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Influence of organic mulches on growth, yield and quality attributes of banana (*Musa paradisiaca* L.) cv. Udhayam under Chhattisgarh plain

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Abstract

Organic mulching offers a simple approach for improving banana performance through better growing conditions. The present investigation evaluated the influence of different organic mulches on selected growth, yield and quality attributes and biochemical characteristics of banana (*Musa paradisiaca* L.) cv. Udhayam under the Chhattisgarh plain. The study comprised nine treatments, with Mushroom Dust (Husk), Saw Dust, Cowpea (Cover Crop), Paddy Straw, Cardboard, Rice Husk, Banana Leaves, Green Grass and Control. Mushroom Dust (Husk) (T₁) recorded the highest pseudostem height (413.87 cm), pseudostem girth (94.17 cm), leaf length (198.90 cm), leaf breadth (88.00 cm), finger length (16.97 cm), finger girth (12.92 cm), finger weight (134.33 g) and yield per plant (36.33 kg), while the maximum number of leaves per plant (38.80) was recorded with Cowpea (Cover Crop) (T₃). Mushroom Dust (Husk) also produced the highest reducing sugar (10.50%) and non-reducing sugar (19.50%). The findings establish Mushroom Dust (Husk) as the most promising mulch among the evaluated treatments, demonstrating its potential to enhance vegetative growth, fruit attributes, yield and sugar composition of banana cv. Udhayam under the Chhattisgarh plain.

Keywords: Organic mulch, Mushroom Dust, growth, yield, finger quality, reducing sugar, non-reducing sugar

1. Introduction

Banana is one of the oldest cultivated tropical fruit crops and is widely valued for its food, nutritional and economic importance. It belongs to the family Musaceae and genus *Musa*. The botanical name used for the crop in the present study is *Musa paradisiaca* L. Banana is a large herbaceous plant with a pseudostem formed by tightly overlapping leaf sheaths, while the edible fruit is botanically classified as a berry. The crop is considered to have originated in the humid tropical regions of Southeast Asia, with India regarded as one of the important centres associated with its origin and diversity. Modern cultivated bananas have developed largely from *Musa acuminata*, *Musa balbisiana* and their natural hybrids. From its centre of origin, banana cultivation gradually spread to other tropical and subtropical regions of the world. Banana is particularly important because of its year-round availability, edible and easily digestible fruit and wide range of uses. Mulching is an important soil-management practice that can improve the growing environment of banana. Organic mulches reduce soil moisture evaporation, moderate soil temperature, suppress weed growth and gradually contribute organic matter and nutrients to the soil. These effects can enhance root activity and plant growth and may ultimately improve fruit development, yield and quality. The performance of mulch, however, varies considerably with the type of material and the prevailing agro-climatic conditions. Considering these aspects, the present investigation was undertaken to assess the influence of different organic mulches on selected growth, yield and quality and biochemical parameters of banana cv. Udhayam under the Chhattisgarh plain, with particular emphasis on identifying a suitable organic mulch for improving plant growth, fruit attributes, yield and sugar composition.

