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EFFECT OF DIFFERENT PALM OIL MILL WASTE COMPOSTS ON VEGETATIVE AND FLORAL CHARACTERS OF RED GINGER

M. Vasantha Ratna[1]*, K. Ramachandrudu[2], A.V.D. Dorajee Rao[1], K. Suresh[2] and K. Umakrishna[3]

[1]Department of Floriculture and Landscape Architecture, Dr. Y.S.R. Horticultural University, Venkataramannagudem - 534 101, Andhra Pradesh, India.
[2]ICAR-Indian Institute of Oil Palm Research, Pedavegi, Eluru - 534 453, Andhra Pradesh, India.
[3]Department of Statistics, Dr. Y.S.R. Horticultural University, Venkataramannagudem - 534 101, Andhra Pradesh, India.
*Corresponding author E-mail : manukondaraju299@gmail.com
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ABSTRACT

The presence of abundant oil palm residues in India prompted the need to utilize this waste to avoid environmental pollution. The study was conducted to determine the vegetative and floral characters of red ginger affected by oil palm mill wastes. The experiment was conducted at ICAR – IIOPR, Pedavegi, Andhra Pradesh. Treatments included empty fruit bunch fibre compost, decanter cake, palm oil mill effluent sludge, palm oil mill effluent, combination of mill wastes, farm yard manure and RDF(control). Most of the vegetative parameters have been found to be significant among the treatments.Of all the treatments, highest plant height (113.80 cm), Number of leaves (13.13), leaf length (27.90 cm), number of shoots per plant (29.88) and maximum shoot girth (4.30 cm) were observed in T_5. For floral characters also T_5 showed maximum spike length (15.53 cm), spike girth (14.88 cm), number of bracts/spike (41.44), number of spikes/plant (12.50), spike weight (41.66 g) and flower yield (381.25 g). Early sprouting (26.00 days) was observed in T_1, maximum leaf width (7.67 cm) in T_3, early flower bud emergence (262.67 days) in T_4 and days taken for 50% flowering (307.67 days) in T_6.

Key words : Red ginger, Vegetative characters, Floral, Mill wastes, Oil palm.

Introduction

Ornamental red ginger [*Alpinia purpurata* (Vieillard) K. Schumann] belonging to the family Zingeberaceae. It is a tall, upright, herbaceous, evergreen and perennial cut flower crop with elegant bright red floral bracts and inconspicuous white flowers. Red ginger is quite popular as an ornamental and cut flower, both for home and for commercial sale. It is a shade loving crop, comes up well even in dense shade of 70-80% in oil palm plantations. It is one of the most important and universal flower crop, which is gaining importance in the floral decoration. Under congenial climatic conditions, flowering of red ginger occurs throughout the year (Kent *et al.*, 2007). In Andhra Pradesh, red ginger is cultivated as intercrop in the inter spaces of oil palm plantation. Industries have increased the threat of oil pollution to the environment and concomitant effluent discharged into the natural environment had created major ecological problem throughout the world.

Palm oil processing is carried out using large quantities of water in mills where oil is extracted from the palm fruits. About 43-45% of this is always a mill residue in the form of empty fruit bunches (EFB), shell, fibre and palm oil mill effluent (POME), which will continue to accumulate with increasing production (Nwachukwu *et al.*, 2018). Rudiyanto and Ermayanti (2013) reported that palm oil effluent, palm kernel cake, decanter cake, empty fruit bunch and palm kernel shell have the potential to be used as an organic amendment to the soil. Oil palm processing mills are generating of lot of waste, which is ligno-cellulosic in nature and good source of nutrients, but its utilization is almost negligible. The main objective of conducting this experiment is to study influence of various oil palm mill wastes on growth of red ginger grown in mature oil palm plantation.

