



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
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NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; 9(7): 1027-1030
Received: 11-05-2026
Accepted: 15-06-2026

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Influence of organic and inorganic mulches on fruit yield and quality of Guava (*Psidium guajava* L.) cv. Allahabad Safeda

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DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i7m.6053>

Abstract

This present investigation was examined to see how varied organic and inorganic mulches affected the fruit yield and fruit quality of guava (*Psidium guajava* L.) cv. Allahabad Safeda, roughly speaking. The experiment went on during 2023–2024, at the Model Orchard, School of Agriculture SR University Warangal, Telangana India. Nine treatments, made up of different organic as well inorganic mulches, were studied in a Randomized Block Design, and each treatment was replicated 3 times. The treatments in this study included control, *Tephrosia purpurea* leaves, paddy husk, dry leaves, paddy straw, bark, sawdust, black plastic mulch and white plastic mulch, all were examined. The yield attributing traits like number of fruits per plant, fruit weight (g) and fruit yield (kg/plant) were recorded along with quality parameters such as TSS (⁰Brix) and Ascorbic acid 100g⁻¹ mg. It was observed that using *Tephrosia purpurea* leaves at 5 t ha⁻¹ significantly increased the yield to 2.35 kg/plant, mainly through better yield determining characters viz., number of fruits per plant 19.65 fruits/plant and individual fruit weight 174.00 g. On the other hand, paddy straw applied at 3.5 t/ha significantly increased the total soluble solids to 11.95 ⁰Brix and also boosted Ascorbic acid up to 202.81 100g⁻¹ mg.

Keywords: Guava, mulching, organic mulch, plastic mulch, yield and fruit quality

1. Introduction

Guava (*Psidium guajava* L.) is maybe one of the most economically important fruit crops grown in tropical and subtropical zones because it has high nutritional value, good adaptability and it can keep producing fruits year around. India is widely known as the world's largest producer of guava, and it adds a lot to the overall global output. The guava fruits themselves are great sources of vitamin C, dietary fiber, minerals, antioxidants, and phenolic compound s, so in a way they become an important part of nutritional security.

Despite its adaptability, guava productivity is often constrained by erratic rainfall, increasing temperatures, poor soil moisture availability, nutrient depletion, and weed competition. Climate variability has further intensified these challenges, particularly in semi-arid regions where water availability has become increasingly uncertain. Consequently, effective soil management practices that enhance water-use efficiency and maintain favorable soil conditions are essential for sustainable guava production.

Among various soil management practices, mulching has gained considerable importance because of its multiple agronomic benefits. Mulches reduce evaporation losses, improve infiltration, regulate soil temperature, suppress weeds, minimize nutrient leaching, enhance microbial activity and improve soil structure (Yadav *et al.*, 2023) [12]. Organic mulches additionally contribute organic matter and nutrients during decomposition, thereby improving soil fertility and biological activity.

Various organic materials, including paddy straw, paddy husk, dry leaves, bark, green leaf biomass, and sawdust, have been widely used as mulches in fruit orchards. Among these, green leaf mulch from the nitrogen-fixing species *Tephrosia purpurea* has recently gained importance cause of its ability to maintain soil moisture while enriching soil fertility. Its decomposition enhances nitrogen availability, microbial activity, and soil organic carbon, thereby reducing the

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dependence on chemical fertilizers (Lal, 2020) [5]. Polyethylene mulch is also extensively used for soil moisture conservation and effective weed suppression. However, comparative information on the performance of *Tephrosia purpurea* green leaf mulch, other organic mulches and polyethylene mulch in guava, particularly under the agro-climatic conditions of Telangana, is very limited.

In view of the above facts, the present investigation was kind of undertaken to assess and compare the effects, of organic and inorganic mulches, on the vegetative growth, fruit yield and also on the fruit quality of guava (*Psidium guajava* L.) cv. Allahabad Safeda under field conditions.

