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Effect of Organic Manures and Liquid Biofertilizers on Vegetative Growth Parameters of Newly Planted Guava (*Psidium guajava* L.) cv. Hisar Safeda under Meadow Orchard

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Abstract

A field experiment was conducted from October 2025 to March 2026 at the Research Field, Department of Horticulture, Naini Agricultural Institute (NAI), Faculty of Agriculture (FoA), Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, (U.P.), India. During the six-month research programme, approximately 55 one-year-old wedge-

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grafted Hisar Safeda guava plants were purchased from the registered Zaid Nursery, Lucknow District, (U.P.), India. Approximately 45 plants were incorporated into the research trial, whereas the remaining plants were used for gap filling and replanting. The experiment was laid out in a Randomised Block Design {RBD} with 15 treatments, each replicated three times. The experiment comprised fifteen treatment combinations, *viz.*, T_0:Control T_1:FYM @ 5 kg per plant^{-1}T_2:Vermicompost @ 10 kg per plant^{-1}T_3:Poultry Manure @ 2.5 kg plant^{-1} T_4:Bone Meal @ 2.5 kg plant^{-1} T_5:FYM @ 5 kg per plant-1 + Vermicompost 5 kg per plant^{-1} T_6:FYM @ 5 kg per plant^{-1}+ Poultry Manure @ 2.5 kg plant^{-1} T_7:Vermicompost @ 10 kg per plant^{-1}+ Poultry Manure @ 2.5 kgplant^{-1} T_8:FYM @ 5 kg per plant-1 + Vermicompost 5 kg per plant-1+*Azotobacter*+PSB (20g per plant^{-1}) T_9:FYM @ 5 kg per plant^{-1}+ Poultry Manure @ 2.5 kg plant^{-1}+ *Azotobacter* +PSB (20g per plant^{-1}) T_{10}:Vermicompost @ 10 kg per plant^{-1}+ Poultry Manure @ 2.5 kg plant^{-1}+ *Azotobacter* +PSB (20g per plant^{-1}) T_{11}:FYM @ 5 kg per plant^{-1}+ *Azotobacter* +PSB (20g per plant^{-1}) T_{12}:Vermicompost @ 10 kg per plant^{-1}+ *Azotobacter* +PSB (20g per plant^{-1}) T_{13}:Poultry Manure @ 2.5 kg plant^{-1}+ *Azotobacter* +PSB (20g per plant^{-1}) and T_{14}:Bone Meal @ 2.5 kg plant^{-1}+ *Azotobacter*+PSB (20g per plant^{-1}). The results of the investigation revealed that the treatment T_{10} (Vermicompost @ 10 kg plant^{-1} + Poultry manure @ 2.5 kg plant^{-1} + *Azotobacter* + PSB @ 20 g plant^{-1}) was significantly superior to all other treatments with respect to the establishment of newly planted guava (*Psidium guajava* L.) cv. Hisar Safeda under meadow orchard conditions.

Keywords: Vermicompost; poultry manure; FYM; bone meal; azotobacter; Phosphate Solubilizing Bacteria (PSB); Guava; cultivar hisar safeda; establishment; meadow orchard.

1. Introduction

Guava (*Psidium guajava* L.), a member of the Myrtaceae family, is one of the most significant fruit crops in India's tropical and subtropical regions (Kumar *et al.*, 2024). Research studies conducted at CCS Haryana Agricultural University, Hisar have evaluated the performance of 'Hisar Safeda' under different orchard management conditions. Sharma *et al.* (2011) studied flowering behaviour and fruit set characteristics of guava cultivars including 'Hisar Safeda' and reported significant variation among cultivars regarding flowering season, fruit set and fruit drop behaviour. Sharma *et al.* (2017) also investigated flowering time, floral bud development and floral morphology of 'Hisar Safeda' under semi-arid conditions and highlighted the importance of cultivar-specific growth behaviour for orchard management. Applications of organic manures, such as F.Y.M. and vermicompost, and inorganic fertilisers, such as N, P and K, have been reported to increase the number of leaves and branches and plant height, while also enhancing fruit yield and quality, shoot growth, and fruit set under ambient conditions (Jaiswal *et al.*, 2023). Organic farming does not make use of synthetic agrochemicals. Organic manures have a lower concentration of plant nutrients than fertilisers, but they contribute to improved soil permeability, good soil aggregation, and the supply of various macro- and micronutrients (Kumar *et al.*, 2024). Biofertilisers, which are preparations containing beneficial microorganisms, have gained attention as eco-friendly alternatives to chemical fertilisers. They enhance nutrient uptake, improve soil stability, recycle nutrients, promote symbiotic associations, and aid in bioremediation of contaminated soils (Rivera-Cruz *et al.,* 2008). Biofertilisers are inputs containing microorganisms capable of mobilising and solubilising nutrient elements through biological processes. They are less expensive, eco-friendly, and sustainable and do not require non-renewable sources of energy during their production. They improve plant growth and fruit quality by producing plant hormones. They increase soil fertility and productivity, thereby contributing to sustainability. They are also useful as biocontrol agents because they control many plant pathogens and harmful microorganisms (Singh *et al.*, 2020).

