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The effect of organic inputs and organic formulations on quality of mango cv. Keshar

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Abstract
A field experiment to investigate the effect of organic inputs, specifically FYM at 10 kg per plant, vermicompost at 10 kg per plant and a combination of FYM at 5 kg per plant with vermicompost at 5 kg per plant as the main plot treatments alongside organic formulations such as jeevamrut at 10 liters per plant, EM solution at 10 liters per plant, waste decomposer at 10 liters per plant: Tank mixture of jeevamrut and EM solution at 10 liters per plant: Tank mixture of jeevamrut and waste Decomposer at 10 liters per plant. Mix of EM solution and waste decomposer at 10 liters per plant as the subplot treatments on the quality of mango cultivar. A field trial was conducted in a nine-year-old mango orchard over the years 2023-2024 and 2024-2025. The chemical composition of mango fruits was markedly influenced by the soil application and drip application of various organic inputs and formulations. The application of vermicompost at 10 kg per plant resulted in significantly elevated values of total soluble solids (TSS): 18.00, 18.63 and 18.31 ºBrix; ascorbic acid: 52.43, 52.47 and 52.45 mg per 100 g; reducing sugars content: 6.24, 6.42 and 6.33%; non-reducing sugars content: 6.82, 7.07 and 6.95%; total sugars content: 13.06, 13.49 and 13.28%; and a reduction in acidity: 0.20, 0.17 and 0.19% in mango during the years 2023-24, 2024-25 and the pooled data, respectively.
The elevated values of these biochemical parameters were likewise seen in the tank mix of jeevamrut and EM solution at 10 liters per plant recorded the following values: TSS: 17.39, 17.95 and 17.67 ºBrix; ascorbic acid: The mango exhibited the following metrics: reducing sugar levels of 6.20%, 6.39% and 6.30%; non-reducing sugar levels of 6.39%, 6.62% and 6.51%; total sugar levels of 12.60%, 13.01% and 12.80%; and decreased acidity measurements of 0.22%, 0.20% and 0.21%, respectively, based on pooled data.

Keywords: Vermicompost, Jeevamrut, EM solution, Total Suspended Solids (TSS), Acidity, Reducing and Non-reducing sugar, Mango

Introduction
Organic farming approaches depend on the management of soil organic matter to improve the chemical, biological and physical characteristics of the soil. Enhanced soil biological activity is seen as a crucial factor in mitigating weeds, pests, and illnesses (IFOAM, 1998) [3]. Organic produce contains a higher concentration of vitamins, minerals, enzymes, trace elements and cancer-fighting antioxidants than conventionally farmed food (Bhattacharyya and Chakraborty, 2005) [2]. The widespread use of agrochemicals in agricultural production and protection has adversely impacted soil health, crop productivity and the ecosystem. Organic amendments have been suggested as an effective alternative for improving soil and plant health. Vermicompost addition provides a sustainable method for plant feeding, enhancing soil health and fertility. (Rehman *et al*., 2023) [13]. Jeevamrut is an organic fertilizer and an excellent alternative to chemical fertilizers. It is an excellent source of biomass, natural carbon, nitrogen, phosphorus, calcium and other nutrients vital for plant growth and development. Jeevamrut is utilized to enhance the microbial population in the soil. Jeevamrut augments microbial activity in soil and contributes to the enhancement of soil fertility. (Kaur, 2020) [6]. Decomposers play a crucial role in the fragmentation and degradation of agricultural waste. The compositing process is labor-intensive. Incomplete or immature composts adversely damage soil, impairing plant growth and ecosystem functionality. This product is environmentally sustainable, economically

advantageous and beneficial as it transforms biowaste into organic fertilizer (Kannan, 2020) [5].

In mango cultivation, numerous issues related to fruit set, productivity and quality arise from insufficient nutrient management. Both macronutrients and micronutrients are equally vital for plant growth and development. Organic fertilizers are utilized in live formulations to enhance the mobilization and availability of nutrients, mostly through their biological activity, which fosters the proliferation of beneficial soil microorganisms, hence increasing soil health (Sabale *et al*., 2023). An inquiry was done to examine the effect of organic inputs and organic formulations on the quality of mango cultivar. Kesar.

