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Impact of organic mulches on yield and quality of guava (*Psidium guajava* L.) under ultra high density planting system

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Abstract
The present investigation "Impact on effect of organic mulches on yield and quality 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 maximum yield character give better results in terms of fruit length (8.04 cm), fruit width (8.71 cm), fruit volume (198.00 cc), fruit weight (196.00 g), fruit yield (18.62 kg/plant) was observed under treatment T_5 (Rice husk) followed by T_1 (Paddy straw) and T_8 (Mushroom compost). Treatment T_5 significantly maximum quality parameter - total soluble solids (12.10°Brix), minimum titrable acidity (0.19%), ascorbic acid (196.63 mg/100 g), reducing sugar (4.91%), non- reducing sugar (5.12%), total sugar (10.03%) of fruits pulp followed by T_1 (Paddy straw) and T_8 (Mushroom compost).

Keywords: Organic mulching, mushroom compost and paddy husk

Introduction
Guava (*Psidium guajava* L.) is one of the most important economic fruit crops in tropical and subtropical regions of India. It belongs to the genus *Psidium* of the Myrtaceae family, with about 150 species. Native of tropical America (from Mexico to Peru). In guava, most commercial cultivars are diploid (2n = 22), while seedless cultivars are triploid and shy bearer in nature.

Guava is a fast-growing evergreen shrub or small tree that grows between 3 and 10 metres 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) [1, 9]. 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.

Guava is typically grown using a standard planting strategy. In which achieving a desirable level of productivity is extremely challenging. Furthermore, because huge plants give low production per unit space, the guava plant takes 4-5 years to come into commercial bearing in an ultra high density planting method, maximizing the overall cost of production per unit area. This includes using the right plant density, canopy management, high-quality planting materials, and a support and management system with the right inputs. One approach for achieving efficient and economical land usage is to space out plants. Its primary purpose is to limit the plant's exploitation zone in terms of light, water, and nutrients, in order to get the maximum total yield positional in the smallest feasible space. The amount of photo-synthetically active radiation (PAR) measured in tightly spaced trees was lower than in medium and low trees. Overall, light penetrates the tree centre, the centre between tree rows, and the centre between rows.

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. 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_0
2	Paddy straw	T_1
3	Farm compost	T_2
4	Cover crop	T_3
5	Saw dust	T_4
6	Rice husk	T_5
7	Card board	T_6
8	Banana leaves	T_7
9	Mushroom compost	T_8

Result

Impact of organic mulches on average fruit length (cm) ranged between 6.39 to 8.04 cm. The maximum fruit length (cm) of guava was obtained in significantly treatment T_5 – Rice husk (8.04 cm) as compared with rest of all treatment. However, it was at par treatment T_1 – Paddy straw (7.83 cm), T_8 – Mushroom compost (7.10 cm). The treatment T_0 (Control - No mulch) was obtained minimum fruit length (6.39 cm). Similar result was also observed by Maji and Das (2008) [5] studied in fruit length maximum in 8.74 cm treatment paddy straw mulch than all other treatments.

The effects of various organic mulching treatments on fruit width (cm) are summarized in Table 1. It is apparent from the data that different mulching treatment had a significant impact on fruit width (cm). The maximum fruit width of 8.71 cm was recorded with the use rice husk mulch (T_5), which was followed by 8.33 cm with the use of paddy straw mulch (T_1), 8.02 cm with the use of saw dust mulch (T_4) and were significantly different from each other. Whereas, the minimum fruit width of 7.03 cm was recorded in T_0 control where no mulch material was used. Similar result was also observed by Maji and Das (2008) [5] studied in fruit width maximum in 8.23 cm treatment paddy straw mulch than all other treatments.

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

Treatments	Fruit length (cm)	Fruit width (cm)	Fruit volume (cc)	Fruit weight (g)	Fruit yield kg / plant
T_0 - No mulch (control)	6.39	7.03	166.00	170.00	11.39
T_1 - Paddy straw	7.83	8.33	195.00	193.00	17.37
T_2 - Farm compost	6.74	7.66	180.00	181.00	13.93
T_3 - Cover crop	6.63	7.47	174.00	176.00	12.84
T_4 - Saw dust	6.98	8.02	191.00	189.00	15.68
T_5 - Rice husk	8.04	8.71	198.00	196.00	18.62
T_6 - Card board	7.00	7.60	181.00	183.00	14.82
T_7 - Banana leaves	6.90	7.40	178.00	179.00	13.42
T_8 - Mushroom compost	7.10	7.83	193.00	191.00	16.42
SEm±	1.12	1.23	2.50	2.27	1.96
CD at 5% level	3.40	3.70	7.51	6.83	5.88

It is apparent from the data that different mulching treatment had a significant impact on fruit volume (cc). The maximum fruit volume of 198.00 cc was recorded with the use rice husk mulch (T_5), which was followed by 195.00 cc with the use of paddy straw mulch (T_1), 193.00 cc with the use of mushroom compost mulch (T_8), 191.00 cc with the use of saw dust mulch (T_4), 181.00 cc with the use of card board mulch (T_6), 180.00 cc with the use of farm compost mulch (T_2), 178.00 cc with the use of banana leaves mulch (T_7), 174.00 cc with the use of cover crop mulch (T_3) and were significantly different from each other. Whereas, the minimum fruit volume of 166.00 cc was recorded in T_0 where no mulch material was used. Similar result was also observed by Mishra *et al*. (2004) [6] studied in fruit volume maximum in 205.00 cc treatment sugarcane trash mulch than all other treatments.

