorded the maximum leaf area which is markedly superior to other treatments except T_5 (406.82 cm^2) while the minimum leaf area was noticed in T_1 (159.60 cm^2). Treatments T_3 and T_5 were at par with each other. Similarly, results were not significant between T_2 (335.84 cm^2) and T_4 (326.07 cm^2). More leaf area in T_3 can be ascribed to improved nutrient availability leading to enhanced plant uptake and increased photosynthetic activity. It's plausible that a strong correlation exists between chlorophyll levels and leaf area as higher chlorophyll content signifies increased nitrogen accumulation in leaves. The present results are similar to reports by Embrandiri *et al*., (2013) [5] in lady's finger, Kim *et al*., (2021) [7] in apple, Suryanto *et al*., (2015) [14], Rahman *et al*., (2021) [12] and Osman *et al*., (2021) [10] in oil palm.

The perusal of the results (Table 1 & Fig.4) indicated that among different treatments the higher production of the total fresh biomass was recorded in T_3 (11.79 g) which was at par with the treatment T_4 (11.78 g) followed by T_5 (11.18 g) whereas treatment T_1 showed the lowest total fresh biomass (5.90 g) among all the treatments.

The decanter cake which has higher N content may be responsible for higher vegetative growth and development of oil palm seedlings. Improved fresh biomass production under T_3 might be attributed to better photosynthetic rate which in turn might have confirmed greater synthesis, translocation and accumulation of photosynthates. These results are in correspondence with findings by Embrandiri *et al.*, (2013) [5] in lady's finger and Ramachandrudu *et al.*, (2020) [13] in oil palm.

Similarly, significant differences were observed among different treatments for total dry biomass of the seedlings. Higher production of dry biomass was registered in T_3 (3.74 g) followed by T_5 (3.47 g) and both were at par with each other and significantly better than other treatments. Of all the treatments, the treatment T_1 resulted in lowest production of total dry biomass (1.55 g). The increase in total biomass might be due to better utilization of nutrients present in the decanter cake. The growth performances and biomass production of oil palm seedlings were significantly affected by the various ratios of treated oil palm decanter cake (OPDC) (Osman *et al.*, 2021) [10] in oil palm. Thornley and Johnson, (1990) [15] reported that increase in dry matter could be attributed to photosynthesis and nutrient concentration in vegetative plants.

Table 1: Effect of different growing media on morphological parameters of oil palm seedling raised during primary nursery stage.

Treatments	Seedling height (cm)	Number of Leaves	Leaf area (cm^2)	Total fresh Biomass(g)	Total dry Biomass(g)
T_1	23.81	4.56	159.60	5.90	1.55
T_2	32.41	5.00	335.84	9.39	2.92
T_3	33.18	5.11	421.15	11.79	3.74
T_4	30.79	4.89	326.07	11.78	3.29
T_5	32.37	5.22	406.82	11.18	3.47
T_6	27.33	4.78	253.23	8.56	2.55
SE(m) $\pm$	0.94	0.11	12.54	0.37	0.22
C.D (0.05)	5.05	NS	66.97	2.01	0.40
C.V %	9.46	7.13	11.87	11.60	7.77

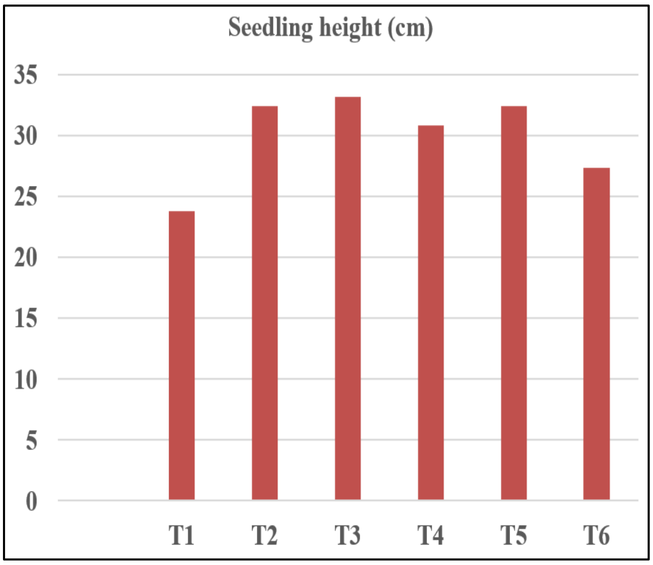

Fig 1: Effect of different growing media on seedling height of oil palm seedling raised during primary nursery stage.

