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# STUDY ON THE IMPACT OF DIFFERENT MULCH MATERIALS ON WEED SUPPRESSION, SOIL PROPERTIES, GROWTH, YIELD AND QUALITY OF GUAVA CV. ALLAHABAD SAFEDA UNDER MEADOW ORCHARDING

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**ABSTRACT**

The experiment titled "Study on the impact of different mulch materials on weed suppression, soil properties, growth, yield and quality of guava cv. Allahabad Safeda under meadow orcharding" was conducted from January to May 2026 at the Centre of Excellence, Siddipet district, Mulugu, using a Randomised Block Design (RBD) with 10 treatments and 3 replications, $T_1$-paddy straw 5 cm thickness, $T_2$-paddystraw 10 cm thickness, $T_3$-coconut fibre mat, $T_4$-horse gram as live mulch, $T_5$- black gram as live mulch, $T_6$-dried leaves 5 cm thickness, $T_7$-dried leaves 10 cm thickness, $T_8$-biodegradable mulch, $T_9$-black polythene mulch,$T_{10}$-no mulch. The growth attributes studied included canopy volume, leaf area index (LAI), days to flower initiation, days to full bloom, and chlorophyll content. The maximum canopy volume (25.66 $m^3$) was recorded under $T_2$ paddy straw mulch (10 cm thickness), which was statistically on par with coconut fibre mat and black gram live mulch. Black gram live mulch produced the highest leaf area index (5.80). The earliest flower initiation was observed under black polythene mulch (22.00 days) and biodegradable mulch (23.33 days. Horse gram live mulch and dried leaves mulch (5 cm) recorded the minimum number of days to full bloom (33.33 and 33.00 days, respectively). The highest chlorophyll content was recorded with $T_1$ paddy straw mulch (5 cm),(47.36) while the lowest chlorophyll content (39.09)was observed under $T_8$ biodegradable mulch. Overall, the study demonstrated that organic mulches, particularly paddy straw, and live mulches significantly improved the growth performance of guava.

***Key words :*** Guava, Mulching, Weed suppression, Meadow orcharding, Growth.

## Introduction

Guava is one of the major fruit crops of tropical and sub-tropical regions, commonly grown throughout the world. It is readily available at a reasonable price and is thus also known as 'The Apple of the Tropics' or 'Poor Man's Fruit'. In India, guava is cultivated on 359 thousand hectares, with a production of 5.59 million metric tons. (NHB, 2023). According to the National Horticulture Database (2nd Advance Estimates) released by the National Horticulture Board, fruit production and area under cultivation for fiscal year 2024 were estimated at 112.62 million metric tons and 7.04 million hectares, respectively. Guava is one of the richest natural sources of vitamin C, containing 2 to 5 times more vitamin C than oranges. High concentrations of flavonoids and polyphenols linked to strong antioxidant activity can be found in guava leaves (Pandhi *et al*., 2022). In Telangana, it is commercially grown in Rangareddy, Sangareddy and Khammam districts of Telangana state.

The guava fruit is a rich source of vitamins A, B and C in addition to minerals, carbohydrates, crude fibre, flavonoids, thiamin, niacin, pyridoxine, cyanocobalamin, phenolic, betacyanins, polyphenol, and carotene. The fruit is rich in nutrients and can be consumed fresh or processed into various products such as juice, jam, jelly, beverages, nectar, shrikhand, slices, leather and pulp

(Bhattacharya and Tandon, 2021). Guava processing generates substantial waste, including peels, seeds and pomace, which can create value-added products like animal feed, essential oils, and nanomaterials (Pathak *et al*., 2020).

Soil degradation has become a major challenge in guava orchards of Telangana due to intensive cultivation, continuous cropping without adequate nutrient replenishment, excessive use of agrochemicals and poor soil management practices. In addition, drought-prone conditions and water scarcity have accelerated the depletion of soil organic matter, nutrient losses, soil erosion, and declining soil fertility, ultimately affecting plant growth, fruit yield, and quality. Therefore, sustainable orchard management practices are essential to maintain soil health and ensure long-term productivity.

Mulching is an effective practice for improving soil fertility by conserving soil moisture, regulating soil temperature, suppressing weeds, enhancing microbial activity and increasing nutrient availability. Organic mulches such as paddy straw and live mulches gradually release nutrients during decomposition, while plastic and biodegradable mulches improve the soil microclimate and water-use efficiency. Bakshi *et al*. (2015) reported that mulching enhances nutrient availability and reduces nutrient losses by minimising weed competition, thereby improving fruit yield and quality. Hence, evaluating different mulching materials is essential for identifying sustainable mulching practices to improve soil properties, growth, yield, and fruit quality of guava under high-density and ultra-high-density planting systems.