2. Materials and Methods

The field trial was carried out roughly during July 2023 to January 2024 at the Model Orchard, School of Agriculture, SR University, Ananthasagar, Warangal, Telangana, India. The experimental farm is located around 18°03' N latitude and 79°31' E longitude, and it sits at an altitude of about 275 m over mean sea level. The area shows a tropical semi arid sort of weather, with warm summers, mild winters, and an average yearly rainfall in the 850–950 mm range, most of it comes during the southwest monsoon time (June–September). During the trial months, the maximum mean temperature stayed between 28 to 38°C, whereas the minimum average temperature ranged from 15 to 24°C. The site had a well drained sandy loam soil, with moderate fertility, and a somewhat alkaline response, which fits nicely for guava cultivation.

The experiment was done on healthy, uniformly statured guava (*Psidium guajava* L.) plants, of the cultivar Allahabad Safeda. The orchard had bearing plants that were of similar age and vigour, with the plants kept at a spacing of 5 m × 5 m. Normal orchard cultivation practices like irrigation, pruning, nutrient management and plant protection measures were followed for everyone, for all treatments, except the mulch treatments that were being studied.

The trial was conducted in a Randomized Block Design (RBD) with nine treatments viz., T₁ Control (Without mulch), T₂ Leaves of *Tephrosia purpurea* @ 5.0 t ha⁻¹, T₃ Paddy husk @ 3.5 t ha⁻¹, T₄ Dry leaves @ 3.5 t ha⁻¹, T₅ Paddy straw @ 3.5 t ha⁻¹, T₆ Bark mulch @ 3.5 t ha⁻¹, T₇ Sawdust @ 3.5 t ha⁻¹, T₈ Black polyethylene mulch (50% RDF) and T₉ White polyethylene mulch (50% RDF) and treatments were replicated thrice. Numbers of fruits per tree, fruit weight (g), yield (kg/plant), TSS (°Brix) and Ascorbic acid content (mg per 100 g of pulp) were recorded during the study.

The experimental data was put through ANOVA (Analysis of Variance) but in a way that fit a Randomized Block Design (RBD), so yeah, it followed the processes described by Panse and Sukhatme (1985) [6]. The treatment effect was then looked at under the 5% probability level i.e. ($P \leq 0.05$) for significance. For all cases where the treatment effects turned out significant, the Standard Error of Mean (SEM $\pm$), the Critical Difference (CD) at 5%, and the F-test values were worked out. Overall statistical analysis was carried out using regular agricultural statistical methods, and afterward the treatment means were compared by applying the least significant difference (LSD) test.

3. Results and Discussion

The application of different organic and inorganic mulching materials significantly influenced the fruit yield and fruit quality of guava (*Psidium guajava* L.) cv. Allahabad Safeda.

Fruit Yield and Fruit Yield attributing parameters

The data (Table 1) revealed that, organic and inorganic mulching material significantly influenced the fruit yield and fruit yield attributing characters of guava cv. Allahabad safeda. Among the different treatments, *Tephrosia purpurea* leaf mulch (T₂) has recorded highest number of fruits per plant (19.65 fruits/plant) which is at par with Paddy husk (T₃) (17.83 fruits/plant). The lowest fruits number per plant was recorded with control/without mulch (T₁) (12.10 fruits/plant).

The increased fruit set under *Tephrosia* mulch may be attributed to improved soil moisture conservation, gradual nitrogen release during decomposition, enhanced microbial activity, and improved nutrient availability that promoted flowering and fruit retention. Organic residues also improve soil biological activity and nutrient mineralization, thereby increasing reproductive efficiency. Similar increased fruits number per plant with organic mulch was earlier reported by Singh *et al.*, (2019) [11] in guava, Sharma *et al.*, (2020) [10] in guava and Abeer Ali *et al.*, (2024) [1] in guava.

Fruit weight was significantly influenced by mulching (Table 1). The maximum fruit weight was recorded with application of *Tephrosia* leaf mulch (T₂) (174.00 g), which is followed by dry leaves mulch (T₄) (156.25 g), Bark mulch (T₆) (153.95 g) and Saw dust mulch (T₇) (142.68 g). However, the minimum fruit weight was recorded with control/without mulch (T₁) (141.00 g) treatment.