2. Materials and Methods

The experiment was conducted at the Precision Farming Development Centre (PFDC), Department of Fruit Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during 2025–26 using tissue culture plants of banana (*Musa paradisiaca* L.) cv. Udhayam. The experiment was laid out in a Randomized Block Design (RBD) with nine treatments and three replications, comprising three plants per treatment in each replication and a total of 81 plants. The treatments were T₀: Control, T₁: Mushroom Dust (Husk), T₂: Saw Dust, T₃: Cowpea (Cover Crop), T₄: Paddy Straw, T₅: Cardboard, T₆: Rice Husk, T₇: Banana Leaves and T₈: Green Grass. The tissue culture plants were planted in February 2025 and the respective mulching materials were applied uniformly around the base of the plants after planting. Common agronomic practices were followed at appropriate stages. The selected growth parameters included pseudostem height, pseudostem girth, number of leaf production per plant, leaf length and leaf breadth. Pseudostem height was measured in centimetres from the ground to the uppermost point of attachment of the petioles of the two youngest leaves using a measuring tape, while pseudostem girth was measured in centimetres at 15 cm above the ground level. The number of newly emerged leaves was recorded for each treatment until shooting and the average was determined. Leaf length was measured in centimetres from the base of the leaf blade to its tip after complete emergence at the shooting stage, whereas leaf breadth was measured at the widest portion of the fully expanded leaf blade at the shooting stage. The yield and quality parameters comprised finger length, finger girth, finger weight and yield per plant. Finger length was measured from the point of attachment between the fruit and its stalk to the distal end using a scale and expressed in centimetres. Finger girth was measured as the circumference at the widest middle portion of individual fruits using Vernier calipers and expressed in centimetres. Finger weight was recorded using an electronic weighing balance and expressed in grams. Bunches were harvested at full physiological maturity and weighed using a calibrated weighing balance, with bunch weight/yield per plant expressed in kilograms. Reducing sugar was estimated by titrating the fruit extract against mixed Fehling's solution using methylene blue as an indicator until the brick-red end point was obtained following the procedure described by Ranganna (1986) [12]. Non-reducing sugar was calculated from total sugar and reducing sugar as specified in the experimental methodology. The data obtained for the selected parameters were analysed according to the Randomized Block Design following Gomez and Gomez (1984) [7]. Analysis of variance was carried out and treatment differences were tested using the appropriate F-test at the 5 per cent probability level. Significant treatment means were further compared using multiple comparison tests.

3. Results and Discussion

3.1 Pseudostem height

A marked variation in pseudostem height was observed among the organic mulch treatments. T₁ (Mushroom Dust, Husk) produced the tallest pseudostem (413.87 cm), followed by T₆ (Rice Husk) (405.40 cm) and T₄ (Paddy Straw) (400.63 cm), whereas the shortest pseudostem was recorded in T₀ (Control) (379.73 cm). The superior performance of Mushroom Dust suggests that this mulch

provided more favourable conditions for vegetative growth compared with the other treatments. Patra *et al.*, (2004) [8].

3.2 Pseudostem girth

Pseudostem girth showed a response similar to that observed for plant height. The maximum girth of 94.17 cm was obtained with T₁ (Mushroom Dust, Husk), followed by T₆ (Rice Husk) (91.33 cm) and T₄ (Paddy Straw) (90.07 cm). In contrast, T₀ (Control) resulted in the minimum pseudostem girth of 79.80 cm. The greater girth under Mushroom Dust indicates better vegetative development under this treatment. Shukla *et al.*, (2000) [13]

3.3 Number of leaf production per plant

Unlike pseudostem height and girth, the highest leaf production was not obtained with Mushroom Dust. T₃ (Cowpea, Cover Crop) recorded the maximum number of leaves per plant (38.80), followed by T₆ (Rice Husk) (37.60) and T₄ (Paddy Straw) (36.30). The minimum number of leaves (25.57) was observed under the untreated control. The results indicate that Cowpea mulch was particularly favourable for leaf production among the evaluated treatments. Bakshi *et al* (2014) [2].

3.4 Leaf length (cm)

Organic mulching also influenced the development of individual leaves. The longest leaves were measured under T₁ (Mushroom Dust, Husk) (198.90 cm), closely followed by T₆ (Rice Husk) (196.60 cm) and T₄ (Paddy Straw) (195.10 cm). The control treatment recorded the shortest leaf length of 188.20 cm. Thus, Mushroom Dust was the most effective treatment for enhancing leaf elongation among the organic mulches tested. Rajput *et al.*, (2014) [9]

3.5 Leaf breadth (cm)

A similar treatment trend was noticed for leaf breadth, with T₁ (Mushroom Dust, Husk) recording the highest value of 88.00 cm. It was followed by T₆ (Rice Husk) (87.20 cm) and T₄ (Paddy Straw) (86.40 cm), while the minimum breadth (79.20 cm) occurred in T₀ (Control). The wider leaves under Mushroom Dust, together with its higher leaf length, indicate better leaf development under this mulch treatment. Ali and Gaur (2013) [1].

3.6 Finger length (cm)

Fruit development was also positively reflected in finger length. T₁ (Mushroom Dust, Husk) recorded the longest fingers (16.97 cm), followed by T₇ (Banana Leaves) (16.67 cm) and T₄ (Paddy Straw) (16.37 cm). The control treatment produced the shortest fingers, measuring 14.03 cm. The higher finger length obtained with Mushroom Dust may be related to the favourable conditions provided by the mulch during fruit development. Ramniwas *et al.*, (2013) [11].