Materials and Methods

A field trial was executed in 2023-2024 and 2024-2025 in a nine-year-old mango orchard at the Organic Farming Research and Training Centre, Mahatma Phule Krishi Vidyapeeth, Rahuri, District. Ahilyanagar, Maharashtra. The statistical analysis of the data for the numerous characters examined in the current inquiry was conducted using a Split Plot Design for each individual year, while a pooled analysis was performed by incorporating the year effect into the subgroup (split) and analysis of variance was done via the split plot design. The effect of organic inputs, specifically FYM at 10 kg per plant, vermicompost at 10 kg per plant and a combination of FYM at 5 kg per plant with vermicompost at 5 kg per plant as the primary plot treatment in addition to a control and organic formulations such as jeevamrut at10 liters per plant, EM solution at 10 liters per plant, waste decomposer at 10 liters per plant: Tank mixture of jeevamrut and EM solution at 10 litersper plant: Tank mixture of jeevamrut and waste decomposer at 10 liters per plant and tank mixture of EM solution and waste decomposer at 10 liters per plant in conjunction with the control, serves as the subplot treatments for the quality of mango. All twenty-eight combination therapies were administered three times.

All organic inputs and formulations were administered in November according to the regimens. The organic inputs were positioned in a circular trench, four feet from the trunk, with a depth of one foot and a width of six inches, then covered with soil. Organic formulation is administered via a drip irrigation system.

In this study, three fruits were randomly selected at the ripe stage and analyzed to ascertain their chemical makeup, including total soluble solids (TSS), reducing sugars, non-reducing sugars, total sugars, acidity, and ascorbic acid content. Total soluble solids (TSS) were measured using a digital hand refractometer with a range of 0 to 32 °Brix. The quantification of reducing sugars, total sugars, and non-reducing sugars was conducted using the methodology proposed by Lane and Eylon (1923) [7] as outlined by Ranganna (1986) [14]. Acidity was assessed by titrating a known quantity of pulp with 0.1 N NaOH, utilizing phenolphthalein as an indicator while, the ascorbic acid content of the fruits was quantified using the dye method described by Ranganna (1986) [14].

Results and discussion

The data reported in Table 1 and Table 2 indicated that chemical composition of mango fruits was significantly affected by soil application and drip application of different organic inputs and organic formulations respectively.

A. The effect of organic input application on total soluble solids (ºBrix) in mango

The application of vermicompost at 10 kg per plant resulted in significantly elevated total soluble solids (TSS) values of 18.00, 18.63, and 18.31 ºBrix for the years 2023-24, 2024-25and the combined data, respectively (Table 1). The use of vermicompost resulted in an increase in TSS. The application of vermicompost enhanced the activity of various enzymes in physiological processes, potentially elevating the total soluble solid content of the fruits. Comparable findings were reported by Patel *et al*. (2022) [11] in mango, Baviskar *et al*. (2011) [1] in sapota, Rani *et al*. (2021) [15] in guava, and Sheikh *et al*. (2019) [17] in sapota.

B. The effect of organic formulations on total soluble solids (ºBrix) in mango

The F_5 treatment (tank mix of jeevamrut + EM solution at 10 liters per plant) recorded significantly elevated total soluble solids (TSS) values of 17.39, 17.95 and 17.67 ºBrix for the both years and pooled data, respectively (Table 1). This treatment was statistically equivalent to treatments F_7 and F_3 for both years and in the aggregated data. The rise in TSS observed with the application of jjeevamrut + EM solution can be ascribed to the swift metabolic conversion of starch and pectin into soluble compounds, along with the rapid translocation of sugars from leaves to developing fruits and the transformation of complex polysaccharides into simple sugars. These results are closely similar to the findings of Sheikh *et al*. (2019) [17].

The interaction between organic inputs and organic formulations was shown to be non-significant for both yearsas well as in the pooled mean.

