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Ashutosh
M.Sc. Horticulture, Department of Fruit Science, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Dr. GD Sahu
Associate Professor Fruit Science, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Dr. Prabhakar Singh
Professor and Head, Department of Fruit Science, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Maksudan
Ph.D. Research Scholar, Department of Fruit Science, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Corresponding Author:
Ashutosh
M.Sc. Horticulture, Department of Fruit Science, Indira Gandhi Krishi Vishwavidyalaya Raipur, Chhattisgarh, India

Effect of different bunch covering materials for improving fruit yield and quality of Banana (*Musa paradisiaca*)

Ashutosh, Dr. GD Sahu, Dr. Prabhakar Singh and Maksudan

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Abstract
The present investigation the effect of different bunch covering materials for improving fruit yield and quality of Banana (*Musa Paradisiaca*) 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 experiment was laid out in a Randomized Block Design with eight treatments with three replications. The results indicate that the yield parameter *viz*., bunch length (cm), bunch diameter (cm), bunch weight (kg) yield (t/ha) and quality parameter *viz*., total soluble solid (°Brix), acidity (%), Ascorbic acid mg/100 g) total sugar (%) of banana were significantly influenced by the different bunch covering materials. The results revealed that maximum yield and quality parameter were recorded at the application of T_7 - Bunch cover with blue polythene bag followed by T_3 - Bunch cover with transparent polythene bag. While the minimum were observed under T_0 (No bunch covering).

Keywords: Bunch covering material, blue polythene, transparent polythene

Introduction
Banana (*Musa paradisiaca* L.) cultivated by man since prehistoric times. The fruit provides nutrition and well-balanced diet to millions of people around the globe and also contributes to livelihood through crop production, processing and marketing (Singh, 2002) [13]. Banana grows well in humid tropical low lands. Banana *(Musa paradisiaca)* chromosome number 2n =33, family musaceae is an important fruit crop in India. South-East Asian countries, especially eastern Malaysia is believed to be the center of origin of banana (Saucer, 1952) [12]. Its cultivation is distributed throughout the warmer countries and is confined to the region between 30° North and 30° South of the equator.

Banana is one of the major fruit crop in the tropics and subtropics and make a vital contribution to the economies of a number of countries. It is very important in the nutrition of local population as well as tradable commodities with a large market throughout the developed world. Banana is a large herbaceous, perennial, monocotyledonous and monocarpic plant. It is the staple food in some of the developing countries like Uganda, Bukaba and Tanzania and one of the most important traded tropical fruits in the world (Radha and Mathew, 2007) [10].

In India, banana ranks first position in production among all fruits. Banana is grown in all over India and is available round the year. However, Tamil Nadu, Andhra Pradesh, Maharashtra, Gujarat, Karanataka, Madhya Pradesh and Bihar have ideal condition for its growth and production. India is the world's leading banana producer, accounting for about 25.7% of the global harvest of 113.28 million tonnes bananas. Banana is grown on 5.49 million ha around the world, with global yield of 113.28 million tonnes and a yield of 20.62 MT/ha (Anon, 2018). India is the world's leading banana producer, accounting for 25.7% of global production and ranking first in both region and production. Bananas occupy 883.8 thousand ha of India's total fruit cropland, producing 25.51 million tonnes with a total productivity of 34.9 t/ha.

Chhattisgarh is one of the States, where bananas are grown on an area of 26.57 thousand hectares, with an annual production of 745.78 million tonnes and an estimated productivity of 28.07 MT/ha (Anon, 2018).

Bananas, on the other hand, have a high export opportunity. Banana exports are now being directed to markets such as the Russian Federation, China and Eastern Europe. India exports bananas to countries in the middle East.

Banana provides dessert fruit or starch staple to millions of people in the world. It is easy to digest, nearly fat free with high nutritive value and relatively cheaper than other fruits. The total energy provided by 100g edible ripe pulp is 67-137 K calories. The fruit is composed of 1.2 g protein, 0.3 g fat, 27.2 g carbohydrates, 0.4 g fibre, 7 mg vitamin C and 0.8 g of minerals (Chandler, 1995) [5]. As a diet, it is highly satisfying, easy to digest, nearly fat free, rich source of carbohydrate. It contains various vitamins and has therapeutic values for the treatment of many diseases (Singh, 2007) [14].

