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## Response of organic mulches on weed and soil parameters of guava (*Psidium guajava* L.) under ultra high density planting system

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### Abstract

The present investigation “response of organic mulches on weed and soil parameter of guava (*Psidium guajava* L.) under ultra-high density planting system” was conducted at PFDC (Precision Farming Development Centre), Department of Fruit Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya Raipur during the year 2022-2023. The results revealed that the significantly minimum weed density (2.00) per m<sup>2</sup> with the use of rice husk mulch. At 90 days after organic mulch the maximum soil moisture percent of 21.96% and minimum soil temperature of 21.85°C was recorded in tree basin mulched with rice husk mulch, which was followed treatments use of card board mulch.

**Keywords:** Organic mulching, weed flora, paddy husk and soil temperature

### Introduction

Guava (*Psidium guajava* L.) is one of the most important and popular fruit crop of tropical and sub-tropical regions of India. It has good nutritive value, high yielding capacity, good processing quality. Guava belongs to Myrtaceae family with chromosome number 2n=22. Guava is a fast-growing evergreen shrub or small tree that grows between 3 and 10 meters tall. Guava generates suckers from the roots and low drooping branches from the base. The guava fruit grows on a short tree with a single to multi-stemmed trunk and a wide, short canopy. The guava tree has a greenish bark and long, serrated leaves that are 3-7 inches long. It blooms white and bears little round, oval, or pear-shaped fruits. These are more precisely berries with soft flesh that can be white, pink, yellow or even red in colour with a taste that ranges from acidic to sour to sweet depending on the variety. Guava fruits are commonly eaten raw and are processed into jams, jellies and preserves. Guava tree bears flowers and a fruits on the current season recently matured shoots either from lateral buds on older wood or shoot terminals (Crane and Balerdi 2005 and Thakre *et al.* 2013) [3, 10]. Therefore, increase in the number of current season new shoots has a significant impact on the production. Guava fruit contains antioxidant properties and is known to regulate the systolic blood pressure.

It is also known as the "Apple of the Tropics" and "Poor Man's Apple." Guava fruit is high in vitamin C with 260-300mg/100g depending on cultivar, season, region, and maturity stage. At the mature stage, the fruit peel contains the most vitamin C. Guava has the highest fiber content, at 6.9%. Fruits include significant amounts of thiamine, niacin and riboflavin and are a good source of vitamin A (approximately 250 mg/100 g). The fruit also contains considerable amount of calcium, phosphorus and iron. Guava fruits have a high pectin content, ranging from 0.5 to 1.8% (Adsule and Kadam, 1995) [1].

Mulching with poly mulch and paddy straw promotes optimum plant growth and development by lowering soil temperature, increasing nutrient availability, and conserving moisture (Kher *et al.* 2010) [5]. The uses of mulches help to reduce water consumed (Keramat *et al.* 2011) [4]. It aids in soil water conservation, weed control, 3 improved soil consistency, moderated soil temperature variations, enhanced uptake of water droplets from precipitation or irrigation, improved soil structure for organic mulches, and gradual nutrient release.

Mulches not only save soil moisture, but also have a variety of other benefits, such as reducing water loss through evaporation, resulting in greater stored soil moisture (Shirugure *et al.* 2003) [8] and maintaining soil fertility (Slathia and Paul 2012) [9]. Paddy straw is the commonly used mulching material for fruit and vegetable production. Though paddy straw is poor in nutrient value but after decomposition, it makes soil more fertile.

## Materials and Methods

The experiment was conducted in the PFDC, at Department of Fruit Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya Raipur during the year 2022 – 2023. The experiment was conducted on guava with nine treatment and three replication in Randomized Block Design (RBD). The total number of tree included in the experiment were 81 plant and were space at 2 m x 1 m.

**Treatment combinations**

S. No.	Treatments	Notations to be used
1	No mulch	T <sub>0</sub>
2	Paddy straw	T <sub>1</sub>
3	Farm compost	T <sub>2</sub>
4	Cover crop	T <sub>3</sub>
5	Saw dust	T <sub>4</sub>
6	Rice husk	T <sub>5</sub>
7	Card board	T <sub>6</sub>
8	Banana leaves	T <sub>7</sub>
9	Mushroom compost	T <sub>8</sub>

## Result

**Identification of weed flora:** The weed flora of experimental field was studied after 30, 60 and 90 day of mulching and they

were identified and categories as per Botanical name, English name, common name, family and growth habit. List of dominant weed species are given in Table 1.

