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Effect of vermiwash and panchgavya on growth and yield of sesame (*Sesamum indicum* L.)

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Abstract
A field experiment entitled "Effect of Vermiwash and Panchgavya on Growth, and Yield of Sesame (*Sesamum indicum* L.)" was conducted during *Kharif 2024* at the Agronomy Farm of Suresh Gyan Vihar University, Jaipur. The experiment was laid out in a Randomized Block Design (RBD) with 16 treatments and three replications to evaluate the effect of different concentrations of vermiwash (5%, 10%, 15%) and panchgavya (1%, 3%, 5%) on the growth, yield, and quality of sesame. Results revealed that the application of vermiwash and panchgavya significantly enhanced growth and yield parameters compared to the control. Vermiwash @ 15% recorded the maximum plant height (117.23 cm), dry matter accumulation (114.82 g/plant), and seed yield (881 kg/ha), while Panchgavya @ 5% showed similar results with a seed yield of 897 kg/ha. Both organic treatments also improved yield attributes such as the number of capsules per plant, seeds per capsule, and test weight. However, the harvest index was not significantly affected. The findings suggest that higher concentrations of vermiwash and panchgavya can be effectively used as sustainable organic inputs for improving the productivity and quality of sesame without harming soil health and the environment.

Keywords: Sesame, vermiwash, panchgavya, organic manures, growth parameters, yield attributes, sustainable agriculture

1. Introduction
Sesame (*Sesamum indicum* L.), commonly known as *til*, is one of the oldest and most important oilseed crops in the world, often referred to as the "queen of oilseeds" because of its superior oil quality, nutritional value, and therapeutic properties (Jamir *et al.*, 2019). It is extensively cultivated in tropical and subtropical regions, particularly in countries such as Sudan, Myanmar, India, China, and Mexico, for its edible seeds and high-quality oil. India ranks among the top producers and exporters of sesame, contributing significantly to global production and trade (Anon., 2023) [1]. However, in recent years, climate change, erratic rainfall, and the overuse of chemical fertilizers and pesticides have led to soil degradation and reduced productivity, posing a major challenge to sustainable sesame cultivation. Organic farming provides a promising alternative by ensuring ecological balance, soil fertility, and environmental safety (Behera *et al.*, 2024) [2]. The use of fermented organic liquid manures such as *panchgavya* and *vermiwash* has gained considerable importance due to their eco-friendly and cost-effective nature. *Panchgavya*, a traditional formulation derived from cow-based products, contains essential nutrients, hormones, and beneficial microorganisms that promote plant growth and enhance resistance to diseases (Golakiya *et al.*, 2019) [7]. Similarly, *vermiwash*, a liquid extract from vermicompost, is rich in enzymes, vitamins, and plant growth regulators that improve yield, quality, and overall plant health (Varghese and Prabha, 2014; Chandana *et al.*, 2023) [17, 4]. Therefore, the present investigation was undertaken to study the effect of liquid organic manures such as *panchgavya* and *vermiwash* on growth and yield of sesame (*Sesamum indicum* L.) under organic nutrient management practices for sustainable crop production.

2. Materials and Methods
The field experiment entitled "Effect of Vermiwash and Panchgavya on Growth and Yield of

Sesame (*Sesamum indicum* L.)" was conducted at agronomy farm of Suresh Gyan Vihar University, Jaipur during *kharif* season of the year 2024. The experiment was laid out in a Randomized Block Design with 16 treatments and three replications to minimize experimental error (Panse and Sukhatme, 1985) [13]. The sesamum variety used for the study was 'RT-346, sown at a spacing of 30 cm × 10 cm using a seed rate of 4 kg ha^{-1}. The experimental layout followed the random allocation of treatments as per the method of Fisher and Yates (1963) [6]. The treatments of vermiwash *viz.*, V_0- Control, V_1 - Vermiwash @ 5%, V_2- Vermiwash @ 10% and V_3- Vermiwash @ 15% and Panchgavya: P_0 - Control, P_1- Panchgavya @ 1%, P_2 - Panchgavya @ 3%, and P_3- Panchgavya @ 5%, used during experiment. Biometric observations were recorded from five randomly selected and permanently tagged plants in each plot. Growth parameters such as plant stand per metre row length were assessed at 20 DAS. Plant height (cm) and dry matter accumulation (g $plant^{-1}$) were recorded at 30 DAS, 60 DAS, and at harvest. Dry matter was measured by oven-drying samples at 70°C until constant weight. For yield parameters, number of capsules per plant, number of seeds per capsule, test weight was recorded. The total biomass harvested from each net plot was threshed, winnowed and dried. Seed thus obtained were weighed separately in kg/plot and converted into grain yield in kg ha^{-1}. Straw yield was calculated by subtracting the seed yield from the biological yield. All collected data were subjected to appropriate statistical analysis to interpret treatment effects.