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 banana with eight treatment and three replication in Randomized block design. The total number of tree included in the experiment were 90 plant and were space at 1.8 m x 1.8 m.

Covering of bunches: Nine plants (three from each treatment) of ten months age having uniform flowering time were selected for the research, after de-naveling, 25 days after opening of floral emergence the bunches were covered with respective treatments.

Treatment combinations

S. No.	Treatments	Notations to be used
1	No covering	T_0
2	Bunch cover with black polythene bag	T_1
3	Bunch cover with jute bag	T_2
4	Bunch cover with transparent polythene bag	T_3
5	Bunch cover with paper bag	T_4
6	Bunch cover with Gunny bag with transparent polythene	T_5
7	Bunch cover with Dry leaves	T_6
8	Bunch cover with blue polythene bag	T_7

Result

Effect of different bunch covering materials on the bunch length (cm) after bunch harvesting was ranged from 61.50 to 79.11 cm. The highest bunch length (cm) (79.11 cm) was found in treatment T_7 (Bunch cover with blue polythene bag) followed by Treatments T_3 – (Bunch cover with transparent polythene bag) recorded 77.23 cm. In contrast, lowest bunch length (cm) (61.50 cm) was observed under treatment T_0 (Control - No bunch covering). Blue covers let in 73% of the wavelengths in the PAR, whereas transparent ones let in 93%. Nevertheless, blue covers produce heavier bunches because it lets in the heat without causing burns because it blocks UV rays. Similar result was also observed by Biswas and Lemture, (2012) [4] studied in bunch length maximum in 63.5 cm treatment blue polythene tube than all other treatments.

The bunch diameter (cm) ranged between 32.77 to 44.10 cm. The highest bunch diameter of banana was obtained in significantly treatment T_7 - Bunch cover with blue polythene bag (44.10 cm) as compared with rest of all bunch covering materials treatment. However, it was at par treatment T_3 - Bunch cover with transparent polythene bag (43.57 cm) and T_5 - Bunch cover with gunny bag with transparent polythene form (42.34 cm). In the same way treatments T_2 (42.21 cm), T_1 (40.44 cm), T_4 (39.96 cm) were statistically at par, but their impact on bunch diameter of banana were significantly different when compared with treatment T_0 (Control - No bunch covering) was obtained lowest bunch diameter of banana (32.77 cm). Blue covers let in 73% of the wavelengths in the PAR, whereas transparent ones let in 93%. Nevertheless, blue covers produce heavier bunches because it lets in the heat without causing burns because it blocks UV rays. Blue Polyethylene bags used to improve banana's quality, appearance and protect from birds and pests. These bags allow faster & more trustworthy harvest with adequate ripening of the banana. These also protect from external natural conditions (wind, rain, sun damage, etc.) and prevent mechanical injuries.

The bunch weight (kg) ranged between 19.86 to 29.10 kg. The highest bunch weight (kg) of banana was obtained in significantly treatment T_7 - Bunch cover with blue polythene bag (29.10 kg) as compared with rest of all bunch covering materials treatment. However, it was at par treatment T_3 - Bunch cover with transparent polythene bag (28.77 kg) and T_5 - Bunch cover with gunny bag with transparent polythene form (28.39 kg). In the same way treatments T_2 (27.51 kg), T_1 (26.70 kg), T_4 (25.61 kg) were statistically at par, but their impact on bunch weight of banana were significantly different when compared with treatment T_0 (Control - No bunch covering) was obtained lowest bunch weight of banana (19.86 kg). Similar result was also observed by Kumare *et al.*, (2013) [7] studied in bunch weight (kg) maximum in 35.68 kg treatment blue polythene cover than all other treatments.