Materials and Methods

The present investigation was carried out at ICAR-Indian Institute of Oil Palm Research (IIOPR), Pedavegi which is situated in West Godavari District of Andhra Pradesh during the years 2022-23. The experimental site (Pedavegi) is located at 16^0 43'N and 81^0 09'E with a mean sea level of 13.41m. The experiment was laid out in randomized block design with seven treatments and three replications. Treatments included T_1 (RDN through empty fruit bunch fibre compost), T_2 (RDN through decanter cake), T_3 (RDN through palm oil mill effluent sludge), T_4 (RDN through palm oil mill effluent), T_5 (RDN through combination of mill wastes), T_6 (RDN through farm yard manure) and T_7 (Recommended dose of fertilizers). Large sized rhizomes were selected and neatly dressed using secateurs and used for planting with a spacing of 2.89m × 2m in oil palm interspaces with two rows in triangular manner. Observations recorded at one year after planting and data analyzed by using WASP 2.0 software.

Observations recorded

Vegetative characters

Days taken for sprouting

Days taken for sprouting from date of planting was recorded.

Plant height (cm)

The length from the base of the leaf to the tip recorded for 3rd leaf was measured using meter scale and value was expressed in centimeters.

Number of leaves per plant

Average number of leaves were counted for each plant and recorded

Leaf length (cm)

Leaf length is measured for fully opened 3rd leaf from one end to other end from top to bottom and expressed in centimeters

Leaf width (cm)

Width of leaf was measured for fully opened 3rd leaf from one end to other end at the middle of the leaf and was recorded in centimeters.

Number of shoots per plant

Number of shoots per plant were counted and recorded.

Shoot girth (cm)

Shoot girth was measured with thread and average stem girth was expressed in centimeters.

Floral characters

Days to flower bud emergence

Number of days taken for emergence of flower bud from date of planting was observed and recorded.

Days to 50% flowering

Number of days taken for 50% of flower opening from date of planting was observed and recorded.

Spike length (cm)

The length of spike was measured from the base to the tip of the spike with a meter scale and was recorded in centimeters.

Spike girth (cm)

Spike girth was measured with tape at fully opened middle portion of the spike and was expressed in centimeters

Number of bracts per spike

Number of bracts on a matured spike were counted and recorded

Number of spikes per plant

Number of spikes per plant was counted during one year duration and was recorded.

Spike weight (g)

Fresh weight of the spike along with 30cm stalk were weighed on electronic weighing balance and expressed in centimeters.

Flower yield (g)

Individual spike was weighed by using digital electronic weighing balance and cumulatively flower yield per plant was expressed in grams.

Results and Discussion

Days taken for sprouting

It is vivid from the data days taken for sprouting of the rhizome is influenced by the different palm oil mill wastes are furnished in Table 1. The data indicates significant variations in the days taken for sprouting among different treatments. T_1 exhibited the earliness for sprouting with 26.00 days, which is on par with T_5 (26.33 days) and T6 (26.67 days), respectively. While, T_2 took the longest duration for sprouting with 34.33 days.

Plant height

The data pertaining to the influence of individual treatments on plant height is clearly articulated in Table 1. Significant results obtained for plant height among various treatments. Treatment T_5 resulted in the tallest plants with an impressive height of 113.80 cm and T_3 closely trailed with a height of 111.62 cm, whereas T_1 had the shortest plants at 74.97 cm. This variation in plant height could be attributed to the diverse nutrient content or growth-promoting factors present in the different compost treatments. Pome sludge was able to promote a beneficial effect on the height. According to Silva *et al.* (2010), sludge composts mainly contributed N and P as nutrients for plant growth. The composition of the soil rich in nitrogen was able to promote the growth of plants. The supply of nutrients which are conducive to the physical environment leads to better aeration, the activity of roots and absorption of nutrients and complementary effects due to fly ash applications with organic manures will result in higher plant height (Reddy *et al.*, 2010).