It is apparent from the data that different mulching treatment had a significant impact on fruit weight (g). The maximum fruit weight of 196.00 g was recorded with the use rice husk mulch (T_5), which was followed by 193.00 g with the use of paddy straw mulch (T_1), 191.00 g with the use of mushroom compost mulch (T_8), 189.00 g with the use of saw dust mulch (T_4), 183.00 g with the use of card board mulch (T_6), 181.00 g with the use of farm compost mulch (T_2), 179.00 g with the use of banana leaves mulch (T_7), 176.00 g with the use of cover crop mulch (T_3) and were significantly different from each other. Whereas, the minimum fruit weight of 170.00 g was recorded in T0 where no mulch material was used. Similar result was also observed by Debnath *et al*. (2004) [3] studied in fruit weight maximum in 195.00 g treatment paddy straw mulch than all other treatments.

Impact of different mulching treatment had a significant impact on fruit yield kg / plant. The maximum fruit yield 18.62 (kg/plant) was recorded with the use rice husk mulch (T_5), which was followed by 17.37 (kg/plant) with the use of paddy straw mulch (T_1), 16.42 (kg/plant) with the use of mushroom compost mulch (T_8), 15.68 (kg/plant) with the use of saw dust mulch (T_4), 14.82 (kg/plant) with the use of card board mulch (T_6), 13.93 (kg/plant) with the use of farm compost mulch (T_2), 13.42 (kg/plant) with the use of banana leaves mulch (T_7), 12.84 (kg/plant) with the use of cover crop mulch (T_3) and were significantly different from each other. Whereas, the minimum fruit yield 11.39 (kg/plant) was recorded in T_0 where no mulch material was used. Similar result was also observed by Patra *et al*. (2003) [7] studied in fruit yield maximum in 22.32 kg per plant treatment Paddy straw and black polyethylene mulch than all other treatments.

Table 2: Impact of organic mulches on yield of guava (*Psidium guajava* L.) under ultra high density planting system

Treatments	Total Soluble Solid (°Brix)	Titratable acidity (%)	Ascorbic acid (mg/100 g)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)
T_0 - No mulch (control)	9.94	0.33	176.62	4.34	3.85	8.19
T_1 - Paddy straw	11.73	0.21	194.29	4.88	5.08	9.96
T_2 - Farm compost	11.09	0.30	182.21	4.67	4.93	9.60
T_3 - Cover crop	10.77	0.31	178.15	4.53	4.92	9.45
T_4 - Saw dust	11.33	0.25	188.74	4.79	5.02	9.81
T_5 - Rice husk	12.10	0.19	196.63	4.91	5.12	10.03
T_6 - Card board	11.15	0.27	184.75	4.72	4.06	9.72
T_7 - Banana leaves	10.96	0.30	179.23	4.65	4.89	9.54
T_8 - Mushroom compost	11.66	0.23	194.89	4.84	5.06	9.91
SEm±	0.53	0.01	1.36	0.22	0.23	0.45
CD at 5% level	1.60	0.03	4.08	0.68	0.70	1.37

In this study, it was revealed that the main effect of organic mulching, has significant effect on total soluble solid (ºBrix). Maximum TSS (12.10 ºBrix) was recorded under the treatment T_5- Rice husk, followed by 11.73 (ºBrix) with the use of paddy straw mulch (T_1), 11.66 (ºBrix) with the use of mushroom compost mulch (T_8), 11.33 (ºBrix) with the use of saw dust mulch (T_4), 11.15 (ºBrix) with the use of card board mulch (T_6), 11.09 (ºBrix) with the use of farm compost mulch (T_2), 10.96 (ºBrix) with the use of banana leaves mulch (T_7), 10.77 (ºBrix) with the use of cover crop mulch (T_3) and were significantly different from each other. Whereas, the minimum total soluble solid 9.94 (ºBrix) was recorded in T0 where no mulch material was used. Similar result was also observed by Das *et al*. (2010) [2] studied in total soluble solids maximum in 12.98 (°Brix) treatment paddy straw mulch than all other treatments.