Recent studies have continued to evaluate vermicompost, organic manures, and microbial biofertilisers in relation to plant growth and crop performance across guava and other horticultural systems (Jakhar et al., 2025; Li et al., 2023; Manzoor et al., 2024; Ogugua et al., 2025; Sakshi et al., 2024).

Within the literature summarised above, direct comparative information remains limited on the combined use of the organic manures and liquid biofertilisers evaluated in this manuscript for the early vegetative establishment of newly planted guava cv. Hisar Safeda under meadow orchard conditions.

1.1 Objective

The objective of the present study was to evaluate the effects of organic manures and liquid biofertilisers, applied individually and in combinations, on the vegetative growth and establishment of newly planted guava (*Psidium guajava L.*) cv. Hisar Safeda under meadow orchard conditions.

2. Materials and Methods

The experiment was carried out at the Research Field, Department of Horticulture, Naini Agricultural Institute (NAI), Faculty of Agriculture (FoA), Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, U.P., India during 2025-2026. During the six-month research programme, approximately 55 one-year-old wedge-grafted Hisar Safeda guava plants were purchased from the registered Zaid Nursery, Lucknow, U.P., India. Approximately 45 plants were incorporated into the research trial, whereas the remaining plants were used for gap filling and replanting. The experiment was laid out in a Randomised Block Design {RBD} with 15 treatments, each replicated three times. The experiment comprised fifteen treatment combinations, viz., T_0:Control T_1:FYM @ 5 kg per plant^{-1} T_2:Vermicompost @ 10 kg per plant^{-1} T_3:Poultry Manure @ 2.5 kg plant^{-1} T_4:Bone Meal @ 2.5 kg plant^{-1} T_5:FYM @ 5 kg per plant-1 + Vermicompost 5 kg per plant^{-1} T_6:FYM @ 5 kg per plant^{-1}+ Poultry Manure @ 2.5 kg plant^{-1} T_7:Vermicompost @ 10 kg per plant^{-1}+ Poultry Manure @ 2.5 kgplant^{-1} T_8:FYM @ 5 kg per plant-1 +

Vermicompost 5 kg per plant-1+*Azotobacter*+PSB (20g per plant^{-1}) T_9:FYM @ 5 kg per plant^{-1}+ Poultry Manure @ 2.5 kg plant^{-1}+*Azotobacter*+PSB (20g per plant^{-1}) T_{10}:Vermicompost @ 10 kg per plant^{-1}+ Poultry Manure @ 2.5 kg plant^{-1}+*Azotobacter*+PSB (20g per plant^{-1}) T_{11}:FYM @ 5 kg per plant^{-1}+ *Azotobacter*+PSB (20g per plant^{-1}) T_{12}:Vermicompost @ 10 kg per plant^{-1}+ *Azotobacter*+PSB (20g per plant^{-1}) T_{13}:Poultry Manure @ 2.5 kg plant^{-1}+ *Azotobacter*+PSB (20g per plant^{-1}) and T_{14}:Bone Meal @ 2.5 kg plant^{-1}+ *Azotobacter*+PSB (20g per plant^{-1}). The experimental area was laid out according to the experimental design, and planting spots were marked at a spacing of 2.0 m × 2.0 m**.** Planting pits measuring 60 cm × 60 cm × 60 cm were dug at the marked locations approximately 5 days before transplanting. All the recorded observations were subjected to statistical analysis. The data recorded during the course of the investigation were subjected to statistical analysis using the "Analysis of variance technique".