The yield (t/ha) ranged between 61.28 to 82.23 t/ha. The maximum yield (t/ha) of banana was obtained in significantly treatment T_7 - Bunch cover with blue polythene bag (82.23 t/ha) as compared with rest of all bunch covering materials treatment. However, it was at par treatment T_3 - Bunch cover with transparent polythene bag (79.54 t/ha) and T_5 - Bunch cover with gunny bag with transparent polythene form (77.13 t/ha). The T_0 (Control - No bunch covering) was obtained minimum yield (t/ha) of banana (61.28 t/ha). Blue covers let in 73% of the wavelengths in the PAR, whereas transparent ones let in 93%. Nevertheless, blue covers produce heavier bunches because it lets in the heat without causing burns because it blocks UV rays. Similar result was also observed by Debnath *et al.* (2001) [6] studied in yield (t/ha) maximum in 77.89 t/ha treatment bunch cover with transparent polyethylene than all other treatments.

It is evident from the table 2. that the effect of different bunch covering materials on the total soluble solid content (23.13 ºBrix) was significantly increased by applied of treatment T_7 (Bunch cover with blue polythene bag) at par with the treatments, T_3 (Bunch cover with transparent polythene bag) i.e. 22.95 ºBrix, T_5 (Bunch cover with gunny bag with transparent polythene) i.e. 22.76 ºBrix. The lowest total soluble solid content (19.15 ºBrix) was recorded in treatment T_0 control (No bunch covering). Banana production regions mostly use blue covers as they let in heat without causing sun scald (Muchui *et al.*, 2010) [8], because it blocks UV rays. Blue Polyethylene bags used to improve banana's quality, appearance and protect from birds and pests. These bags allow faster & more trustworthy harvest

with adequate ripening of the banana. These also protect from external natural conditions (wind, rain, sun damage, etc.) and prevent mechanical injuries. Similar results were found by Rubel *et al*., (2019) [11] the data revealed that, the total soluble solid content (24.28 °Brix) was significantly by bunch cover with blue polythene bag.

The titratable acidity (%) ranged between 0.30 to 0.39%. The minimum titratable acidity (%) of banana was obtained in significantly treatment T_7 - Bunch cover with blue polythene bag (0.30%) as compared with rest of all bunch covering materials treatment. However, it was at par treatment T_3 - Bunch cover with transparent polythene bag (0.31%) and T_5 - Bunch cover with gunny bag with transparent polythene form (0.32). In the same way treatments T_2 and T_1 (0.33%), T_4 (0.34%) were statistically at par, but their impact on titratable acidity (%) of banana were significantly different when compared with treatment T_0 (0.39%). Banana production regions mostly use blue covers as they let in heat without causing sun scald (Muchui *et al*., 2010) [8], because it blocks UV rays. Blue Polyethylene bags used to improve banana's quality, appearance and protect from birds and pests. These bags allow faster & more trustworthy harvest with adequate ripening of the banana. These also protect from external natural conditions (wind, rain, sun damage, etc.) and prevent mechanical injuries (Marks and Scratches). Similar results were found by Pathak *et al*. (2014) [9] studied in acidity (%) minimum in 0.30% treatment bunch cover with transparent polyethylene than all other treatments.

The ascorbic acid (mg/100 g) ranged between 10.09 to 13.26 mg/100 g. The maximum ascorbic acid (mg/100 g) of banana was obtained in significantly treatment T_7 - Bunch cover with blue polythene bag (13.26 mg/100 g) as compared with rest of all bunch covering materials treatment. However, it was at par treatment T_3 - Bunch cover with transparent polythene bag (12.66 mg/100 g) and T_5 - Bunch cover with gunny bag with transparent polythene form (11.90 mg/100 g). The treatment T_0 (Control - No bunch covering) was obtained minimum ascorbic acid (mg/100 g) of banana (10.09 mg/100 g). Blue bunch covering alters the temperature within the covers, indirectly leading to faster assimilates translocation and better fruit quality. Apart from this, bunch covers serves in inhancing the external appearance of fruits both by protecting it from pest infestation and harvesting and handling bruises. Similar results were found by Anon (2013) [2] studied in ascorbic acid maximum in 12.36 mg/100 g treatment bunch cover with blue polyethylene sleeves than all other treatments.