Number of leaves per plant

Data recorded for number of leaves varied significantly among treatments were exhibited in Table 1. Among all the treatments, T_5 exhibited highest number of leaves (13.13), followed by T_3 with 11.40, which is on par with T_6 and T_2 with 11.07 and 11.00, respectively. While, T_1 had the lowest (10.40). This disparity may reflect the impact of compost on the foliage development of red ginger, indicating that certain treatments foster a more prolific leaf growth. Darmawan *et al.* (2013) reported that the availability of N in sufficient quantities will help plant metabolism and improve the number leaves. More sunlight the plant receives, the plant will respond by increased the number of leaf. With the increased in the number of leaf, the more carbohydrates produced by these plants in the process of photosynthesis so that it will accelerate plant growth and development (Rouphael *et al.*, 2018).

Leaf length

Analyzed data pertaining to leaf length unveiled significant differences were presented in Table 1. The plants in T_5 demonstrated the longest leaves at 27.90 cm, closely succeeded by T_6 with 25.20cm, which is on par with T_4 (24.70 cm) and T_2 (24.10cm). While, T_7 exhibited the shortest leaf length at 20.97 cm. The difference in leaf length suggests that specific compost treatments may contribute to variations in the elongation of red ginger leaves.

Leaf width

Leaf width varied significantly due to individual treatments was furnished in Table 1. It is vivid from the data treatment T_3 resulted in the widest leaves (7.67cm), followed by T_4, which exhibited 6.83 cm, which is on par with T_2 (6.67 cm). Treatment T_7 exhibited least leaf width (5.88 cm). This variability in leaf width suggests that different compost treatments may influence the lateral growth and overall robustness of the leaves.

Number of shoots per plant

The variations in number of shoots per plant, stemming from different treatments, are explicitly outlined in Table 1. Data pertaining to treatments, T_5 displayed the highest number of shoots per plant (29.88) pursued by T_2 with 26.60, while T_7 had the lowest (21.87). This variation highlights the potential of certain compost treatments to stimulate the production of multiple shoots in red ginger plants.

Shoot girth

The variation in shoot girth, arising from the distinct treatments, is clearly elucidated in Table 1. Significant differences noticed among treatments, T_5 demonstrated the thickest shoots with a girth of 4.30cm and on par with T_3 (3.62 cm), closely succeeded by T_2, which was 3.37 cm, while T_1 had the smallest shoot girth at 2.91 cm. The variation in shoot girth suggests that compost treatments can influence the structural development and thickness of red ginger shoots (Osagbovo *et al.*, 2010). Utilizing EFB compost in the growing medium improved the number of leaves in oil palm Gnimassoun *et al.* (2020).

Days to flower bud emergence

In the analyzed data concerning days to flower bud emergence, as presented in Table 2. Treatments were found to be statistically significant. Earliness is observed in treatment T_4 (262.67 days), which is on par with T_3 (264.33 days) whereas, T_6 the longest duration (289.67 days). This suggests that certain compost treatments may influence the initiation of flower buds differently.

Days to 50% flowering

No significant differences were observed in the analyzed data related to days to 50% flowering, as outlined in Table 2. The days to 50% flowering also exhibited considerable diversity among treatments. T_6 took the shortest time to reach 50% flowering (307.67 days) followed by T_2 (317.00 days). T_5 showed longest duration (334.67 days).

Spike length

The analysis of data concerning spike length showed statistically significant variations, as presented in Table 2. Treatment T_5 resulted in the longest spikes (15.53 cm), followed by T_3 (12.67 cm), while T_1 had the shortest spikes (11.47 cm). This variation in spike length suggests that certain compost treatments may contribute to the elongation and development of the flower spikes in red ginger.

Table 1 : Effect of different palm oil mill waste compost on morphological characters of red ginger.