## Materials and Methods

A field experiment was conducted during January-May 2026 at the Centre of Excellence, Mulugu, Siddipet district, Telangana. The experimental field is situated at an elevation of 333 m above mean sea level and lies between 17.7230$^0$ North latitude and 78.6234$^0$ East longitude.

The experiment was laid out in a Randomised Block Design (RBD) with 10 treatments and 3 replications, which include $T_1$-paddy straw 5 cm thickness, $T_2$-paddystraw 10 cm thickness, $T_3$-coconut fibre mat, $T_4$-horse gram as live mulch, $T_5$- black gram as live mulch, $T_6$-dried leaves 5 cm thickness, $T_7$-dried leaves 10 cm thickness, $T_8$-biodegradable mulch, $T_9$-black polythene mulch, $T_{10}$-no mulch. Organic mulching materials such as paddy straw, dried leaves, coconut fibre mat, and fallen leaves were sourced from nearby agricultural fields. These materials were cleaned to eliminate stones, weed seeds, and other undesirable elements. The mulch components were then chopped into small segments of roughly 5cm and 10cm thickness in length to ensure even distribution around the base of the trees.

For the treatments involving biodegradable mulch, black polyethene sheets of 100-micron thickness were sourced and cut into circular shapes based on the size of the guava tree basins. Observations on growth parameters, which include canopy volume, days for flower initiation, days for full bloom, leaf area index and chlorophyll content, were recorded. The data were statistically analysed following the procedure of analysis of variance (ANOVA) for a randomised block design.

## Results and Discussion

### Canopy volume (m$^3$)

It was observed from the data that a significant effect was observed among different mulch materials. Among the different mulch materials, the maximum canopy volume was observed in $T_2$ paddy straw (10 cm) at 25.66 m$^3$, which was on par with coconut fibre mat (25.66 m$^3$) and black gram (25.33 m$^3$). The maximum canopy volume in $T_2$ Paddy straw might be due to the mulch acting as a protective layer over the soil surface, reducing evaporation losses and maintaining a more uniform moisture regime around the root zone. The findings are consistent with Choudhri *et al*. (2025), who reported that paddy straw mulch significantly increased canopy volume in the guava cv. Allahabad Safeda under ultra-high-density planting.

**Table 1 :** Effect of mulching on canopy volume (m$^3$) of guava cv. Allahabad Safeda.

| Treatments | Treatment details | Canopy volume (m$^3$) |
|---|---|---|
| $T_1$ | Paddy straw (5 cm thickness) | 20.00$^{cd}$ |
| $T_2$ | Paddy straw (10 cm thickness) | 25.66$^{a}$ |
| $T_3$ | Coconut fibre mat | 25.66$^{a}$ |
| $T_4$ | Horse gram as live mulch | 22.00$^{cd}$ |
| $T_5$ | Black gram as live mulch | 25.33$^{a}$ |
| $T_6$ | Dried leaves (5 cm thickness) | 22.33$^{bc}$ |
| $T_7$ | Dried leaves (10 cm thickness) | 23.66$^{ab}$ |
| $T_8$ | Biodegradable mulch (100 microns) | 23.33$^{ab}$ |
| $T_9$ | Black polythene mulch (100 microns) | 22.00$^{bc}$ |
| $T_{10}$ | No mulch | 19.00$^{d}$ |
| **SE(m)** | | 0.99 |
| **C.D 5%** | | 2.97 |
| **C.V** | | 7.52 |

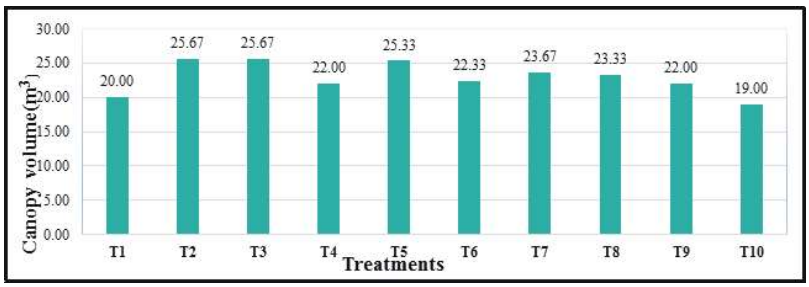



**Fig. 1 :** Effect of mulching on canopy volume ($m^3$) of guava cv. Allahabad Safeda ($T_1$-Paddy straw (5 cm thickness), $T_2$-Paddy straw (10 cm thickness), $T_3$-Coconut fibre mat, $T_4$-Horse gram as live mulch, $T_5$-Black gram as live mulch, $T_6$-Dried leaves (5 cm thickness), $T_7$-Dried leaves (10 cm thickness), $T_8$-Biodegradable mulch (100 microns), $T_9$-Black polythene mulch (100 microns), $T_{10}$-No mulch).