Effect of different organic mulching treatment had a significant impact on titrable acidity (%). The minimum titrable acidity 0.19 (%) was recorded with the use rice husk mulch (T_5), which was followed by 0.21 (%) with the use of paddy straw mulch (T_1), 0.23 (%) with the use of mushroom compost mulch (T_8), 0.25 (%) with the use of saw dust mulch (T_4), 0.27 (%) with the use of card board mulch (T_6), 0.30 (%) with the use of banana leaves (T_7) and farm compost mulch (T_2), 0.31 (%) with the use of cover crops mulch (T_3) and were significantly different from each other. Whereas, the maximum titrable acidity 0.33 (%) was recorded in T_0 where no mulch material was used. Similar result was also observed by Dikshit *et al*. (2010) [4] studied in acidity minimum in 0.22% treatment saw dust than all other treatments.

In this study, it was revealed that the main effect of organic mulching, has significant effect on ascorbic acid (mg/100 g). Maximum ascorbic acid (196.63 mg/100 g) was recorded under the treatment T_5- Rice husk, followed by 194.89 (mg/100 g) with the use of mushroom compost mulch (T_8), 194.29 (mg/100 g) with the use of paddy straw mulch (T_1), 188.74 (mg/100 g) with the use of saw dust mulch (T_4), 184.75 (mg/100 g) with the use of card board mulch (T_6), 182.21 (mg/100 g) with the use of farm compost mulch (T_2), 179.23 (mg/100 g) with the use of banana leaves mulch (T_7), 178.15 (mg/100 g) with the use of cover crop mulch (T_3) and were significantly different from each other. Whereas, the minimum ascorbic acid 176.62 (mg/100 g) was recorded in T_0 where no mulch material was used. Similar result was also observed by Sahu and Sahu (2020) [8] studied in ascorbic acid maximum in 198.57 mg/100 g treatment natural mulch than all other treatments.

It is apparent from the data that different mulching treatment had a significant impact on reducing sugar (%). The maximum reducing sugar 4.91 (%) was recorded with the use rice husk mulch (T_5), which was followed by 4.88 (%) with the use of paddy straw mulch (T_1), 4.84 (%) with the use of mushroom compost mulch (T_8), 4.79 (%) with the use of saw dust mulch (T_4), 4.72 (%) with the use of card board mulch (T_6), 4.67 (%) with the use of farm compost (T_2), 4.65 (%) with the use of banana leaves mulch (T_7), 4.53 (%) with the use of cover crops mulch (T_3) and were significantly different from each other. Whereas, the minimum reducing sugar 4.34 (%) was recorded in T_0 where no mulch material was used. Similar result was also observed by Sahu and Sahu (2020) [8] studied in reducing sugar maximum in 5.10% treatment natural mulch than all other treatments.

Effect of different mulching treatment had a significant impact on non-reducing sugar (%). The maximum non-reducing sugar 5.12 (%) was recorded with the use rice husk mulch (T_5), which was followed by 5.08 (%) with the use of paddy straw mulch (T_1), 5.06 (%) with the use of mushroom compost mulch (T_8), 5.02 (%) with the use of saw dust mulch (T_4), 4.93 (%) with the use of farm compost mulch (T_2), 4.92 (%) with the use of cover crop mulch (T_3), 4.89 (%) with the use of banana leaves mulch (T_7), 4.06 (%) with the use of card board mulch (T_6) and were significantly different from each other. Whereas, the minimum non-reducing sugar 3.85 (%) was recorded in T_0 where no mulch material was used. Similar result was also observed by Sahu and Sahu (2020) [8] studied in reducing sugar maximum in 5.27% treatment natural mulch than all other treatments.

It is apparent from the data that different mulching treatment had a significant impact on total sugar (%). The maximum total sugar 10.03 (%) was recorded with the use rice husk mulch (T_5), which was followed by 9.96 (%) with the use of paddy straw mulch (T_1), 9.91 (%) with the use of mushroom compost mulch (T_8), 9.81 (%) with the use of saw dust mulch (T_4), 9.72 (%) with the use of card board mulch (T_6), 9.60 (%) with the use of farm compost mulch (T_3), 9.54 (%) with the use of banana leaves mulch (T_7), 9.45 (%) with the use of cover crops mulch (T_3) and were significantly different from each other. Whereas, the minimum total sugar 8.19 (%) was recorded in T_0 where no mulch material was used. Similar result was also observed by Dikshit *et al*. (2010) [4] studied in total sugar maximum in 10.83% treatment saw dust than all other treatments.

Conclusion

- From the results obtained in this study, it can be concluded that T_5 (Rice husk) and T_1 (Paddy straw) have proven to be the best treatment to improve yield and quality parameters of guava.

- Guava organic mulching materials in treatment T_5 (Rice husk) was found to be superior to yield parameter followed by T_1 and minimum was found in T_0 (control).
- Treatment T_5 (Rice husk) followed by T_1 (Paddy straw) showed the best results with regarding to quality attributes (TSS °brix, acidity%, ascorbic acid mg/100 g, reducing sugar %, non-reducing sugar% and total sugar %).
- 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.

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