C. The effect of organic input application on mango acidity (%)

The findings in Table 1 clearly indicates that much decreased acidity specifically 0.20, 0.17and 0.19 percent was seen with the application of vermicompost at a rate of 10 kg per plant. Minimum acidity may result from the consumption of acid during respiration or the conversion of acid into sugar by reactions that reverse the glycolytic pathway in the fruit. These findings concur with those of Naik and Babu (2007) [9] for guava. Ramand Varma (2015) [12] in Mango.

D. The effect of organic formulations on the acidity percentage of mango

The treatments F_5 (tank mix of jeevamrut + EM solution at 10 liters per plant) and F_7 (tank mix of EM solution + waste decomposer at 10 liters per plant) exhibited significantly reduced acidity levels of 0.22, 0.20 and 0.21 percent for the both years and pooled data, respectively (Table 1). These results are closely related to the findings of Jhade *et al*. (2020) [4] regarding papaya.

The interaction between organic inputs and organic formulations was non-significant throughout both years as well as in the pooled mean data.

E. The effect of organic input application on ascorbic acid concentration (mg per 100g) in mango

The application of vermicompost at 10 kg per plant resulted in significantly elevated ascorbic acid levels of 52.43, 52.47 and 52.45 mg per 100 g for the years 2023-24, 2024-25 and the pooled data respectively (Table 1). The elevated ascorbic acid concentration may result from a rise in organic dietary sources that enhance the catalytic activity of various enzymes involved in the manufacture of ascorbic acid and its precursors. These results align with the findings of Talanget al. (2017) [18] and Maurya *et al.* (2020) [8] in mango.

F. The effect of organic formulations on ascorbic acid content (mg 100g-1) in mango

The treatment F_5 (tank mix of jeevamrut and EM solution at 10 liters per plant) exhibited a considerably elevated level of ascorbic acid. 52.10, 52.13 and 52.11 mg100g^{-1} for the twoyears and the aggregated data respectively (Table 1).This treatment was statistically comparable to treatments F_7, F_4, and F_3 in the first year and in the second year it was statistically comparable to treatments F_7 and F_3. In the pooled data treatment F_7 was statistically comparable to this treatment. These results are closely associated with the findings of Sheikh *et al.* (2019) [17] and Nanjundappa *et al.* (2001) [10] concerning sunflower.

The interaction between organic inputs and organic formulations was shown to be non-significant for both yearsas well as in the pooled mean data.

G. The effect of organic input application on the percentage of reducing sugars in mango

The content of reducing sugars measured at 6.24%, 6.42% and 6.33%, was significantly elevated in fruits harvested from trees treated with vermicompost at a rate of 10 kg per plant during both years and in the pooled data (Table 2). This treatment was statistically comparable to treatments I_4 and I_3. These results are closely associated with the findings of Rani *et al.* (2021) [15] in guava and Sheikh *et al.* (2019) [17] in sapota.

H. The effect of organic formulations on the percentage of reducing sugars in mangoes

The treatment F_5 (a tank mix of jeevamrut and EM solution at 10 liters per plant) exhibited significantly elevated levels of reducing sugar measuring 6.20%, 6.39% and 6.30% for the both years and the pooled data respectively (Table 2).This treatment was statistically comparable to all treatments except control for both years and in pooled data. Similar findings were reported by Sheikh *et al.* (2019) [17].

The interaction between organic inputs and organic formulations was shown to be non-significant for both years as well as in the pooled mean data.

I. The effect of organic input application on the percentage of non-reducing sugars in mango

The highest level of non-reducing sugars (6.82, 7.07 and 6.95%) was seen in fruits collected from trees treated with vermicompost at a rate of 10 kg per plant for both years and in the pooled data, respectively (Table 2). These results are closely associated with the findings of Rani *et al.* (2021) [15] in guava and Sheikh *et al.* (2019) [17].

