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Effect of organic and inorganic mulches on growth parameters of Guava (*Psidium guajava* L.) cv. Allahabad Safeda under high density planting system

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Abstract
The present investigation entitled "Effect of organic and inorganic mulches on growth parameters of Guava *(Psidium guajava* L.) cv. Allahabad Safeda under high density planting system" was carried out during 2024-25 at the Precision Farming Development Centre, Department of Fruit Science, IGKV, Raipur (C.G.). The experiment was laid out in a Randomized Block Design with 13 treatments and 3 replications. Various organic (paddy straw, banana leaves, kans grass, mushroom husk, cardboard,) and inorganic (silver, black and transparent polythene) mulches were evaluated along with a control (no mulch). The study revealed that mulching had a significant effect on all growth parameters of guava, including tree height, tree volume, leaf area, leaf area index and chlorophyll content. Among the treatments, silver polythene mulch (T_7) recorded the maximum tree height (3.00 m), tree volume (7.21 m^3), leaf area (93.42 cm^2), leaf area index (3.41) and chlorophyll content (48.00 SPAD), followed by transparent and black polythene mulches. The control treatment recorded the lowest values across all parameters. The improved growth under mulched conditions may be attributed to better soil moisture retention, favorable root-zone temperature and enhanced nutrient availability. The findings demonstrate that silver polythene mulch is most effective in promoting vegetative growth of guava under high-density planting systems, suggesting its suitability for optimizing orchard productivity and resource use efficiency.

Keywords: Guava, *Psidium guajava*, mulching, high density planting, growth parameters, silver polythene mulch, moisture conservation

Introduction
Guava (*Psidium guajava* L.), a member of the Myrtaceae family, is a tropical fruit crop known for its high nutritional value and adaptability to diverse agro-climatic conditions. It is rich in vitamin C, dietary fiber and essential minerals, making it a valuable fruit for both domestic consumption and export (Gupta, 2014; Singh *et al.*, 2003) [5, 12]. In India, guava occupies about 358 thousand hectares with an annual production of 5.26 million tonnes, yet the productivity remains below potential due to suboptimal orchard management practices. In Chhattisgarh, productivity is only 9.77 MT/ha compared to the national average of 14.70 MT/ha (Anonymous, 2023) [2], primarily because of inadequate moisture and weed management.

Mulching has emerged as a promising agronomic practice for improving soil conditions, conserving moisture, suppressing weeds and enhancing fruit yield and quality. Organic mulches such as crop residues, straw and leaves improve soil fertility and microbial activity, while inorganic mulches like plastic films effectively regulate soil temperature and reduce evaporation losses (Singh *et al.*, 2004; Anikwe *et al.*, 2007; Zhang *et al.*, 2019) [13, 1, 16]. Previous studies have shown that mulching improves soil hydrothermal regimes, water use efficiency and fruit quality in various horticultural crops (Smets *et al.*, 2008; Brar *et al.*, 2017) [14, 3]. However, information on the comparative performance of different mulch types under high-density guava planting systems is limited.

Considering the growing demand for high-quality guava and the need for sustainable orchard management practices, it becomes essential to identify suitable mulching materials that can optimize yield and quality. Therefore, the present investigation was undertaken to study the effect of different organic and inorganic mulches on yield and quality attributes of guava (*Psidium guajava* L.) cv. Allahabad Safeda under high-density planting system.

Materials and Methods

The field experiment entitled "Effect of organic and inorganic mulches on yield and quality attributes of guava (*Psidium guajava* L.) cv. Allahabad Safeda under high-density planting system" was conducted during 2024-25 at the Precision Farming Development Centre, Department of Fruit Science, IGKV, Raipur (C.G.), situated at 21.16°N latitude, 81.36°E longitude and 289.56 m altitude. The region has a sub-humid climate with annual rainfall of 1200-1400 mm and temperatures ranging from 8 °C to 46 °C. The soil was slightly acidic (pH 6.5) and low in fertility, containing 0.15% organic carbon, 94.14 kg/ha nitrogen, 17.49 kg/ha phosphorus and 102.52 kg/ha potassium.