3. Results and Discussion

3.1 Growth Parameters

The data in table 1 revealed that the plant stand per meter row length of sesame was not influenced significantly at 20 DAS and at harvest due to different concentrations of vermiwash and panchgavya application. The application of vermiwash and panchgavya had a significant positive impact on the plant height of sesame throughout its growth stages. Vermiwash at 15% consistently produced the tallest plants, recording 38.71 cm in early growth, 110.45 cm at 60 days after sowing (DAS), and 117.23 cm at harvest, all significantly superior to the control. Lower concentrations of vermiwash (10% and 5%) also showed marked improvement over the control but remained inferior to the 15% treatment. Similarly, panchgavya application led to substantial increases in plant height compared to untreated plants. The highest values were observed with panchgavya at 5%, which recorded 39.80 cm during early growth, 106.11 cm at 60 DAS, and 115.43 cm at harvest. Panchgavya at 3% and 1% also enhanced plant height but were less effective than the 5% concentration. Overall, both organic treatments improved plant growth significantly, with higher concentrations yielding better results. Dry matter accumulation in sesame was significantly enhanced by the application of both vermiwash and panchgavya, with higher concentrations yielding better results. Vermiwash at 15% consistently recorded the highest dry matter accumulation across all stages, with values of 13.92 g/plant during early growth, 102.06 g/plant at 60 DAS, and 114.82 g/plant at harvest, all significantly superior to the control. Vermiwash at 10% and 5% also resulted in notable increases over the control, though they remained statistically inferior to the 15% treatment. Similarly, panchgavya application led to significant improvements, with the 5% concentration producing the highest dry matter accumulation at all stages 13.25 g/plant in early growth, 109.95 g/plant at 60 DAS, and 121.62 g/plant at harvest. Panchgavya at 3% and 1% also outperformed the control, and at harvest, the 3% treatment (115.04 g/plant) was statistically at par with the 5% dose. Overall, both vermiwash and panchgavya significantly boosted dry matter accumulation in sesame, with maximum effectiveness observed at their highest concentrations. The present investigation in line with agreement with Tharmaraj *et al.* (2010) [16] reported comparable results in blackgram. The similar results were also obtained by Kiran *et al.*, (2016) [10], Rajan and Murugesan (2012) [14], Karuppaiah *et al.*, (2011) [8] and Kaur *et al.*, (2015) [9].

3.2 Yield attributes and Yield

The data presented in Tables 2 revealed that both vermiwash and panchgavya significantly influenced the number of capsules per plant in sesame. Vermiwash @ 15% produced the highest number of capsules (34.24), significantly outperforming the control (27.18) and the 5% treatment (30.12), while being statistically at par with the 10% treatment (32.30). Similarly, panchgavya @ 5% also led to the maximum capsule number (34.25), which was significantly higher than the control (28.05) and panchgavya @ 1% (30.20), and comparable to panchgavya @ 3% (32.30). Overall, both organic treatments, particularly at higher concentrations, effectively enhanced capsule production in sesame compared to untreated plants. Data from table 2 indicate that the number of seeds per capsule in sesame was significantly influenced by both vermiwash and panchgavya applications. Vermiwash @ 15% resulted in the highest number of seeds per capsule (48.81), which was significantly superior to the control (39.12) and the 5% treatment (43.10), but statistically at par with the 10% level (46.10). Similarly, panchgavya @ 5% produced the maximum number of seeds per capsule (50.80), significantly higher than the control (41.22) and panchgavya @ 1% (45.17), while being statistically comparable to the 3% treatment (48.04). Overall, higher concentrations of both vermiwash and panchgavya markedly improved seed count per capsule compared to lower doses and the control. Data from table 2 demonstrate that both vermiwash and panchgavya applications had significant effects on the test weight of sesame. Vermiwash @ 15% recorded the highest test weight (2.96 g), significantly outperforming the control (2.07 g) and vermiwash @ 5% (2.51 g), while being statistically at par with the 10% treatment (2.78 g). Similarly, panchgavya @ 5% resulted in the maximum test weight (2.98 g), which was significantly higher than the control (2.13 g) and panchgavya @ 1% (2.45 g), and statistically comparable to panchgavya @ 3% (2.75 g). These results indicate that higher concentrations of both vermiwash and panchgavya effectively enhanced the seed test weight of sesame.