J. The effect of organic formulations on the percentage of non-reducing sugars in mango

The treatment F_5 (tank mix of jeevamrut + EM solution at 10 liters per plant) exhibited significantly elevated levels of non-reducing sugar measuring 6.39%, 6.62% and 6.51% for the both years and the pooled data, respectively (Table 2). This treatment was statistically comparable to the treatments F_7, F_6, and F_3 for both years and in the pooled data. Comparable findings were reported by Sheikh *et al.* (2019) [17] in sapota.

The interaction between organic inputs and organic formulations was significant during the both years as well as in the pooled mean data. The treatment involved the application of vermicompost at 10 kg per plant and a tank mix of jeevamrut and EM solution at 10 litersper plant combination exhibited a significantly higher value of 8.42 percent.

K. The effect of organic input application on total sugar percentage in mango

The total sugar content (13.06%, 13.49% and 13.28%) was significantly elevated in the fruits obtained from trees treated with vermicompost at 10 kg per plant throughout both years and in the pooled data (Table 2). These results are closely associated with the findings of Rani *et al.* (2021) [15] and Sheikh *et al.* (2019) [17].

L. The effect of organic formulations on total sugar content (%) in mango

The F_5 treatment (tank mix of jeevamrut + EM solution at 10 liters per plant) recorded significantly elevated total sugar values of 12.60%, 13.01%, and 12.80% for the bothyears and pooled data,respectively (Table 2). This treatment was statistically comparable to the rest of treatments except control for the first yearand F_7, F_6, F_3, and F_4 in the second year as well as in pooled data, with F_7 and F_6. Similar findings were reported by Sheikh *et al.* (2019) [17].

The interaction between organic inputs and organic formulations was shown to be non-significant for both years as well as in the pooled mean data.

The increase in total and non-reducing sugars can be attributed to the gradual supply of nutrients and organic manures throughout the growth period which enhanced metabolites, improved soil moisture availability, pH, organic carbon, and nutrient status while reducing fruit acidity. This may result from the conversion of complex substances (starch) into sugars and their derivatives through reactions involving the reversal of the glycolytic pathway or their utilization in respiration, or both.

Table 1: Effect of application of organic inputs and organic formulation on TSS, acidity and ascorbic acid of mango fruits

Treatments	TSS (°Brix)			Acidity (%)			Ascorbic acid (mg100g^{-1})		
	2023-24	2024-25	Pooled mean	2023-24	2024-25	Pooled mean	2023-24	2024-25	Pooled mean
A, Main plot: Organic inputs (I)									
I_1 - Control	14.91	15.39	15.15	0.26	0.25	0.26	49.56	49.58	49.57
I_2- FYM@10 kg plant^{-1}	15.64	16.14	15.89	0.25	0.24	0.24	50.67	50.70	50.69
I_3- Vermicompost @10 kg plant^{-1}	18.00	18.63	18.31	0.20	0.17	0.19	52.43	52.47	52.45
I_4- FYM@5 kg plant^{-1} + Vermicompost @5 kg plant^{-1}	16.54	17.08	16.81	0.23	0.22	0.23	51.60	51.63	51.62
S.Em±	0.19	0.20	0.14	0.01	0.01	0.01	0.19	0.19	0.13
C. D. at 5%	0.66	0.69	0.42	0.02	0.03	0.02	0.65	0.65	0.41
B, Sub plot: Organic formulations (F)									
F_1 -Control	14.17	14.63	14.40	0.28	0.26	0.27	47.65	47.68	47.66