The experiment was laid out in a Randomized Block Design with 13 treatments and 3 replications using 'Allahabad Safeda' guava under 2 × 1 m spacing. Treatments consisted of various organic and inorganic mulches paddy straw, farm compost, rice husk, sawdust, banana leaves, cardboard, mushroom compost, cover crop and plastic mulches (silver, transparent, black) along with a control (no mulch). Mulches were applied around the tree basins after weed removal.

Observations were recorded on growth parameters including tree height (m), tree volume (m^3), average leaf area (cm^2), leaf area index and chlorophyll content following standard methods (Ranganna, 1986; Nelson, 1994) [10, 7]. The data were analyzed statistically using ANOVA for RBD as per Fisher (1967) [4] and treatment means were compared using the critical difference (CD) at a 5% level of significance.

Results and Discussions

Tree Height (m)

The data presented in Table 1 and Fig. 1 reveal that different mulching treatments significantly influenced tree height of guava. The maximum height (3.00 m) was recorded with silver polythene mulch (T_7), which was statistically at par with T_9, T_8, and T_1 (2.90, 2.85 and 2.82 m, respectively). The minimum height (1.75 m) was observed in the control (T_0) without mulch. Enhanced plant height under plastic mulches may be attributed to reduced evaporation and improved nutrient and moisture availability. Similar results were reported by Patra *et al.* (2004) [8] in guava and Shirgure *et al.* (2003) [11] in Nagpur mandarin, where mulching significantly increased plant height.

Tree Volume (m^3)

The data in Table 2 and Fig. 2 indicate that mulching treatments significantly influenced the tree volume of guava. The highest tree volume (7.21 m^3) was recorded under silver polythene mulch (T_7), which was statistically at par with T_9, T_8 and T_1 (7.16, 7.12 and 7.12 m^3, respectively). The lowest tree volume (4.49 m^3) was observed in the control (T_0) without mulch. The increase in tree volume under mulched conditions may be attributed to improved soil moisture retention and favorable temperature, which enhanced physiological activities and vegetative growth. Similar findings were reported by Rajput *et al.* (2014) [9], who observed maximum tree volume with paddy straw mulch compared to other treatments.

Average Leaf Area (Cm^2)

The data presented in Table 3 and Fig. 3 show that different mulching treatments significantly affected the average leaf area of guava. The highest leaf area (93.42 cm^2) was recorded with silver polythene mulch (T_7), which was statistically comparable with T_9 and T_8 (92.32 and 91.56 cm^2, respectively). The lowest leaf area (50.34 cm^2) was observed in the control (T_0) without mulch. The increase in leaf area under mulched conditions may be attributed to favorable root zone temperature and improved nutrient and moisture availability, which enhanced vegetative growth. Similar results were reported by Hussain *et al.* (2017) [6], who observed maximum leaf area with paddy straw mulch compared to other treatments.

Leaf Area Index

The data presented in Table 4 and Fig. 4 indicate that various mulching treatments significantly influenced the leaf area index of guava. The highest leaf area index (3.41) was recorded under silver polythene mulch (T_7), which was statistically at par with T_9, T_8 and T_1 (3.36, 3.31 and 3.27, respectively). The lowest value (2.32) was obtained in the control (T_0) without mulch. The increase in leaf area index under mulched conditions may be attributed to improved soil structure, moisture conservation, and aeration that enhance root activity and canopy development. Similar observations were reported by Sujatha *et al.* (2018) [15], who found maximum leaf area index with paddy straw mulch compared to other treatments.

Chlorophyll Content

The data presented in Table 5 and Fig. 5 reveal that different mulching treatments had a significant effect on chlorophyll content (SPAD) in guava leaves. The highest chlorophyll content (48.00 SPAD) was recorded with silver polythene mulch (T_7), which was statistically comparable with T_9 (46.86 SPAD). The lowest chlorophyll content (28.14 SPAD) was observed in the control (T_0) without mulch. The higher chlorophyll concentration under mulched conditions may be attributed to consistent soil moisture and favorable temperature, which reduce water stress and promote chlorophyll synthesis and leaf turgidity. Similar findings were reported by Sujatha *et al.* (2018) [15], who observed maximum chlorophyll content with paddy straw mulch compared to other treatments.