3. Results and Discussion

The data presented in Tables 1, 2 and 3 revealed that the application of different organic manures and liquid biofertilisers significantly influenced the plant height (cm), number of leaves per plant^{-1}, number of branches plant^{-1}, stem girth (cm), plant spread (E-W) and (N-S), leaf area (cm^2), survival percent (%), plant mortality (%) and chlorophyll (SPAD value) of newly planted guava cv. Hisar Safeda at all stages of observation (30, 60, 90, 120, 150 and 180 DAT). The data presented in Table 1 revealed that the application of different organic manures and liquid biofertilisers significantly influenced the plant height (cm) and number of leaves per plant throughout the observation period (30–180 DAT). The maximum plant height at 180 DAT (86.77 cm) was recorded under T_{10} (Vermicompost @ 10 kg plant^{-1} + Poultry manure @ 2.5 kg plant^{-1} + *Azotobacter* + PSB @ 20 g plant^{-1}), which was statistically at par with T_7 (81.45 cm), T_{11} (80.18 cm), T_8 (80.06 cm) and T_{12} (79.01 cm). The minimum plant height (46.83 cm) was recorded under T_0 (Control). The maximum number of leaves (117.42 plant^{-1}) at 180 DAT was recorded in T_{10}, which was significantly superior to all other treatments. It was followed by T_{12} (105.49 plant^{-1}), T_7 (101.77 plant^{-1}), T_{13} (94.15 plant^{-1}) and T_{14} (93.50 plant^{-1}). The minimum number of leaves (49.97 plant^{-1}) was recorded under the untreated control (T0). The present investigation revealed that the maximum plant height (cm) and number of leaves per plant were recorded under treatment T_{10} (Vermicompost @ 10 kg plant^{-1} + Poultry manure @ 2.5 kg plant^{-1} + *Azotobacter* + PSB @ 20 g plant^{-1}). The exceptional efficacy of this treatment can be ascribed to the combined use of organic manures and beneficial biofertilisers, which together improved nutrient availability, enhanced soil physical characteristics, and stimulated microbial activity within the rhizosphere. Vermicompost is acknowledged as a rich source of easily accessible nutrients, humic substances, vitamins, enzymes, and plant growth regulators that promote vegetative growth, while poultry manure provides significant amounts of nitrogen, phosphorus, potassium, and essential micronutrients for robust plant development. The introduction of *Azotobacter* and phosphate-solubilising bacteria (PSB) further enhanced nitrogen fixation and phosphorus availability, leading to increased cell division, cell elongation, and photosynthetic activity, which in turn boosted plant height and leaf production. These results align with earlier studies indicating that integrated nutrient management substantially enhances vegetative growth in horticultural crops (Adesemoye *et al.,* 2009; Atiyeh *et al.,* 2002; Hayat *et al.,* 2010; Meena *et al.,* 2014; Richardson *et al.*, 2009; Vessey, 2003). The data presented in Table 2 revealed that the application of different organic manures and liquid biofertilisers significantly influenced the number of branches plant^{-1} and stem girth (cm) throughout the observation period (30–180 DAT). Among all the treatments, T_{10} (Vermicompost @ 10 kg plant^{-1} + Poultry manure @ 2.5 kg plant^{-1} + *Azotobacter* + PSB @ 20 g plant^{-1}) recorded the maximum number of branches per plant at all stages, with values of 2.62, 3.84, 5.56, 7.95, 9.94 and 12.90 branches plant^{-1} at 30, 60, 90, 120, 150 and 180 DAT, respectively. This treatment was statistically superior over all other treatments