F_2 -Jeevamrut@10 lit plant^{-1}	16.25	16.77	16.51	0.24	0.22	0.23	51.34	51.37	51.36
F_3 -EM solution @10 lit plant^{-1}	16.61	17.19	16.90	0.23	0.21	0.22	51.73	51.77	51.75
F_4-Waste decomposer @10 lit plant^{-1}	16.11	16.63	16.37	0.24	0.23	0.24	51.79	51.23	51.21
F_5-Tank mix of Jeevamrut + EM solution @10 lit plant^{-1}	17.39	17.95	17.67	0.22	0.20	0.21	52.10	52.13	52.11
F_6-Tank mix of Jeevamrut + Waste decomposer solution @10 lit plant^{-1}	16.46	17.04	16.75	0.23	0.22	0.23	51.56	51.59	51.57
F_7-Tank mix of EM solution + Waste decomposer solution @10 lit plant^{-1}	16.92	17.47	17.20	0.22	0.20	0.21	51.88	51.91	51.90
S.Em±	0.28	0.29	0.20	0.01	0.01	0.01	0.15	0.15	0.11
C. D. at 5%	0.79	0.81	0.56	0.03	0.03	0.02	0.42	0.42	0.30
C, Interactions: I X F									
S.Em±	0.56	0.57	0.40	0.02	0.02	0.02	0.30	0.30	0.21
C. D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS
General mean	16.27	16.81	16.54	0.24	0.22	0.23	51.06	51.10	51.08

Table 2: Effect of application of organic inputs and organic formulation on reducing sugar, non- reducing sugar and total sugar content of mango fruits

Treatments	Reducing sugar (%)			Non- reducing sugar (%)			Total sugar (%)		
	2023-24	2024-25	Pooled mean	2023-24	2024-25	Pooled mean	2023-24	2024-25	Pooled mean
A, Main plot: Organic inputs (I)									
I_1 - Control	5.59	5.75	5.67	5.13	5.32	5.23	10.72	11.07	10.90
I_2- FYM@10 kg plant^{-1}	5.97	6.15	6.06	5.62	5.83	5.73	11.60	11.98	11.79
I_3- Vermicompost @10 kg plant^{-1}	6.24	6.42	6.33	6.82	7.07	6.95	13.06	13.49	13.28
I_4- FYM@5 kg plant^{-1} + Vermicompost @5 kg plant^{-1}	6.13	6.32	6.23	5.74	5.95	5.84	11.87	12.26	12.07
S.Em±	0.09	0.10	0.07	0.11	0.11	0.08	0.16	0.16	0.11
C. D. at 5%	0.32	0.33	0.21	0.38	0.39	0.24	0.54	0.56	0.35
B, Sub plot: Organic formulations (F)									
F_1 -Control	5.25	5.41	5.33	4.73	4.90	4.82	9.98	10.31	10.15
F_2 -Jeevamrut@10 lit plant^{-1}	6.06	6.24	6.15	5.76	5.97	5.86	11.82	12.21	12.01
F_3 -EM solution @10 lit plant^{-1}	6.07	6.25	6.16	6.10	6.32	6.21	12.17	12.57	12.37
F_4-Waste decomposer @10 lit plant^{-1}	6.04	6.22	6.13	5.63	5.83	5.73	11.67	12.05	11.86
F_5-Tank mix of Jeevamrut + EM solution @10 lit plant^{-1}	6.20	6.39	6.30	6.39	6.62	6.51	12.60	13.01	12.80
F_6-Tank mix of Jeevamrut + Waste decomposer solution @10 lit plant^{-1}	6.08	6.26	6.17	5.97	6.19	6.08	12.06	12.45	12.25
F_7-Tank mix of EM solution + Waste decomposer solution @10 lit plant^{-1}	6.18	6.36	6.27	6.23	6.46	6.34	12.41	12.81	12.61
S.Em±	0.19	0.20	0.14	0.15	0.15	0.11	0.25	0.26	0.18
C. D. at 5%	0.55	0.56	0.39	0.42	0.43	0.30	0.71	0.73	0.50
C, Interactions: I X F									
S.Em±	0.38	0.40	0.28	0.29	0.31	0.21	0.50	0.52	0.36
C. D. at 5%	NS	NS	NS	0.84	0.87	0.60	NS	NS	NS
General mean	5.98	6.16	6.07	5.83	6.04	5.94	11.81	12.20	12.01

Conclusion

Based on two years of field research it can be concluded that the application of vermicompost at 10 kg per plant in conjunction with a tank mix of jeevamrut and EM solution at 10 liters per plant is effective can enhance the quality of fruit in mango cultivar. Kesar.

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