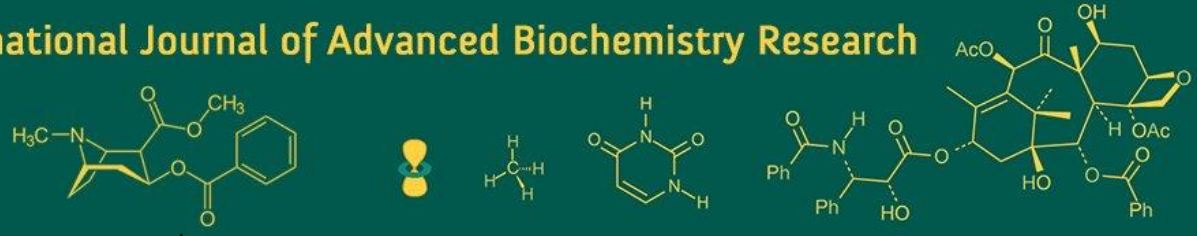
International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(5): 29-32
www.biochemjournal.com
Received: 08-03-2024
Accepted: 13-04-2024

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Effect of different bagging materials on fruit growth, yield and quality attributes of guava (*Psidium guajava* L.) cv Allahabad Safeda

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DOI: https://doi.org/10.33545/26174693.2024.v8.i5Sa.1113

Abstract
The present experiment entitled "Effect of different bagging materials on fruit growth, yield and quality attributes of guava (*Psidium guajava* L.) cv Allahabad Safeda" was conducted at Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the session 2022 - 2024. The experiment was laid out in randomized block design, and the study consists of nine treatments with three replications including control. From the present investigation, it was concluded that bagging had significant effect on fruit characters in guava. The best treatment was T_1 (15 days after fruit setting by Yellow cloth bag) was found best for maintaining yield attributes i.e. maturity (88.32%), minimum fruit drop (9.66%), maximum fruit weight (149.91 g), polar diameter of fruit (6.90 cm), radial diameter of fruit (6.94 cm), specific gravity (1.25 g cc^{-1}) minimum Insect damage fruit (1.05%), Seed weight (5.45 g), and with best quality attributes i.e. TSS (12.58 ^{0}Brix), minimum Acidity (0.38%), reducing sugar (5.09 %), maximum total sugar (8.36%) and the maximum Ascorbic acid (201.13 mg/100g pulp) was obtained in white perforated polythene bags (T_4). Increased fruit yield and quality might be due to the increase absorption of apply to bagging.

Keywords: Guava, yellow cloth bags, white perforated polythene, bagging

1. Introduction
Guava (*Psidium guajava* L.) is the apple of the tropics and is one of the popular fruits grown in tropical, sub-tropical and some parts of arid regions of India. Guava fruit belongs to the family Myrtaceae**.** Guava is the 5th most important fruit of India based on acreage and production after mango, banana, apple and citrus. Guava has become more popular in our country due to its prolific and precocious bearing habit, and wider adaptability under various agro-climatic conditions.

Guava is a climacteric fruit and used as fresh fruit as well as for making jam, jelly, paste, toffees, candy etc. Guava is available in cheap rate and popularly known as "apple of plains and poor man's apple". In north Indian agro-climate conditions guava flowers twice in a year-first in April-May for rainy season crop and then, September-October for winter season crop. Generally, fruit yield is more in rainy season crop as compared to winter season (Rathore and Singh, 1974) [14], but fruits of rainy season crop is poor in taste quality (Meena, 2016) [9] and more infestation of pests and diseases in comparison to winter season (Rawal and Ullasa, 1988) [15].

Guava is mainly grown in the states of Uttar Pradesh, Madhya Pradesh, Maharashtra and Bihar. The excellent quality guava fruit in the world is produced from Allahabad district of Uttar Pradesh. Uttar Pradesh occupied first rank in production of guava in India with production of 4,86,700 Metric tones (NHB-2023). 30-50 percent of losses are seen in post-harvest handling due to the lack of marketing and storage facilities**.** It contains remarkable mineral levels that includes calcium, phosphorus, iron and vitamins such as niacin, pantothenic acid, thiamin, riboflavin and ascorbic acid. It has large amounts of antioxidant properties due to the existence of polyphenolic compounds and carotenoids in it.

Guava is native to Mexico, Central America, the Caribbean, and northern South America. Commercially, it is a very important fruit in several countries due to its availability throughout the year, nutritional value, and affordability. There are mainly three bahar seasons of the guava fruit. Ambe bahar, Mrig bahar, Hasth bahar. The fruits of the ambe

bahar are of poor quality whereas the fruit of the hasth bahar has excellent quality and good yield.

Fruit bagging decreases the defects generated due to increased flesh firmness and taste, as well as disorders and insects. The most important purpose of fruit bagging was to successfully shield fruits from physiological influences, which resulted in a considerable decline in the overall amount of harmful, degenerative, and faulty fruits (17.7-33.3%) as compared to non-bagged fruits. To increase skin colour, many fruit crops use the physical protection technique known as bagging, which also reduces the risk of disease, insect pests, mechanical damage, pesticide residues on the fruit, and bird damage (Meena *et al*., 2016) [9].

Pre-harvest bagging significantly protects the fruit from biotic and abiotic stresses such as incidence of pests, birds damage risk of microbial pathogens and disease incidence in fruit physical and mechanical damage Furthermore, the fruit produced using bagging technology has great market value due to their clean and healthy skin with attractive colour.