Conclusion

The present study revealed that both organic and inorganic mulches significantly improved the growth performance of guava under high-density planting conditions. Among the treatments, silver polythene mulch proved superior by recording the highest tree height, tree volume, leaf area, leaf area index and chlorophyll content, followed closely by transparent and black polythene mulches. The enhanced growth under these treatments can be attributed to improved soil moisture retention, regulated soil temperature, and reduced weed competition. Organic mulches like paddy straw and mushroom husk also showed favorable effects and may serve as sustainable alternatives in eco-sensitive areas. Overall, the application of silver polythene mulch is recommended for achieving vigorous plant growth and better orchard performance in guava cv. Allahabad Safeda under high-density planting systems.

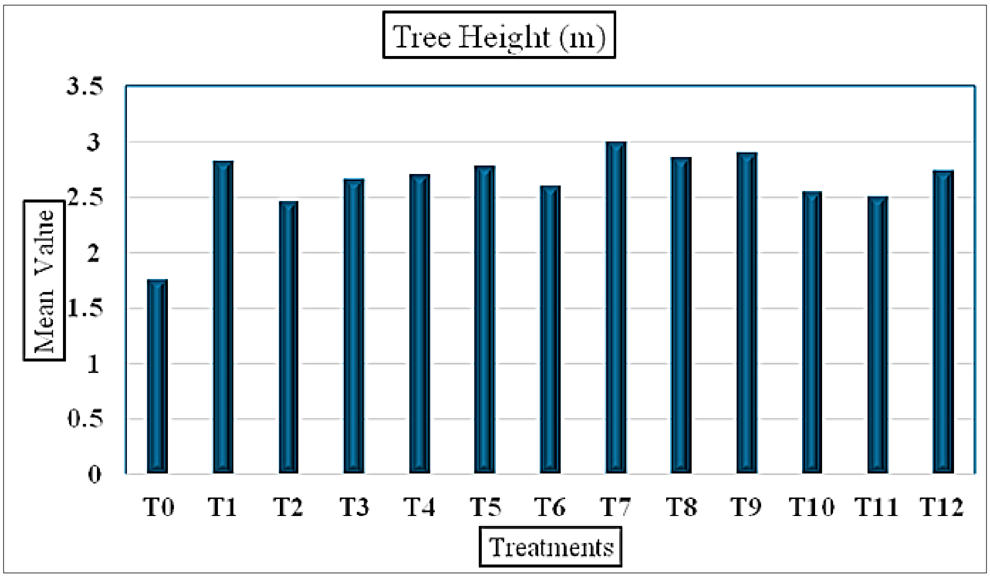

Fig 1: Effect of organic and inorganic mulches on tree height (m)