and was closely followed by T_{12} (Vermicompost + *Azotobacter* + PSB) with 12.81 branches plant^{-1}, T_7 (Vermicompost + Poultry manure) with 12.69 branches plant^{-1}, and T_8 (FYM + Vermicompost + *Azotobacter* + PSB) with 12.54 branches plant^{-1} at 180 DAT. Treatment T_{10} recorded the highest stem girth (7.71 cm) and remained statistically at par with T_{12} (7.64 cm), T7 (7.60 cm), T_8 (7.54 cm), T_9 (7.40 cm) and T_{11} (7.27 cm). Treatments receiving individual organic manures produced comparatively lower stem girth than their combinations with biofertilisers. Bone meal treatments (T_4 and T_{14}) remained among the least effective after the control. The exceptional efficacy of this treatment can be ascribed to the synergistic interaction between organic manures and biofertilisers, which enhanced soil fertility, increased nutrient availability, and stimulated beneficial microbial activity within the rhizosphere. Vermicompost offers a well-balanced supply of vital nutrients, humic substances, enzymes, and compounds that promote plant growth, while poultry manure provides significant quantities of nitrogen, phosphorus, potassium, and organic matter. The incorporation of *Azotobacter* and phosphate-solubilising bacteria (PSB) further augmented biological nitrogen fixation and phosphorus solubilisation, leading to improved nutrient absorption and robust vegetative growth. The cumulative impact of these inputs facilitated the development of lateral shoots and heightened cambial activity, resulting in a greater number of branches and thicker stems. Comparable findings have been documented in guava under integrated nutrient management by Goswami *et al.* (2015) and Goswami *et al.* (2012). The positive influence of plant growth-promoting rhizobacteria on vegetative growth has also been reported by Vessey (2003) and Bhattacharyya and Jha (2012). The data presented in Table 3 revealed that the application of different organic manures and liquid biofertilisers significantly influenced the plant spread (E-W) and (N-S) throughout the observation period (30–180 DAT). The maximum plant spread was recorded under T_{10} (46.34 cm). It was statistically at par with T_{12} (46.27 cm), T_7 (46.12 cm), T_8 (46.06 cm) and T_9 (45.60 cm). These treatments showed consistently superior plant spread throughout the experimental period because of improved nutrient availability, better soil structure and enhanced biological activity. The minimum plant spread was recorded in T_0 (Control) with 26.36 cm. The observed increase in plant spread under T_{10} aligns with the principle that integrated nutrient management improves nutrient use efficiency and fosters balanced plant growth through enhanced physiological processes, including photosynthesis, cell division, and carbohydrate translocation. Organic amendments contribute to better soil moisture retention, aeration, and cation exchange capacity, which in turn support improved root proliferation and effective nutrient uptake. As a result, this leads to greater vegetative vigour, manifested as wider canopy expansion in both directions. Similar enhancements in the vegetative growth parameters of guava, following the combined application of vermicompost, poultry manure, and biofertilisers, have been documented by Meena *et al.* (2014), Goswami *et al.* (2015), and Sourabh *et al.* (2018). They attributed the improved canopy development to the synergistic interactions between organic manures and beneficial microbial inoculants.