The increase in fruit weight may be attributed to enhanced nitrogen availability, improved microbial biomass, greater photosynthetic efficiency and better assimilate translocation towards developing fruits. Organic mulches enhance nutrient-use efficiency while reducing soil evaporation losses, resulting in better fruit development. Similar improvement in fruit weight with organic mulch in guava was earlier reported by Sharma *et al.*, (2020) [10] Patel *et al.*, (2021) [7] and Abeer Ali *et al.*, (2024) [1].

Fruit yield per plant was significantly influenced by mulching treatments (Table 1). The maximum yield per plant was recorded in *Tephrosia* leaf mulch (T₂) (2.35 kg/plant) which was on par with application of Saw dust mulch (T₇) (2.15 kg/plant), white plastic mulch (T₉) (2.15 kg/plant) and Dry leaves mulch (T₄) (2.14 kg/plant). However, minimum yield per plant was recorded with control/without mulch treatment (T₁) (1.73 kg/plant).

The higher yield under organic mulches resulted from improved soil moisture conservation, minimized weed competition, enhanced nutrient mineralization, and greater root activity. Organic mulches also enhance soil organic carbon and microbial biomass, leading to sustained nutrient release throughout the crop growth cycle. These results earlier confirmed with Kader in guava, Ranjan *et al.*, (2021) [9] in guava and Rani *et al.*, (2022) [8] in guava.

Fruit Quality parameters

The fruit quality parameters like total soluble solids (TSS) and ascorbic acid, improved quite noticeably under both organic mulches and inorganic mulches (Table 2). When we compare among the mulches themselves, paddy straw mulch (T₅) showed the highest TSS value (11.95 °Brix), and it was more or less at par with dry leaves mulch (T₄) (11.60 °Brix). In contrast, the lowest TSS (°Brix) showed up in the control treatment without mulch (T₁) (10.75 °Brix). For ascorbic acid, the maximum content (mg 100 g⁻¹ pulp) was recorded with paddy straw mulch (T₅) (202.81 mg 100 g⁻¹ pulp), while the minimum ascorbic acid content (mg 100 g⁻¹ pulp) came from control/without mulch (T₁) (172.63 mg 100 g⁻¹ pulp).

Higher TSS and ascorbic acid under organic mulches may be associated with improved photosynthetic efficiency, balanced nutrient availability, enhanced carbohydrate accumulation, and reduced moisture stress. Improved soil microbial activity further supports metabolic processes responsible for sugar accumulation

and vitamin C synthesis. Similar improvement in guava fruit quality parameters with application of organic mulching was earlier confirmed by Beelagi (2020)^[2], Kumar *et al.*, (2020)^[4] and Abeer Ali *et al.* (2024)^[1].

Table 1: Influence of organic and inorganic mulches on yield attributing characters of guava cv. Allahabad Safeda