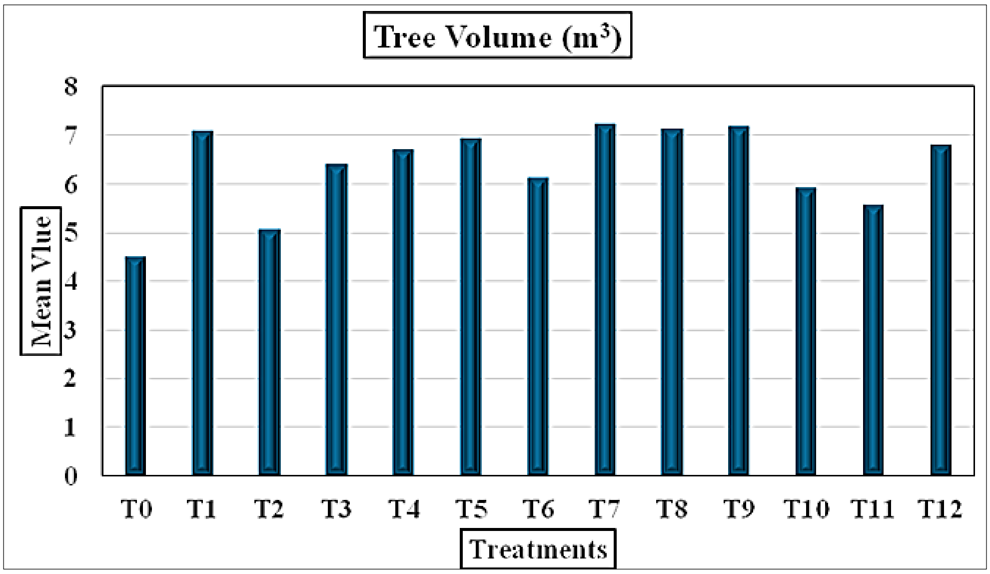

Fig 2: Effect of organic and inorganic mulches on tree volume (m^3)

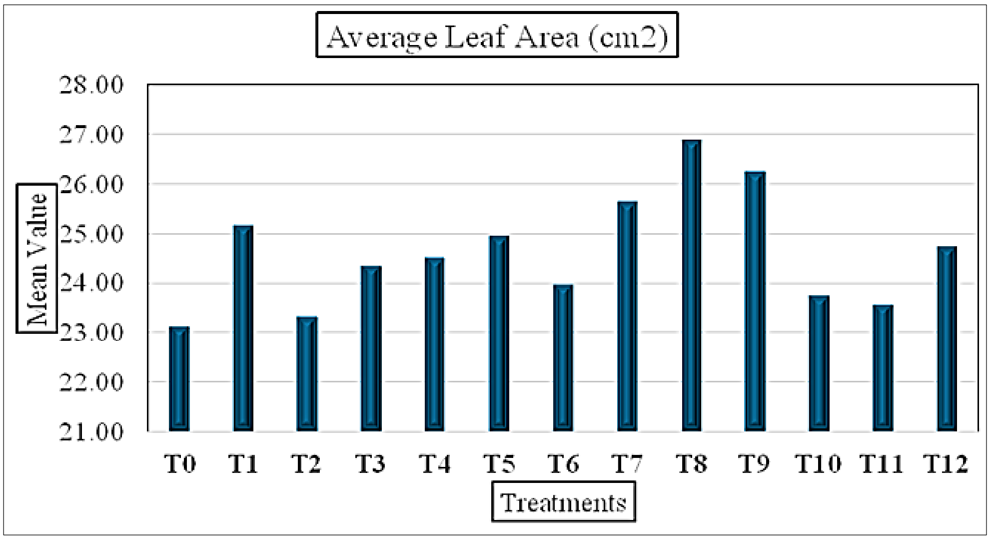

Fig 3: Effect of organic and inorganic mulches on Average leaf area (cm^2)