Table 1. Effect of organic manures and liquid biofertilizers on plant height (cm) and number of leaves per plant of newly planted guava (*Psidium guajava* L.) cv. Hisar Safeda under meadow orchard

Treatment Notations	Initial plant height (cm)	Plant height (cm)						Initial No. of leaves per plant^{-1}	No. of leaves per plant^{-1}					
		30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT		30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT
T_0	27.15	30.44	33.80	37.08	39.23	42.68	46.83	25.63	28.50	33.94	37.05	40.16	44.82	49.97
T_1	30.55	35.16	39.04	43.14	46.85	52.21	57.53	34.11	39.38	45.63	51.26	56.89	62.25	69.50
T_2	32.15	34.33	38.88	44.16	48.04	54.14	60.24	35.15	39.40	45.81	50.06	54.31	60.41	66.63
T_3	31.52	35.29	39.57	44.62	48.06	54.39	60.87	32.15	37.31	43.53	49.63	55.73	61.55	68.00
T_4	30.88	34.16	37.61	41.72	45.16	50.31	56.41	28.15	32.03	38.49	44.82	51.15	57.48	64.70
T_5	32.45	35.87	41.35	46.76	51.01	58.42	63.67	40.11	45.88	53.03	58.90	64.77	71.23	78.68
T_6	31.55	34.00	39.25	45.13	49.46	56.82	63.15	37.63	43.14	50.66	56.71	62.76	69.42	77.08
T_7	39.52	47.07	53.09	60.19	65.30	73.35	81.45	53.41	60.96	69.01	77.06	85.11	93.72	101.77
T_8	38.15	46.33	52.21	59.32	64.37	71.78	80.06	51.44	57.65	63.98	70.50	77.02	84.07	91.12
T_9	38.63	44.70	50.80	57.85	62.73	70.09	78.53	38.41	43.69	50.51	56.97	63.43	70.65	77.76
T_{10}	41.45	48.98	56.03	63.48	69.26	77.62	86.77	61.45	71.95	81.20	89.65	98.10	106.98	117.42
T_{11}	40.50	47.92	54.14	60.39	64.83	72.08	80.18	48.25	55.07	61.51	68.84	76.17	83.53	90.75
T_{12}	38.45	43.31	49.76	56.98	62.34	70.56	79.01	58.66	66.75	74.86	81.91	88.96	97.24	105.49
T_{13}	37.33	41.37	46.82	53.37	58.19	65.85	74.87	50.63	56.98	64.08	71.41	78.74	86.79	94.15
T_{14}	37.15	42.34	47.44	53.56	57.89	65.22	70.29	49.25	55.34	62.39	70.62	78.85	85.96	93.50
C.D.		**0.505**	**0.507**	**0.576**	**0.554**	**0.790**	**0.582**		**1.111**	**0.937**	**0.940**	**0.818**	**0.877**	**1.173**
SE(m)		**0.174**	**0.174**	**0.198**	**0.190**	**0.271**	**0.200**		**0.382**	**0.322**	**0.323**	**0.281**	**0.301**	**0.403**
SE(d)		**0.245**	**0.246**	**0.280**	**0.269**	**0.384**	**0.283**		**0.540**	**0.455**	**0.457**	**0.397**	**0.426**	**0.570**
C.V.		**0.750**	**0.666**	**0.669**	**0.593**	**0.752**	**0.497**		**1.347**	**0.998**	**0.896**	**0.704**	**0.687**	**0.837**

Table 2. Effect of organic manures and liquid biofertilizers on number of branches per plant and stem girth (cm) of newly planted guava (*Psidium guajava* L.) cv. Hisar Safeda under meadow orchard

Treatment Notations	Number of branches plant^{-1}						Stem girth (cm)					
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT
T_0	1.06	2.05	3.06	4.14	5.58	6.37	0.96	1.27	2.76	3.10	3.83	4.07
T_1	1.61	2.37	4.44	6.19	6.47	9.19	1.18	1.75	3.26	3.83	4.46	6.39
T_2	1.64	2.45	4.56	6.26	6.78	9.46	1.24	1.91	3.35	3.91	4.51	6.49
T_3	1.54	2.22	4.32	6.18	6.27	8.09	1.13	2.07	3.17	3.73	4.39	5.68
T_4	1.10	2.12	4.22	5.08	6.16	7.16	1.07	1.95	3.08	3.63	4.21	5.40
T_5	1.88	2.89	4.80	6.69	8.77	11.75	1.30	2.12	3.53	4.21	5.61	6.75
T_6	1.80	2.81	4.74	6.62	8.58	10.95	1.24	2.09	3.45	4.09	5.46	6.68
T_7	2.52	3.72	5.44	7.82	9.66	12.69	1.48	2.39	3.86	4.80	6.34	7.60
T_8	2.44	3.51	5.34	7.74	9.59	12.54	1.46	2.34	3.81	4.75	6.23	7.54
T_9	2.31	3.47	5.28	7.58	9.37	12.31	1.42	2.26	3.74	4.62	6.15	7.40