**Table 1:** Response of organic mulches on weed flora of guava (*Psidium guajava* L.) under ultra high density planting system

S. No.	Botanical name	English name	Hindi	Family	Growth habit
1.	<i>Cynodon dactylon</i>	Bermuda grass	Doob grass	Poaceae	Perennial
2.	<i>Cyperus rotundus</i>	Purple nut sedge	Motha	cyperaceae	Perennial
3.	<i>Euphorbia hirta</i>	Itsit or Snake weed	Dodak	Euphorbiaceae	Annual
4.	<i>Ageratum conizoides</i>	Goat weed	Nilam	Compositae	Annual
5.	<i>Amranthus viridis</i>	Slender amranth	Chaulai	Amranthaceae	Annual
6.	<i>Commelina communis</i>	Asiatic dayflower	Kana	Commelinaceae	Annual
7.	<i>Echinochloa colona</i>	Wild rice	Janguli	Poaceae	Annual
8.	<i>Elymus virginicus</i>	wildrye	Jalgali saraso	Poaceae	Perennial
9.	<i>Ipomea triloba</i>	Little Bell	Ratalu	Convolvulaceae	Perennial

## Weed flora density

Weed flora density (Table No.02) after 30 days of organic mulching the maximum weed density of (4.66) per m<sup>2</sup> was observed in trees where no mulch was used which was followed by (2.63) per m<sup>2</sup> with the use of farm compost mulch and (2.20) per m<sup>2</sup> with the use of paddy straw whereas, no weed was observed in tree mulched with cover crop, saw dust, rice husk, card board, banana leaves and mushroom compost.

After 60 days of organic mulch application the maximum weed density of (8.13) per m<sup>2</sup> was observed in trees basin where no mulch was used, followed by (5.40) per m<sup>2</sup> with the use of farm compost mulch, (4.97) per m<sup>2</sup> with the use of paddy straw mulch, (3.11) per m<sup>2</sup> with the use of banana leaves mulch, (3.05) per m<sup>2</sup> with the use mushroom compost, whereas no weed growth was observed in tree basin mulched with the application cover crop, saw dust, rice husk, card board mulching.

After 90 days of organic mulch application the maximum weed density of (10.26) per m<sup>2</sup> was observed in trees basins where no mulch was used, followed by (7.23) per m<sup>2</sup> with the use of farm compost, (6.19) per m<sup>2</sup> with the use of paddy straw, (6.05) per m<sup>2</sup> with the use of banana leaves, (5.88) per m<sup>2</sup> with the use of mushroom compost, (2.33) per m<sup>2</sup> with the use of saw dust mulch, (2.21) per m<sup>2</sup> with the use of cover crops mulch and least weed density of (2.13) per m<sup>2</sup> with the use of card board mulch and (2.00) per m<sup>2</sup> with the use of rice husk mulch.

Similar result was also observed by Brar *et al.* (2017) [2] studied in weed density minimum in the paddy straw mulch exhibited

promising results, with 93.2% reduction in total weed biomass.

## Soil moisture (%)

Soil moisture (Table No.03) at 15 days after mulching maximum soil moisture of 26.79% was recorded in tree basins mulched with the rice husk mulch, which was followed by 25.46% with the use of white card board, 25.10% with the use of paddy straw mulch, 24.48% with the use of banana leaves, 24.44% with the use of cover crops, 24.10% with the use of saw dust, 23.68% with the use of farm compost mulch, 23.52% with the use of mushroom compost, Whereas, the minimum soil moisture of 23.11% was recorded in trees where no mulch material was used.

Similarly after 30 days of mulching, the maximum soil moisture percent of 25.10% was recorded in tree basin mulched with rice husk mulch, which was followed by 24.66% with the use of card board mulch, 24.54% with the use of paddy straw mulch, 22.19% with the use of mushroom compost, 22.10% with the use of farm compost, 22.08% with the use of banana leaves, 21.98% with the use of cover crop, 21.48% with the use of saw dust. Whereas, the minimum soil moisture of 20.23% was recorded in tree where no mulch material was used.

At 45 day interval the maximum soil moisture percent of 24.81% was recorded with the use of rice husk mulch, which was followed by 23.48% with the use of card board mulch, 23.11% with the use of saw dust mulch, 22.24% with the use of paddy straw mulch, 21.92% with the use of mushroom compost,

21.84% with the use of farm compost, 21.50% with the use of banana leaves, 21.24% with the use of cover crop thickness. Whereas, the minimum soil moisture of 19.52% was recorded in tree where no mulch material was used.