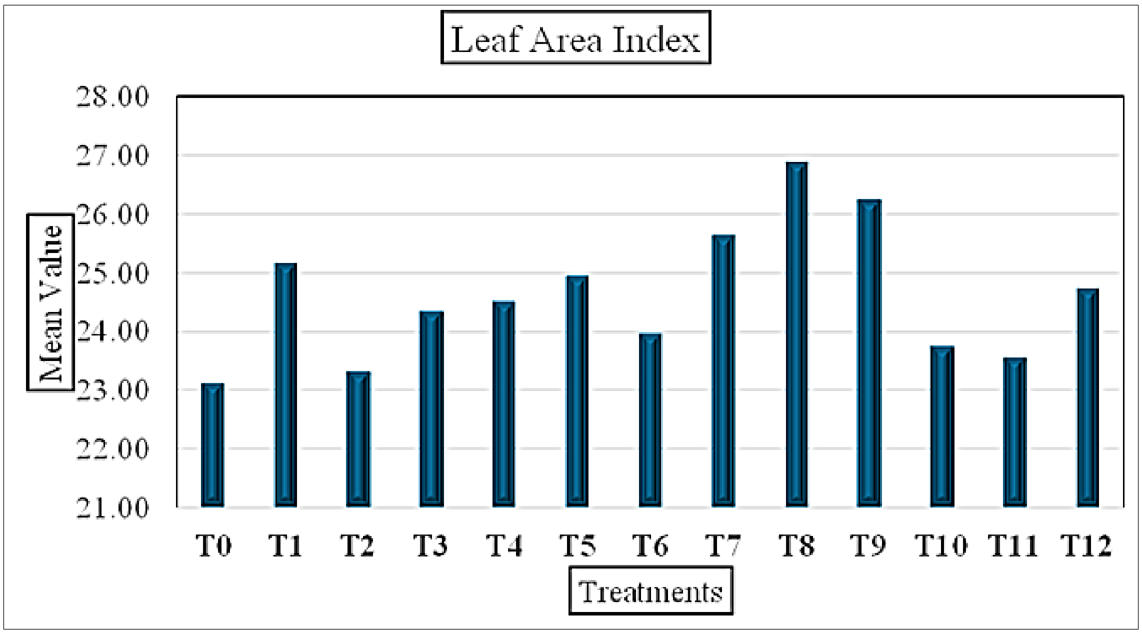

Fig 4: Effect of organic and inorganic mulches on leaf area index

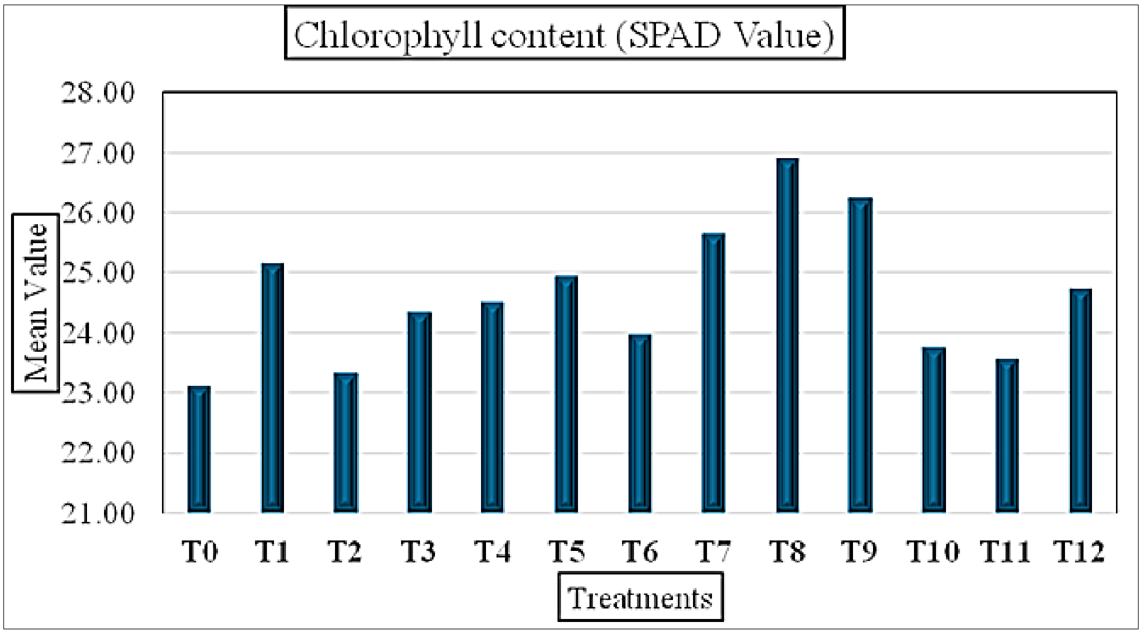

Fig 5: Effect of organic and inorganic mulches on chlorophyll content in leaves (SPAD value)

Table 1: Effect of organic and inorganic mulches on tree height (m)