Treatments	Number of fruits per plant			Fruit weight (g)			Fruit yield (kg/plant)		
	60 Days After Mulch Application	90 Days After Mulch Application	Mean	60 Days After Mulch Application	90 Days After Mulch Application	Mean	60 Days After Mulch Application	90 Days After Mulch Application	Mean
T ₁ – Control (No Mulch)	14.60	9.59	12.1 ^c	143.00	139.00	141.00 ^c	1.60	1.85	1.73 ^c
T ₂ – Leaves of <i>Tephrosia purpurea</i> @ 5.0 t/ha	19.50	19.80	19.65 ^a	172.00	176.00	174.00 ^a	2.27	2.42	2.35 ^a
T ₃ – Paddy husk @ 3.5 t/ha	17.64	18.01	17.83 ^a	144.00	151.75	147.88 ^b	1.90	1.97	1.94 ^b
T ₄ – Dry leaves @ 3.5 t/ha	14.96	15.57	15.27 ^b	140.25	172.25	156.25 ^b	2.10	2.17	2.14 ^a
T ₅ – Paddy straw @ 3.5 t/ha	13.77	14.90	14.34 ^b	141.50	159.75	150.63 ^b	1.99	2.11	2.05 ^b
T ₆ – Bark @ 3.5 t/ha	13.42	15.10	14.26 ^b	148.90	159.00	153.95 ^b	1.97	2.10	2.04 ^b
T ₇ – Sawdust @ 3.5 t/ha	12.50	13.50	13.00 ^c	139.50	145.85	142.68 ^b	1.95	2.35	2.15 ^a
T ₈ – Black plastic mulch (50% RDF)	14.00	15.00	14.5 ^b	145.50	155.65	150.58 ^b	1.95	2.00	1.98 ^b
T ₉ – White plastic mulch (50% RDF)	13.50	14.00	13.75 ^b	145.00	153.75	149.38 ^b	1.85	2.45	2.15 ^a
F-test	*	*	*	*	*	*	*	*	*
S.Em. ±	0.546	0.657	0.749	5.700	4.989	5.026	0.101	0.097	0.077
CD at 5%	1.650	1.987	2.266	17.237	15.087	15.197	0.306	0.292	0.234

***Note:** Figures with same alphabets did not differ significantly. *Significant at (p= 0.05 LOS). Values were compared with respective C.D values.

Table 2: Effect of organic and inorganic mulches on fruit quality characters of guava cv. Allahabad Safeda

Treatments	TSS (^o Brix)			Ascorbic acid (mg 100 g ⁻¹ pulp)		
	60 Days After Mulch Application	90 Days After Mulch Application	Mean	60 Days After Mulch Application	90 Days After Mulch Application	Mean
T ₁ – Control (No Mulch)	10.2	11.30	10.75 ^c	166.5	178.75	172.63 ^d
T ₂ – Leaves of <i>Tephrosia purpurea</i> @ 5.0 t/ha	10.3	11.40	10.85 ^c	174.62	176.12	175.37 ^d
T ₃ – Paddy husk @ 3.5 t/ha	10.9	11.90	11.40 ^b	184.25	203.37	193.81 ^b
T ₄ – Dry leaves @ 3.5 t/ha	11.1	12.10	11.60 ^a	178.75	210.37	194.56 ^b
T ₅ – Paddy straw @ 3.5 t/ha	11.4	12.50	11.95 ^a	192.5	213.12	202.81 ^a
T ₆ – Bark @ 3.5 t/ha	10.8	11.80	11.30 ^b	179.32	196.35	187.84 ^c
T ₇ – Sawdust @ 3.5 t/ha	10.25	11.40	10.83 ^c	172.62	193.81	183.22 ^c
T ₈ – Black plastic mulch (50% RDF)	10.35	11.60	10.98 ^c	175.37	194.56	184.97 ^c
T ₉ – White plastic mulch (50% RDF)	10.55	11.90	11.23 ^b	170.25	202.81	186.53 ^c
F-test	*	*	*	*	*	*
S.Em. ±	0.175	0.185	0.119	4.217	2.429	1.952
CD at 5%	0.529	0.559	0.359	12.753	7.346	5.901

***Note:** Figures with same alphabets did not differ significantly. *Significant at (p = 0.05 LOS). Values were compared with respective C.D values.

Conclusion

The present investigation showed that using organic and inorganic mulches has a very noticeable impact on guava yield and fruit quality (*Psidium guajava* L.) cv. Allahabad Safeda under the agro-climatic semi-Arid situation of Telangana. Organic mulches seemed to perform better than the inorganic type, mainly because they helped with soil moisture saving, improved nutrient availability, and supported better overall plant growth, not just one thing. In the set of treatments that were examined, *Tephrosia purpurea* leaf mulch at 5.0 t ha⁻¹ turned out most effective, giving the highest fruit count, fruit weight, and fruit yield per plant. On the other hand, paddy straw mulch brought clearer gains in fruit quality, in particular by raising total soluble solids (TSS) and also ascorbic acid levels.

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