At 60 day interval the maximum soil moisture percent of 23.48% was recorded in tree basin mulched with rice husk mulch, which was followed by 23.11% with the use of card board mulch, 21.43% with the use of paddy straw mulch, 21.50% with the use of farm compost mulch, 21.09% with the use of saw dust, 21.04% with the use of mushroom compost, 20.68% with the use of banana leaves, 20.53% with the use of cover crop. Whereas, the minimum soil moisture of 17.44% was recorded in tree where no mulch material was used.

At 75 day interval the maximum soil moisture percent of 22.76% was observed in tree basin mulched with rice husk mulch, which was followed by 20.60% with the use of card board mulch, 20.50% with the use of paddy straw mulch, 20.15% with the use of farm compost mulch, 19.85% with the use of saw dust, 19.15% with the use of mushroom compost, 18.51% with the use of banana leaves, 18.23% with the use of cover crop. Whereas, the minimum soil moisture of 15.33% was recorded in tree where no mulch material was used.

At 90 day interval the maximum soil moisture percent of 21.96% was observed in tree basin mulched with rice husk mulch, which was followed by 20.13% with the use of card board mulch, 19.77% with the use of paddy straw mulch, 19.10% with the use of saw dust mulch, 18.54% with the use of mushroom compost, 18.48% with the use of farm compost, 17.23% with the use of banana leaves, 17.11% with the use of cover crop. Whereas, the minimum soil moisture of 14.52% was recorded in tree where no mulch material was used. Similar result was also observed by Mishra *et al.* (2002)<sup>[7]</sup> studied in soil moisture maximum in (21.66%) the paddy straw mulch.

### Soil temperature (°C)

Soil moisture (Table No.04) at 15 days after mulching, the minimum soil temperature of 17.10 °C was recorded in tree basin mulched with rice husk mulch, which was followed by 17.24 °C with the use of card board mulch, 17.53 °C with the use of farm compost mulch, 18.05 °C with the use of cover crop mulch, 18.23 °C with the use of banana leaves, 18.32 °C with the use of paddy straw mulch, 18.40 °C with the use of mushroom compost, 18.41°C with the use of saw dust. Whereas, the maximum soil temperature of 18.51 °C was recorded in tree where no mulch material was used.

Similarly after 30 days of mulching, the minimum soil temperature of 17.83 °C was recorded with the use of rice husk mulch, which was followed by 17.98°C with the use of farm compost mulch, 18.11°C with the use of card board mulch, 18.96°C with the use of mushroom compost mulch, 19.10°C with the use of paddy straw, 19.12°C with the use of banana leaves, 19.15°C with the use of saw dust, 19.34°C with the use of cover crop mulch. Whereas, the maximum soil temperature of 19.18°C was recorded in tree where no mulch material was used. At 45 day interval the minimum soil temperature of 18.22 °C was recorded with the use of farm compost mulch, which was followed by 18.29 °C with the use of card board mulch, 18.40°C with the use of rice husk mulch, 19.25 °C with the use of mushroom compost mulch, 19.67°C with the use of banana leaves, 19.82 °C with the use of cover crop, 19.85 °C with the use of paddy straw, 19.88 °C with the use of saw dust mulch. Whereas, the maximum soil moisture of 20.61 °C was recorded

in tree where no mulch material was used.

At 60 day interval the minimum soil temperature of 19.27°C was recorded in tree basin mulched with card board mulch, which was followed by 19.34 °C with the use of rice husk mulch, 19.59 °C with the use of farm compost mulch, 20.10°C with the use of paddy straw mulch, 20.30 °C with the use of cover crop, 20.43°C banana leaves, 20.57 °C with the use of mushroom compost, 20.59 °C with the use of saw dust. Whereas, the maximum soil temperature of 21.78°C was recorded in tree where no mulch material was used.

At 75 day interval the minimum soil temperature of 20.76°C was recorded in tree basin mulched with rice husk mulch, which was followed by 21.05 °C with the use of card board mulch, 21.42 °C with the use of paddy straw mulch, 21.48°C with the use of farm compost mulch, 21.49°C with the use of mushroom compost, 21.55 °C with the use of cover crops, 21.57 °C with the use of banana leaves, 21.66 °C with the use of saw dust. Whereas, the maximum soil temperature of 22.84°C was recorded in tree where no mulch material was used.

At 90 day interval the minimum soil temperature of 21.85°C was recorded in tree basin mulched with rice husk mulch, which was followed by 21.90 °C with the use of card board mulch, 21.92 °C with the use of banana leaves mulch, 22.24°C with the use of cover crops mulch, 22.33°C with the use of paddy straw, 22.41 °C with the use of mushroom compost, 22.91 °C with the use of farm compost, 23.05 °C with the use of saw dust. Whereas, the maximum soil temperature of 25.70 °C was recorded in tree where no mulch material was used.