Table 1: Effect of different bunch covering materials on Yield attributes of Banana (*Musa paradisiaca* L.)

Treatments	Bunch length (cm)	Bunch diameter (cm)	Bunch weight (kg)	Yield (t/ha)
T_0 - No bunch covering (Control)	61.50	32.77	19.86	61.28
T_1 - Bunch cover with black polythene bag	72.79	40.44	26.70	74.25
T_2 - Bunch cover with jute bag	73.56	42.21	27.51	75.12
T_3 - Bunch cover with transparent polythene bag	77.23	43.57	28.77	79.54
T_4 - Bunch cover with paper bag	71.57	39.96	25.61	73.11
T_5 - Bunch cover with gunny bag with transparent polythene	75.25	42.34	28.39	77.13
T_6 - Bunch cover with dry leaves	71.10	39.36	24.42	70.59
T_7 -Bunch cover with blue polythene bag	79.11	44.10	29.10	82.23
SEm±	0.68	0.38	0.24	2.02
CD at 5% level	2.09	1.17	0.75	6.08

The total sugar ranged between 13.23 to 19.40 (%). The maximum total sugar (%) of banana was obtained in significantly treatment T_7 - Bunch cover with blue polythene bag (19.40%) as compared with rest of all bunch covering materials treatment. However, it was at par treatment T_3 - Bunch cover with transparent polythene bag (18.80%) and T_5 - Bunch cover with gunny bag with transparent polythene form (18.60%). In the same way treatments T_1 (17.38%), T_4 (16.77%) T_2 (16.50%), were statistically at par, but their impact on total sugar (%) of banana were significantly different when compared with treatment T_0 (Control - No bunch covering) was obtained minimum total sugar (%) of banana (13.23%). Banana production regions mostly use blue covers as they let in heat without causing sun scald (Muchui *et al*., 2010) [8], because it blocks UV rays. Blue Polyethylene bags used to improve banana's quality, appearance and protect from birds and pests. Similar results were found by Amarante *et al*., (2002) studied in total sugar maximum in 17.44% treatment bunch cover with transparent polyethylene sleeves than all other treatments.

Table 2: Effect of different bunch covering materials on quality parameters of Banana (*Musa paradisiaca* L.)

Treatments	Total soluble solid (°Brix)	Titratable acidity (%)	Ascorbic acid (mg/100 g)	Total sugar (%)
T_0 -No bunch covering (control)	19.15	0.39	10.09	13.23
T_1 - Bunch cover with black polythene bag	21.86	0.33	10.60	17.38
T_2 - Bunch cover with jute bag	22.64	0.33	10.86	16.50
T_3 - Bunch cover with transparent polythene bag	22.95	0.31	12.66	18.80
T_4 -Bunch cover with paper bag	21.66	0.34	10.40	16.77
T_5 - Bunch cover with gunny bag with transparent polythene	22.76	0.32	11.90	18.60
T_6 - Bunch cover with dry leaves	21.38	0.35	10.28	16.66
T_7 - Bunch cover with blue polythene bag	23.13	0.30	13.26	19.40
SEm±	0.72	0.01	0.37	0.57
CD at 5% level	2.21	0.03	1.13	1.75

Conclusion

The results of the present investigation revealed that the nutritional requirement of banana could be fulfilled with the exclusive use of different bunch covering materials yield and quality attributes. The effect of bunch covering materials treatment T_7 - Bunch cover with blue polythene bag were found superior for on yield and quality parameter.

- From the results obtained in this study, it can be concluded that T_7 (Bunch cover with blue polythene bag) and T_3 (Bunch cover with transparent polythene bag) have proven to be the best treatment to improve yield, quality parameters and to increase the benefit-cost ratio of banana.
- Banana bunch covering materials in treatment T_7 (Bunch cover with blue polythene bag) was found to be superior to yield and quality attributes.
- The major problem of banana cultivation was due to climatic condition of this region. Therefore, it can be concluded that the practice of covering banana bunches can provide a good solution for improving the appearance, quality and productivity of banana fruit.

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