According to the data presented in table 3, both vermiwash and panchgavya applications had significant positive effects on sesame seed yield. The highest yield under vermiwash treatment was recorded at 15% concentration (881 kg/ha), which was significantly greater than the control (550 kg/ha) and vermiwash @ 5% (749 kg/ha), but statistically similar to the 10% treatment (873 kg/ha). Similarly, panchgavya @ 5% produced the maximum seed yield (897 kg/ha), significantly outperforming the control (569 kg/ha) and panchgavya @ 1% (769 kg/ha), while being statistically at par with the 3% level (841 kg/ha). These findings highlight that higher concentrations of both organic treatments substantially improved seed yield in sesame compared to untreated plots. The highest stalk yield under vermiwash treatment was recorded at 15% concentration (2134 kg/ha), which was significantly superior to the control (1654 kg/ha) and vermiwash @5% (1926 kg/ha), while being statistically at par with the 10% level (2047 kg/ha). Similarly, panchgavya @5% resulted in the maximum stalk yield (2127

kg/ha), significantly higher than the control (1623 kg/ha) and panchgavya @ 1% (1867 kg/ha), but statistically comparable to panchgavya @ 3% (2018 kg/ha). These results clearly demonstrate that higher concentrations of both vermiwash and panchgavya significantly improved the stalk yield of sesame over untreated controls. The data from table 3 reveal that the biological yield of sesame was significantly enhanced by both vermiwash and panchgavya applications. Vermiwash at 15% produced the highest biological yield (3120 kg/ha), which was significantly greater than the control (2355 kg/ha) and the 5% treatment (2840 kg/ha), but statistically similar to the 10% treatment (3061 kg/ha). Likewise, panchgavya at 5% resulted in the maximum biological yield (3021 kg/ha), significantly outperforming the control (2328 kg/ha) and the 1% treatment (2621 kg/ha), while being comparable to the 3% treatment (2860 kg/ha). Overall, higher concentrations of both organic treatments effectively increased the biological yield of sesame compared to untreated plants. The data presented in table 4.6 and figure 4.5 indicate that the harvest index of sesame was not significantly affected by the different levels of vermiwash application. Similarly, the harvest index showed no significant variation with the application of different concentrations of panchgavya, suggesting that these factors did not have a notable impact on the ratio of economic yield to biological yield in this study. Similar `findings were also reported by Maheshwari (2016), Kumar *et al.* (2017) [11] in French bean, Bhardwaj and Sharma (2016) [3] in mungbean, Deshmukh *et al.* (2010) [5] and Selvarani *et al.* (2020) [15] in clusterbean.

4. Conclusion

It is concluded that the application of liquid organic manures such as *vermiwash* and *panchgavya* significantly enhances the growth and yield of sesame (*Sesamum indicum* L.). Among all treatments, *vermiwash* @ 15% and *panchgavya* @ 5% proved most effective in improving plant height, dry matter accumulation, yield attributes, and overall productivity. The harvest index was not significantly affected, indicating balanced growth. Therefore, the use of *vermiwash* and *panchgavya* at suitable concentrations can be recommended as eco-friendly and sustainable practices for improving sesame yield and maintaining soil fertility.

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