## Leaf area index

The findings showed that different mulching treatments had a significant impact on leaf area index. Among the different mulch materials, $T_5$ black gram showed a maximum leaf area index of 5.80, which was on par with $T_2$ paddy straw 10 cm thickness, with 5.34, while the minimum leaf area index was observed in $T_3$ coconut fibre mat of 4.20. The maximum leaf area index observed in $T_5$ (black gram) may be attributed to its leguminous nature, which enhanced soil nitrogen through biological nitrogen fixation, promoting vigorous vegetative growth, greater leaf initiation, and increased leaf surface area. Similar findings were documented by Sandmann *et al*. (2010), who found that leaf area index increased maximally in lettuce and Kohlrabi.

**Table 2 :** Effect of mulching on leaf area index of guava cv. Allahabad Safeda.

| Treatments | Treatment details | Leaf area index |
|---|---|---|
| $T_1$ | Paddy straw (5 cm thickness) | $4.23^{d}$ |
| $T_2$ | Paddy straw (10 cm thickness) | $5.34^{ab}$ |
| $T_3$ | Coconut fibre mat | $4.22^{d}$ |
| $T_4$ | Horse gram as live mulch | $5.09^{abc}$ |
| $T_5$ | Black gram as live mulch | $5.80^{a}$ |
| $T_6$ | Dried leaves (5 cm thickness) | $4.78^{bcd}$ |
| $T_7$ | Dried leaves (10 cm thickness) | $4.40^{cd}$ |
| $T_8$ | Biodegradable mulch (100 microns) | $5.14^{ab}$ |
| $T_9$ | Black polythene mulch (100 microns) | $5.21^{ab}$ |
| $T_{10}$ | No mulch | $4.10^{d}$ |
| **SE(m)±** | | 0.24 |
| **C.D 5%** | | 0.72 |
| **C.V** | | 8.71 |

## Days for flower initiation

The findings showed that different mulching treatments showed a significant impact on the days for flower initiation.

Among the different mulch materials, the minimum number of days for flower initiation was observed in $T_8$ biodegradable mulch (23.33) and black polythene mulch (22.00), while $T_1$ paddy straw 5 cm thickness showed the maximum number of days for flower initiation (34). The improved root-zone environment might have promoted efficient uptake of water and nutrients, increased photosynthetic efficiency, and accelerated floral induction, thereby reducing the time required for flower initiation. These findings are supported by research in red raspberry (*Rubus idaeus* L.), where biodegradable plastic mulches improved soil temperature, soil moisture, plant growth, and productivity compared with bare soil (Zandstra *et al*., 2019).

**Table 3 :** Effect of mulching on the days for flower initiation of guava cv. Allahabad Safeda.

| Treatments | Treatment details | Days for flower initiation |
|---|---|---|
| $T_1$ | Paddy straw (5 cm thickness) | $34^{a}$ |
| $T_2$ | Paddy straw (10 cm thickness) | $32.33^{ab}$ |
| $T_3$ | Coconut fibre mat | $30.00^{bc}$ |
| $T_4$ | Horse gram as live mulch | $28.00^{cd}$ |
| $T_5$ | Black gram as live mulch | $27.00^{d}$ |
| $T_6$ | Dried leaves (5 cm thickness) | $24.00^{ef}$ |
| $T_7$ | Dried leaves (10 cm thickness) | $24.00^{ef}$ |
| $T_8$ | Biodegradable mulch (100 microns) | $23.33^{f}$ |
| $T_9$ | Black polythene mulch (100 microns) | $22.00^{f}$ |
| $T_{10}$ | No mulch | $26.00^{de}$ |
| **SE(m)±** | | 0.79 |
| **C.D 5%** | | 2.37 |
| **C.V** | | 5.08 |