Treatment Notations	Number of branches plant^{-1}						Stem girth (cm)					
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT
T_{10}	2.62	3.84	5.56	7.95	9.94	12.90	1.56	2.48	3.91	4.91	6.45	7.71
T_{11}	2.16	3.27	5.09	7.38	9.15	12.21	1.37	2.23	3.64	4.47	6.08	7.27
T_{12}	2.59	3.77	5.51	7.90	9.77	12.81	1.52	2.44	3.89	4.88	6.40	7.64
T_{13}	2.06	3.19	5.03	7.12	9.08	12.07	1.33	2.18	3.60	4.33	6.02	7.09
T_{14}	1.36	2.16	4.11	6.10	7.65	8.31	1.01	1.50	3.02	3.40	4.16	5.37
C.D.	**0.067**	**0.093**	**0.089**	**0.116**	**0.257**	**0.156**	**0.036**	**0.062**	**0.057**	**0.054**	**0.117**	**0.188**
SE(m)	**0.023**	**0.032**	**0.030**	**0.040**	**0.088**	**0.053**	**0.012**	**0.021**	**0.019**	**0.019**	**0.040**	**0.065**
SE(d)	**0.033**	**0.045**	**0.043**	**0.056**	**0.125**	**0.076**	**0.017**	**0.030**	**0.028**	**0.026**	**0.057**	**0.091**
C.V.	**2.090**	**1.892**	**1.104**	**1.024**	**1.869**	**0.874**	**1.660**	**1.773**	**0.972**	**0.775**	**1.301**	**1.692**

Table 3. Effect of organic manures and liquid biofertilizers on vegetative growth and Survival percent (%) of newly planted guava (*Psidium guajava* L.) cv. Hisar Safeda under meadow orchard

Treatment Notations	Plant spread (E-W) and (N-S)						Leaf area (cm^2)	Survival per cent (%)	Plant mortality (%)	Chlorophyll (SPAD value)
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT				
T_0	7.73	9.47	12.34	17.54	20.31	26.36	19.82	13.33	86.67	37.13
T_1	12.20	14.65	18.14	23.22	29.18	39.45	30.41	46.67	53.33	59.43
T_2	12.36	15.13	18.21	23.54	30.34	41.13	31.33	53.33	46.67	61.90
T_3	10.41	15.02	17.32	21.44	28.17	39.77	29.42	53.33	46.67	57.10
T_4	10.14	14.85	16.63	20.28	26.95	36.26	28.42	46.67	53.33	55.37
T_5	12.40	15.23	18.61	25.18	31.12	42.64	32.70	60.00	40.00	58.50
T_6	12.34	15.11	18.48	23.28	30.26	42.11	32.50	66.67	33.33	56.94
T_7	14.20	18.37	24.30	29.33	36.64	46.12	37.93	80.00	20.00	70.57
T_8	14.10	18.16	24.14	29.20	36.45	46.06	36.26	73.33	26.67	68.36
T_9	14.03	17.64	22.48	28.16	36.18	45.60	34.49	73.33	26.67	64.97
T_{10}	14.64	18.69	24.53	29.58	36.85	46.34	40.33	100.00	0.00	74.36
T_{11}	13.31	16.20	21.60	27.33	34.38	44.29	33.94	66.67	33.33	61.32
T_{12}	14.53	18.58	24.37	29.44	36.74	46.27	39.17	93.33	6.67	71.61
T_{13}	13.09	16.31	20.31	26.25	32.58	45.18	33.75	60.00	40.00	60.16
T_{14}	8.13	11.26	14.29	19.20	25.26	30.45	24.13	26.67	73.33	43.67
C.D.	**0.228**	**0.215**	**0.373**	**0.215**	**0.327**	**0.858**	**0.621**	**20.049**	**20.049**	**1.295**
SE(m)	**0.078**	**0.074**	**0.128**	**0.074**	**0.112**	**0.295**	**0.213**	**6.885**	**6.885**	**0.445**
SE(d)	**0.111**	**0.104**	**0.181**	**0.105**	**0.159**	**0.417**	**0.302**	**9.737**	**9.737**	**0.629**
C.V.	**1.106**	**0.818**	**1.126**	**0.515**	**0.619**	**1.239**	**1.143**	**19.586**	**30.492**	**1.282**