Similar result was also observed by Kumari and Khare (2019)<sup>[6]</sup> studied in soil temperature minimum in 24°C the paddy straw mulch.

**Table 2:** Response of organic mulches on weed flora density

Notation	Treatments	Weed flora density		
		30 days	60 days	90 days
T <sub>0</sub>	No mulch	4.66	8.13	10.26
T <sub>1</sub>	Paddy straw	2.20	4.97	6.19
T <sub>2</sub>	Farm compost	2.63	5.40	7.23
T <sub>3</sub>	Cover crop	0.00	0.00	2.21
T <sub>4</sub>	Saw dust	0.00	0.00	2.33
T <sub>5</sub>	Rice husk	0.00	0.00	2.00
T <sub>6</sub>	Card board	0.00	0.00	2.13
T <sub>7</sub>	Banana leaves	0.00	3.11	6.05
T <sub>8</sub>	Mushroom compost	0.00	3.05	5.88
	SEm ±	0.38	0.61	0.79
	CD at 5% level	1.15	1.85	2.41

**Table 3:** Response of organic mulches on soil moisture (%)

Notation	Treatments	Soil moisture (%)					
		15 days	30 days	45 days	60 days	75 days	90 days
T <sub>0</sub>	No mulch	23.11	20.23	19.52	17.44	15.33	14.52
T <sub>1</sub>	Paddy straw	25.10	24.54	22.24	21.43	20.59	19.77
T <sub>2</sub>	Farm compost	23.68	22.10	21.84	21.50	20.15	18.48
T <sub>3</sub>	Cover crop	24.44	21.98	21.24	20.53	18.23	17.11
T <sub>4</sub>	Saw dust	24.10	21.48	23.11	21.09	19.85	19.10
T <sub>5</sub>	Rice husk	26.79	25.10	24.81	23.48	22.76	21.96
T <sub>6</sub>	Card board	25.46	24.66	23.48	23.11	20.60	20.13
T <sub>7</sub>	Banana leaves	24.48	22.08	21.50	20.68	18.51	17.23
T <sub>8</sub>	Mushroom compost	23.52	22.19	21.92	21.04	19.15	18.54
	SEm ±	1.17	0.80	1.62	0.61	2.20	2.30
	CD at 5% level	3.53	2.43	3.23	1.85	6.63	6.90

**Table 4:** Response of organic mulches on soil temperature (°C)

Notation	Treatments	Soil temperature (°C)					
		15 days	30 days	45 days	60 days	75 days	90 days
T <sub>0</sub>	No mulch	18.51	19.18	20.61	21.78	22.84	25.70
T <sub>1</sub>	Paddy straw	18.32	19.10	19.85	20.10	21.42	22.33
T <sub>2</sub>	Farm compost	17.53	17.98	18.22	19.59	21.48	22.91
T <sub>3</sub>	Cover crop	18.05	19.34	19.82	20.30	21.55	22.24
T <sub>4</sub>	Saw dust	18.41	19.15	19.88	20.59	21.66	23.05
T <sub>5</sub>	Rice husk	17.10	17.83	18.40	19.34	20.76	21.85
T <sub>6</sub>	Card board	17.24	18.11	18.29	19.27	21.05	21.90
T <sub>7</sub>	Banana leaves	18.23	19.12	19.67	20.43	21.57	21.92
T <sub>8</sub>	Mushroom compost	18.40	18.96	19.25	20.57	21.49	22.41
	SEm ±	0.79	1.01	1.23	1.12	1.20	1.31
	CD at 5% level	2.41	3.00	3.69	3.40	3.63	3.92

## Conclusion

- From the results obtained in this study, it can be concluded that T<sub>5</sub> (Rice husk) and T<sub>1</sub> (Paddy straw) have proven to be the best results with regard to weed flora.
- Guava organic mulching materials in treatment T<sub>5</sub> (Rice husk) was found to be superior to soil moisture (%) and soil temperature (°C) followed by T<sub>1</sub> and inferior was found in T<sub>0</sub> (control).
- The major problem of guava cultivation was due to climatic condition of this region. Therefore, it can be concluded that the practice of organic mulch can provide a good solution for improving the appearance and productivity of guava fruit.
- Ultra High Density Planting System gave good result in maximization of yield per unit area and availability of the better quality fruits. Hence, this technology should adopted in Chhattisgarh for commercial growing.

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