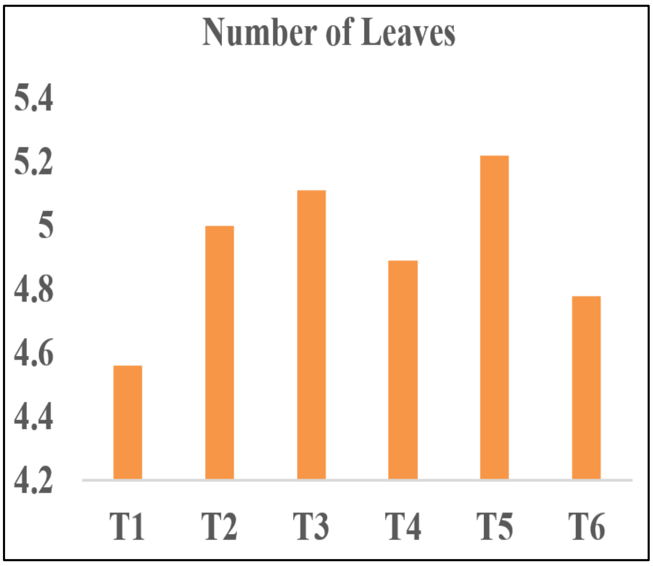

Fig 2: Effect of different growing media on production of leaves of oil palm seedling raised during primary nursery stage.

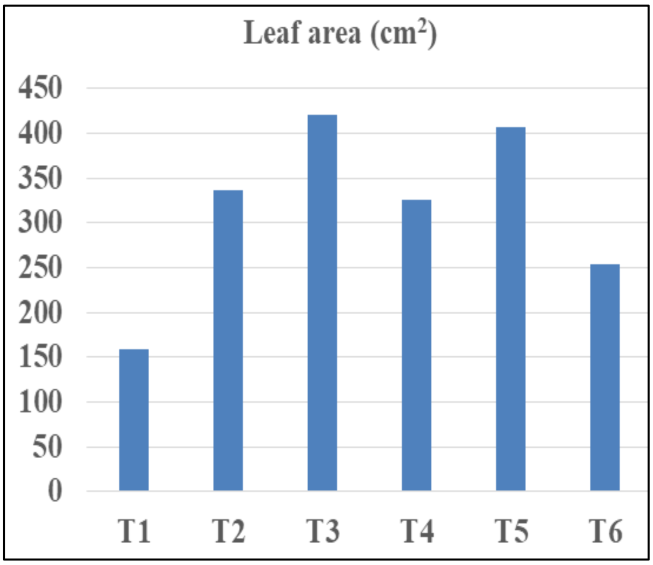

Fig 3: Effect of different growing media on leaf area of oil palm seedling raised during primary nursery stage.

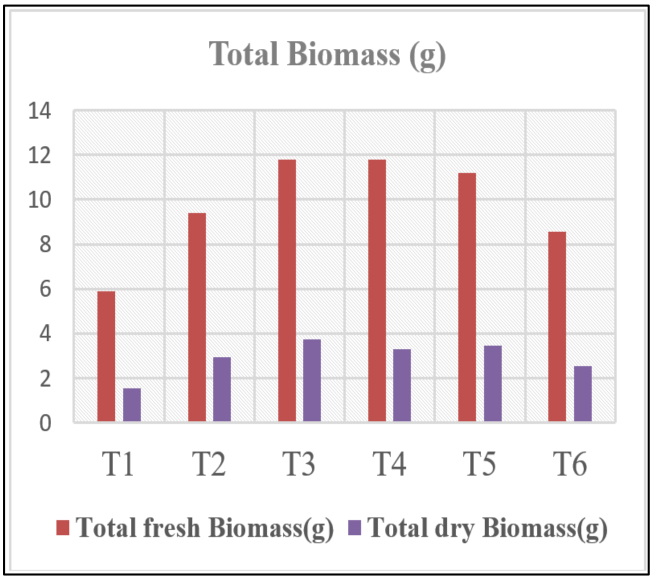

Fig 4: Effect of different growing media on total biomass production of oil palm seedling raised during primary nursery stage.

Conclusion

The outcome of the study reflects a consistent trend across the treatments, highlighting an importance of selecting the appropriate growing medium for optimizing plant growth and development. Among the various media tested, decanter cake demonstrated the most favourable impact, resulting in the tallest seedlings, maximum leaf area, fresh and dry biomass of the seedlings. Based on the performance of seedlings, decanter cake can be utilized for raising oil palm seedlings in pro trays during the primary nursery stage.

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