3.7 Finger girth (cm)

Considerable differences were recorded in finger girth among the treatments. The maximum value (12.92 cm) was registered with T₁ (Mushroom Dust, Husk) and was statistically at par with T₇ (Banana Leaves) (12.85 cm), T₄ (Paddy Straw) (12.54 cm), T₆ (Rice Husk) (12.27 cm) and T₃ (Cowpea, Cover Crop) (11.37 cm). The minimum finger girth of 9.03 cm was obtained under the control. This indicates that several organic mulches improved finger development, although Mushroom Dust recorded the highest numerical value. Ram *et al.*, (2014) [10]

3.8 Finger weight

Individual fruit weight was highest with T₁ (Mushroom Dust, Husk), reaching 134.33 g, followed by T₇ (Banana Leaves) (133.00 g) and T₄ (Paddy Straw) (132.00 g). The lowest finger weight was recorded in T₀ (Control) (118.00 g), with values ranging from 118.00 to 134.33 g across treatments. The thesis relates the greater finger weight under Mushroom Dust to improved assimilate production and its efficient translocation towards developing fruits, along with sustained nutrient availability and favourable soil moisture. Ghosh and Bera (2015) ^[6]

3.9 Yield per plant (kg)

The influence of mulching was particularly evident in yield per plant. T₁ (Mushroom Dust, Husk) recorded the highest yield of 36.33 kg per plant, which was statistically at par with T₇ (Banana Leaves) (34.83 kg). T₄ (Paddy Straw) (33.00 kg) and T₆ (Rice Husk) (30.91 kg) followed, whereas the control registered only 20.67 kg per plant. The higher yield under Mushroom Dust was associated in the thesis with improved vegetative growth, yield attributes, moisture conservation, nutrient availability and photosynthetic efficiency, which favoured assimilate production and translocation towards the developing bunch. Bhat *et al* (2015) ^[3], Devetter *et al.*, (2015).

3.10 Reducing sugar%

The sugar composition of fruits was also significantly affected by the mulching treatments. Mushroom Dust (T₁) resulted in the highest reducing sugar content (10.50%), followed by T₇ (Banana Leaves) (10.30%) and T₄ (Paddy Straw) (10.00%). On the other hand, the control recorded the lowest value of 8.50%, with the treatment means ranging from 8.50 to 10.50 per cent. Thus, Mushroom Dust was the most effective treatment for increasing reducing sugar content in the present study. Das *et al.*, (2016) ^[4].

3.11 Non-reducing sugar%

The pattern observed for non-reducing sugar was also favourable under Mushroom Dust. The highest content (19.50%) was recorded with T₁ (Mushroom Dust, Husk) and was statistically at par with T₇ (Banana Leaves) (19.20%); T₄ (Paddy Straw) recorded 19.00%. The lowest value (18.00%) occurred under T₃ (Cowpea, Cover Crop), while the treatment means ranged from 18.00 to 19.50 per cent. Overall, Mushroom Dust produced the highest non-reducing sugar content among the organic mulch treatments evaluated. Dwivedi *et al.*, (2012) ^[5].