## Days for full bloom

The findings showed that different mulching

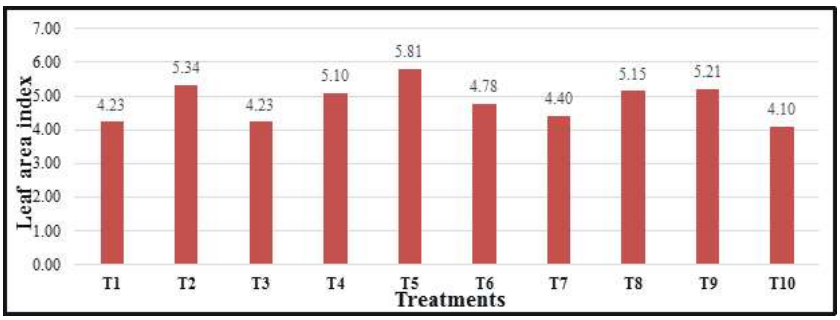



**Fig. 2 :** Effect of mulching on Leaf area index of guava cv. Allahabad Safeda ($T_1$-Paddy straw (5 cm thickness), $T_2$-Paddy straw (10 cm thickness), $T_3$-Coconut fibre mat, $T_4$-Horse gram as live mulch, $T_5$-Black gram as live mulch, $T_6$-Dried leaves (5 cm thickness), $T_7$-Dried leaves (10 cm thickness) $T_8$-Biodegradable mulch (100 microns), $T_9$-Black polythene mulch (100 microns), $T_{10}$-No mulch).

treatments showed a significant impact on the number of days for full bloom.

Among the different mulch materials, the minimum number of days for full bloom was observed in $T_4$ horse gram as live mulch, and $T_6$ dried leaves 5 cm thickness with 33.33 and 33.00; $T_3$ coconut fibre mat showed the maximum number of days for full bloom, 40.33. The rapid growth and development of *M. uniflorum* are closely associated with favourable thermal conditions. As a warm-season crop, it requires higher temperatures for optimum growth. The orchard microclimate enhances heat accumulation, enabling the crop to attain the required Growing Degree Days (GDD) and Heliothermal Units (HTU) more quickly, thereby accelerating vegetative growth and promoting earlier flowering. Swamy (2026) documented that leguminous live covers reduced the number of days required for full bloom in Custard Apple. Similar findings were observed by Singh (2014) in Apple.

**Table 4 :** Effect of mulching on days for full bloom of guava cv. Allahabad Safeda.

| Treatments | Treatment details | Days for full bloom |
|---|---|---|
| $T_1$ | Paddy straw (5 cm thickness) | 36.33$^{abcd}$ |
| $T_2$ | Paddy straw (10 cm thickness) | 34.66$^{cd}$ |
| $T_3$ | Coconut fibre mat | 40.33$^{a}$ |
| $T_4$ | Horse gram as live mulch | 33.33$^{d}$ |
| $T_5$ | Black gram as live mulch | 35.66$^{bcd}$ |
| $T_6$ | Dried leaves (5 cm thickness) | 33.00$^{d}$ |
| $T_7$ | Dried leaves (10 cm thickness) | 39.66$^{abc}$ |
| $T_8$ | Biodegradable mulch (100 microns) | 36.33$^{abcd}$ |
| $T_9$ | Black polythene mulch (100 microns) | 34.66$^{cd}$ |
| $T_{10}$ | No mulch | 38.66$^{abc}$ |
| **SE(m)±** | | 1.43 |
| **C.D 5%** | | 4.28 |
| **C.V** | | 6.83 |

## Chlorophyll content

The findings showed that different mulching treatments showed a significant impact on chlorophyll content.

Among the different mulch materials, $T_1$ paddy straw 5 cm thickness showed maximum chlorophyll content of 47.36, while the minimum chlorophyll content was observed in $T_8$ Biodegradable mulch of 39.09. Improved chlorophyll concentration under paddy straw mulch might be due to increased microbial activity and soil health, which further lead to improved leaf nutrition and chlorophyll accumulation, as well as nutrient mineralisation and availability. These findings are in agreement with those of Bons *et al*. (2018), who reported that paddy straw mulch recorded the highest chlorophyll content in Kinnow mandarin. Similar findings were observed by Krol-Dyrek and Siwek (2015) in raspberry.

**Table 5 :** Effect of mulching on chlorophyll content of guava cv. Allahabad Safeda.

| Treatments | Treatment details | Chlorophyll content |
|---|---|---|
| $T_1$ | Paddy straw (5 cm thickness) | 47.36$^{a}$ |
| $T_2$ | Paddy straw (10 cm thickness) | 42.90$^{b}$ |
| $T_3$ | Coconut fibre mat | 41.53$^{bc}$ |
| $T_4$ | Horse gram as live mulch | 39.67$^{bc}$ |
| $T_5$ | Black gram as live mulch | 39.83$^{bc}$ |
| $T_6$ | Dried leaves (5 cm thickness) | 40.79$^{bc}$ |
| $T_7$ | Dried leaves (10 cm thickness) | 39.16$^{c}$ |
| $T_8$ | Biodegradable mulch (100 microns) | 39.09$^{c}$ |
| $T_9$ | Black polythene mulch (100 microns) | 40.31$^{bc}$ |
| $T_{10}$ | No mulch | 39.99$^{bc}$ |
| **SE(m)±** | | 1.20 |
| **C.D 5%** | | 3.59 |
| **C.V** | | 5.09 |

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