Notation	Treatment Details	Tree height (m)
T_0	No Mulch	1.75^{l}
T_1	Paddy Straw	2.82^{abc}
T_2	Banana leaves	2.46^{kl}
T_3	Kans grass	2.65^{fgh}
T_4	News paper	2.70^{def}
T_5	Mushroom husk	2.77^{bcd}
T_6	Cardboard	2.60^{ghi}
T_7	Silver polythene mulch	3.00^{a}
T_8	Black polythene mulch	2.85^{abc}
T_9	Transparent polythene mulch	2.90^{ab}
T_{10}	Indian bean (sem)	2.54^{hi}
T_{11}	Guar	2.50^{hij}
T_{12}	Cowpea	2.73^{cd}
	SE (m) ±	0.07
	C.D. at 5%	0.21

Table 2: Effect of organic and inorganic mulches on tree volume (m^3)

Notation	Treatment Details	Tree volume (m^3)
T_0	No Mulch	4.49[l]
T_1	Paddy Straw	7.07[abc]
T_2	Banana leaves	5.06[kl]
T_3	Kans grass	6.40[fgh]
T_4	News paper	6.70[def]
T_5	Mushroom husk	6.92[bcd]
T_6	Cardboard	6.12[ghi]
T_7	Silver polythene mulch	7.21[a]
T_8	Black polythene mulch	7.12[abc]
T_9	Transparent polythene mulch	7.16[ab]
T_{10}	Indian bean (sem)	5.90[hij]
T_{11}	Guar	5.55[ijk]
T_{12}	Cowpea	6.80[cde]
	SE (m) ±	0.24
	C.D. at 5%	0.69

Table 3: Effect of organic and inorganic mulches on average leaf area (cm^2)

Notation	Treatment Details	Average leaf area (m^2)
T_0	No Mulch	50.34[m]
T_1	Paddy Straw	90.32[bcd]
T_2	Banana leaves	53.44[l]
T_3	Kans grass	71.49[gh]
T_4	News paper	73.78[g]
T_5	Mushroom husk	87.74[de]
T_6	Cardboard	67.43[i]
T_7	Silver polythene mulch	93.42[a]
T_8	Black polythene mulch	91.56[abc]
T_9	Transparent polythene mulch	92.32[ab]
T_{10}	Indian bean (sem)	62.56[j]
T_{11}	Guar	57.64[k]
T_{12}	Cowpea	77.52[f]
	SE (m) ±	0.97
	C.D. at 5%	2.82

Table 4: Effect of organic and inorganic mulches on leaf area index

Notation	Treatment Details	Leaf area index
T_0	No Mulch	2.32[l]
T_1	Paddy Straw	3.27[abc]
T_2	Banana leaves	2.36[kl]
T_3	Kans grass	2.90[fgh]
T_4	News paper	3.14[def]
T_5	Mushroom husk	3.23[cde]
T_6	Cardboard	2.70[ghi]
T_7	Silver polythene mulch	3.41[a]
T_8	Black polythene mulch	3.31[abc]
T_9	Transparent polythene mulch	3.36[ab]
T_{10}	Indian bean (sem)	2.57[hi]
T_{11}	Guar	2.45[hij]
T_{12}	Cowpea	3.18[cde]
	SE (m) ±	0.19
	C.D. at 5%	0.55

Table: 5: Effect of organic and inorganic mulches on chlorophyll content in leaves (SPAD value)

Notation	Treatment Details	Chlorophyll content
T_0	No Mulch	28.14[m]
T_1	Paddy Straw	44.64[d]
T_2	Banana leaves	29.67[l]
T_3	Kans grass	33.54[h]
T_4	News paper	34.72[g]
T_5	Mushroom husk	41.56[e]
T_6	Cardboard	32.34[i]
T_7	Silver polythene mulch	48.00[a]
T_8	Black polythene mulch	45.70[c]
T_9	Transparent polythene mulch	46.86[b]
T_{10}	Indian bean (sem)	31.61[j]
T_{11}	Guar	30.46[k]
T_{12}	Cowpea	37.65[f]
	SE (m) ±	0.18
	C.D. at 5%	0.51

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