The data presented in Table 3 revealed that the application of different organic manures and liquid biofertilisers significantly influenced the leaf area (cm^2), survival percentage (%), plant mortality (%) and chlorophyll (SPAD value) of newly planted guava cv. Hisar Safeda under meadow orchard conditions. The maximum leaf area (40.33 cm^2) was recorded in T_{10}: Vermicompost @ 10 kg $plant^{-1}$ + Poultry manure @ 2.5 kg $plant^{-1}$ + *Azotobacter* + PSB (20 g $plant^{-1}$). This treatment resulted in 103.48 per cent higher leaf area compared with the control treatment (19.82 cm^2). The maximum survival percentage (100.00%) was recorded under T_{10}: Vermicompost @ 10 kg $plant^{-1}$ + Poultry manure @ 2.5 kg $plant^{-1}$ + *Azotobacter* + PSB (20 g $plant^{-1}$), which was the most effective treatment, while T_{12} and T_7 were statistically at par with T_{10}. The lowest survival percentage was recorded under T_0 (Control). The minimum plant mortality (0.00%) was recorded under T_{10}: Vermicompost @ 10 kg $plant^{-1}$ + Poultry manure @ 2.5 kg $plant^{-1}$ + *Azotobacter* + PSB (20 g $plant^{-1}$), while T_{12} and T_7 were statistically at par with T_{10}. The highest mortality was recorded under T_0 (Control). The maximum chlorophyll content (74.36 SPAD value) was recorded under T_{10}: Vermicompost @ 10 kg $plant^{-1}$ + Poultry manure @ 2.5 kg $plant^{-1}$ + *Azotobacter* + PSB (20 g $plant^{-1}$), while T_{12} and T_7 were statistically at par with T_{10}. The lowest chlorophyll content was recorded under T_0 (Control). Similar observations have been made by Goswami *et al.* (2012), who found that integrated nutrient management significantly enhanced vegetative growth and leaf nutrient status in guava. Similarly, Sourabh *et al.* (2018) reported that organic amendments and biofertilisers significantly improved guava growth and yield. Organic amendments contribute to better soil structure, increased water retention, enhanced aeration, and greater microbial diversity, which in turn support improved root establishment and alleviate transplant stress. The introduction of *Azotobacter* and phosphate-solubilising bacteria further improves nutrient availability and promotes root proliferation, supporting robust plant establishment. These observations align with the findings of Ekka and Saravanan (2020) and Meena *et al.* (2014). Organic manures release nutrients gradually, reduce nutrient losses, and enhance the soil microbial ecosystem, while beneficial microorganisms encourage root growth and nutrient absorption. These synergistic effects support robust plant establishment and vegetative growth. Goswami *et al.* (2012) likewise reported improved guava growth and leaf nutrient status under integrated nutrient management. Comparable improvements in guava growth under organic nutrient sources were reported by Kumar *et al.* (2024).

4. Conclusion

The present study concluded that the integrated application of organic manures and liquid biofertilisers significantly improved the growth, survival, physiological attributes, and soil fertility status of newly planted guava cv. Hisar Safeda under meadow orchard conditions. Among all the treatments, T_{10} (Vermicompost @ 10 kg $plant^{-1}$ + Poultry manure @ 2.5 kg $plant^{-1}$ + *Azotobacter* + PSB @ 20 g $plant^{-1}$) proved to be the most effective treatment in terms of maximum plant height (86.77 cm), number of leaves (117.42 $plant^{-1}$), number of branches (12.90 $plant^{-1}$), stem girth (7.71 cm), plant spread (46.34 cm), leaf area (40.33 cm^2), survival percentage (100%), chlorophyll content (74.36 SPAD value), and the minimum plant mortality (0.00%).

5. Limitation

The study was conducted over a six-month period at a single experimental site using one guava cultivar, *Psidium guajava* L. cv. Hisar Safeda, with 15 treatments replicated three times. Consequently, the findings primarily represent early vegetative establishment under the specific meadow orchard conditions evaluated. The study did not extend to subsequent seasons or assess long-term yield and fruit-quality responses. Generalisation to other cultivars, locations, soil conditions, or climatic environments should therefore be made cautiously. Future studies should include longer evaluation periods, multiple locations and seasons, and greater replication to confirm the consistency of treatment effects.

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Declaration of AI Use

This manuscript was prepared through the intellectual contributions of the author(s) to the study design, data analysis, interpretation of results, and scholarly content. Grammarly and ChatGPT were used solely to assist with grammatical refinement and reference formatting during manuscript revision. The author(s) accept full responsibility for the accuracy, integrity, and final content of the manuscript.

Competing Interests

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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