Table 1: Influence of organic mulches on growth parameters of banana cv. Udhayam

Notation	Pseudo stem Height (cm)				Pseudo stem Girth (cm)				No. of leaf production per plant			
	3 MAP	5 MAP	7 MAP	At Shooting Stage	3 MAP	5 MAP	7 MAP	At Shooting Stage	3 MAP	5 MAP	7 MAP	At Shooting Stage
T ₀	101.17	170.97	239.17	379.73	22.17	36.37	57.53	79.80	10.37	15.80	20.70	25.57
T ₁	125.27	200.90	276.87	413.87	37.60	53.87	74.23	94.17	13.13	19.63	25.87	31.97
T ₂	118.57	192.10	266.17	398.17	33.17	48.70	68.97	88.63	14.77	22.00	28.50	35.33
T ₃	114.17	182.10	252.30	390.30	28.10	42.73	62.43	83.33	16.73	24.27	31.33	38.80
T ₄	120.70	195.13	268.60	400.63	34.13	49.80	69.87	90.07	15.33	22.63	29.37	36.30
T ₅	112.03	178.10	246.07	388.13	25.73	40.17	60.13	82.17	13.70	20.53	26.77	33.40
T ₆	122.43	197.60	272.63	405.40	36.13	51.63	71.73	91.33	15.83	23.37	30.20	37.60
T ₇	116.23	188.17	258.13	394.93	30.27	45.20	64.97	85.63	14.13	21.10	27.23	34.03
T ₈	110.10	174.33	242.17	385.57	23.63	37.80	58.23	81.13	12.40	18.63	24.63	30.60
SE (m) ±	1.32	1.15	1.09	1.41	1.17	1.24	1.33	1.51	0.76	0.99	1.2	1.49
CD at 5%	3.95	3.46	3.27	4.23	3.52	3.73	4	4.52	2.29	2.98	3.58	4.46

Table 2: Influence of organic mulches on growth parameters of banana cv. Udhayam

Notation	Length of leaf (cm)				Breadth of leaf (cm)			
	3 MAP	5 MAP	7 MAP	At Shooting Stage	3 MAP	5 MAP	7 MAP	At Shooting Stage
T ₀	76.5	131.2	153.6	188.2	38.20	56.90	69.00	79.20
T ₁	82	138.9	162.3	198.9	44.20	64.50	77.00	88.00
T ₂	79.3	136.1	158.7	192.6	41.50	61.70	74.20	85.00
T ₃	78.4	134.3	156.9	191.7	40.30	60.30	72.80	83.80
T ₄	80	136.8	159.5	195.1	42.80	63.10	75.50	86.40
T ₅	77.9	133.3	155.7	190.8	39.30	58.80	71.00	81.90
T ₆	80.9	137.8	160.9	196.6	43.50	63.80	76.20	87.20
T ₇	78.7	135.3	158.1	193.5	41.00	61.00	73.60	84.60
T ₈	77.2	132.4	154.8	189.6	38.80	58.00	70.10	80.80
SE (m) ±	0.87	1.02	0.98	1.04	0.76	0.8	0.75	0.74
CD at 5%	2.6	3.05	2.94	3.12	2.28	2.39	2.24	2.22

Table 3: Influence of organic mulches on yield and quality parameters of banana cv. Udhayam

Notation	Finger length (cm)	Finger girth (cm)	Finger weight (g)	Yield per plant (kg)	Reducing sugar%	Non Reducing sugar%
T ₀	14.03	9.03	118.00	20.67	8.50	18.20
T ₁	16.97	12.92	134.33	36.33	10.50	19.50
T ₂	15.87	10.83	128.00	29.00	9.50	18.60
T ₃	15.53	11.37	124.33	27.33	9.00	18.00
T ₄	16.37	12.54	132.00	33.00	10.00	19.00
T ₅	15.20	10.93	123.00	26.00	8.70	18.30
T ₆	16.17	12.27	131.67	30.91	9.80	18.70
T ₇	16.67	12.85	133.00	34.83	10.30	19.20
T ₈	14.90	11.17	118.67	24.00	8.90	18.50
SE (m) ±	0.44	0.54	0.44	0.91	0.12	0.13
CD at 5%	1.31	1.61	1.33	2.72	0.35	0.40

4. Conclusion

The present investigation demonstrated that organic mulching substantially influenced the selected growth, yield and biochemical attributes of banana cv. Udhayam under the Chhattisgarh plain. Among the evaluated treatments, Mushroom Dust (Husk) (T₁) emerged as the most promising mulch, recording the highest pseudostem height, pseudostem girth, leaf length, leaf breadth, finger length, finger girth, finger weight, yield per plant, reducing sugar and non-reducing sugar. Cowpea (Cover Crop) (T₃) was superior for number of leaves per plant. The control treatment generally recorded the lowest values for the selected parameters. Overall, Mushroom Dust (Husk) (T₁) showed the most consistent and favourable performance and can be considered the best-performing organic mulch for improving growth, fruit attributes, yield and sugar composition of banana cv. Udhayam under the conditions of the present investigation.

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6. Competing interests

The author declares that there are no competing interests associated with this research work.

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