Treatments	Days taken for sprouting	Plant height (cm)	Number of leaves	Leaf length (cm)	Leaf width (cm)	Number of shoots/plant	Shoot girth (cm)
T_1	26.00	74.98	10.40	24.03	6.13	22.33	2.91
T_2	34.33	96.87	11.00	24.10	6.67	25.60	3.37
T_3	29.33	111.62	11.40	24.10	7.57	23.47	3.62
T_4	32.00	91.63	10.73	24.70	6.83	22.40	3.04
T_5	26.33	113.80	13.13	27.90	6.43	29.87	4.30
T_6	26.67	90.70	11.07	25.20	6.10	23.73	3.00
T_7	29.33	88.07	10.53	20.97	5.87	21.87	3.22
CD @ 5%	4.40	10.81	0.89	3.33	0.79	3.47	0.81
S EM	1.43	3.51	0.29	1.08	0.26	1.12	0.26
CV(%)	8.48	6.37	4.49	7.66	6.81	8.06	13.51

Table 2 : Effect of different palm oil mill waste compost on floral characters of red ginger.

Treatments	Days to flower bud emergence	Days to 50% flowering	Spike length (cm)	Spike girth (cm)	Number of bracts per spike	Number of spikes per plant	Spike weight (g)	Flower yield (g)
T_1	284.00	318.33	12.67	11.33	25.05	6.87	30.55	209.07
T_2	266.67	317.00	11.47	11.65	29.83	9.20	37.68	344.10
T_3	264.33	320.00	12.07	13.68	29.58	9.80	27.60	261.69
T_4	262.67	326.00	12.23	11.65	28.82	8.07	40.34	324.50
T_5	281.67	334.67	15.53	14.88	41.44	12.50	30.78	381.25
T_6	289.67	307.67	11.57	11.36	26.94	7.53	41.66	310.10
T_7	285.67	321.67	11.50	11.23	23.56	8.53	26.92	230.07
CD @ 5%	18.07	12.31	1.80	1.66	6.50	1.99	5.75	67.64
S EM	5.87	3.99	0.58	0.54	2.11	0.65	1.86	21.95
CV(%)	3.68	2.16	8.14	7.59	12.47	12.54	9.60	12.91

Spike girth

Analysis of data concerning spike girth did revealed statistically significant variations, as furnished in Table 2. The spike girth varied among treatments, with T_5 exhibiting the thickest spike (14.88 cm) followed by T_3 (13.67 cm) and T_7 showing the thinnest spike gith (11.23 cm). This highlights the potential of compost to influence the structural robustness and thickness of the flower spikes.

Number of bracts per spike

Analyzed data pertaining to number of bracts per spike showed significant differences among treatments and were presented in Table 2. T_5 treatment showed highest bracts number per spike with 41.44, followed by T_2 (29.83) while T_7 exhibited least bracts 23.56 per spike.

Number of spikes per plant

In the analyzed data concerning number of spikes per plant, substantial differences are revealed and presented in Table 2. Treatment T_5 demonstrated the highest number of spikes per plant (12.50) followed by T_3 (9.8) and T_2 (9.20), while T_1 had the lowest (6.87). This variation suggests that certain compost treatments may enhance the proliferation of floral spikes in red ginger plants.

Spike weight

Data recorded for spike weight varied significantly among treatments were exhibited in Table 1. Among all the treatments, T_6 exhibited highest number of leaves (41.66 g), followed by T_4 with 40.34 g, while T_7 had the lowest (26.92 g).

Flower yield

The data analysis of flower yield unveils noteworthy differences, as outlined in Table 2. The flower yield showed substantial differences among treatments. T_5 had the highest flower yield (381.25 g) followed by T_2 (344.10 g), while T_1 had the lowest (209.07 g). This indicates that specific compost treatments may positively impact the overall production of red ginger flowers. According to Tangga *et al*. (2022) EFB compost is abundant in nutritional components, which led to the subject of using compost as a fertilizer for the purpose of increasing soil fertility.

Conclusion

It can be concluded from the results that combination of mill wastes (T_5) consistently demonstrated favorable outcomes across multiple parameters, and can be used as nutrient source instead of chemical fertilizers for getting most favourable outcomes in terms of vegetative and floral characteristics in red ginger. This suggests the effectiveness of the applied compost treatment in promoting overall plant growth and enhancing yield. Incorporating organic compost like palm oil mill wastes into agricultural practices can contribute to increased productivity, soil health and environmental sustainability.

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