2. Materials and Methods

2.1 Geographical location of the experimental site

The experimental site is located at a latitude of 25.41º North and longitude of 81.84 º East, with an altitude of 98 meters above the mean sea level (MSL).

2.2 Climatic conditions of the experimental area

The area of Prayagraj comes under humid sub-tropical climate, which experiences warm humid monsoon, hot dry summer and cold dry winter. The annual mean temperature is 26.1 °C while monthly mean temperatures are 18-29 °C. The daily average maximum temperature is about 22 °C and the minimum temperature is 9 °C. The average annual rainfall received is 1042.2 mm. At this location, the temperature reaches upto 46 °C-48 °C and the minimum temperature recorded is 4 °C-5 °C. The relative humidity ranges in this location ranges between 20-94%

2.3 Experimental details

Table 1: Treatment Details

Symbol	Treatment Combination
T_0	Control (without bagging)
T_1	Yellow cloth bag Bagging (15 days)
T_2	Yellow cloth bag Bagging (30 days)
T_3	White perforated polythene bag Bagging (15 days)
T_4	White perforated polythene bag Bagging (30 days)
T_5	Blue cloth bag Bagging (15 days)
T_6	Blue cloth bag Bagging (30 days)
T_7	Black polythene Bagging (15 days)
T_8	Black polythene Bagging (30 days)

3. Results and Discussion

3.1 Effect of bagging on yield parameters of guava fruit

The maximum maturity (88.32%) and fruit weight (149.91) was noted under Yellow cloth bag bagging (15 days) (T_1) and minimum maturity (79.32%) and fruit weight (123.64 g) was recorded in control without bagging (T_0). All the treatments proved significantly superior over control with respect to fruit maturity and fruit weight. This might be due to the fact that temperature and relative humidity are the most important environmental factors affecting fruit growth and development. The warmer temperature in bagged fruit compared to unbagged fruits might perhaps have contributed for early harvesting. Light and air play important role in growth and development of fruit. Bagging the fruits with cloth bags creates a microclimate that minimizes moisture loss, allowing the fruits to retain more water and consequently gain weight.

The yield attributes of fruit like polar and radial diameter of fruits under the treatment T_1 also found maximum among the different bagging of guava fruits under this study. The guava fruit under treatment T_1 (bagging with yellow cloth bag) (15 days) had the maximum polar diameter (6.90 cm) and radial diameter (6.94 cm). On the other hand, the minimum values for these physical traits were recorded in control without bagging (T_0). Better fruit size under yellow colour cloth bag might be due to good movement of light on guava fruits.

Similarly, the guava fruit under treatment T_1 (yellow cloth bag) (15 days) had the maximum fruit specific gravity (1.25 g cc-1). The fruits also showed the higher specific gravity in general that might be due to more compact tissues at under bagging and hence slight increase in intercellular spaces resulting into less increase in volume of fruits in comparison with the increase in fruit weight, which might increased the specific gravity of the fruit under yellow cloth bag.

The effect of bagging on fruit drop (%), insect damaged fruit (%) and seed weight (g) are influenced by various types of bagging. The maximum values for fruit drop (18.66%), seed weight (8.13 g) and insect damaged fruit (14.39%) were observed in control (T_0) while, minimum values for fruit drop(9.66%), insect damaged fruit (1.05%) and seed weight (5.45 g) were noticed under yellow cloth bag Bagging (15 days) (T_1). It might be due to perforations made in these bags allowing free circulation of air and did not allow to build up an excess temperature and relative humidity in bags. The results of the present study were in agreement with in bagged guava fruits.

The seed characters are also associated with the fruit growth and development. Seeds might influence the fruit growth and development, resulted fruits with superior quality as the fruits. Meena *et al*., 2016 [9].

3.2 Effect of bagging on Quality Parameters of guava fruit

The quality parameter of guava i.e. fruit TSS, total sugar, reducing sugar and non- reducing sugar was significantly influenced by different type of bagging (Table 4). Better improvement of maximum TSS (12.85° Brix), total sugar (8.36%), reducing sugar (5.09%) and minimum non-reducing sugar (1.98%) was observed in the treatment T_1 i.e. use of yellow cloth bag (15 days). The minimum TSS (9.81° Brix), total sugar (7.01%), reducing sugar (3.54%) and maximum non-reducing sugar (3.88%) were observed in un-bagged control treatment T_0.

Table 2: Effect of different fruit bagging treatments on maturity, fruit drop, Polar diameter, Radial diameter and fruit weight

Symbol	Maturity (%)	Fruit drop (%)	Fruit weight(g)	Polar diameter of fruit (cm)	Radial diameter of fruit (cm)
T_0	79.32	18.66	123.64	5.03	4.94
T_1	88.32	9.66	149.91	6.9	6.94
T_2	83.99	13.66	144.55	6.08	6.05
T_3	81.99	16.66	130.01	5.21	5.18
T_4	81.32	16.97	127.13	5.32	5.08
T_5	84.32	13.99	138.77	5.58	5.92
T_6	82.32	14.66	135.36	5.55	5.88
T_7	83.32	15.66	135.61	5.43	5.48
T_8	82.23	15.99	130.91	5.31	5.2
F test	S	S	S	S	S
S.Em±	0.83	0.86	2.79	0.19	0.21
CD 5%	0.37	0.39	1.26	0.09	0.1
CV	3	17.01	6.2	10.18	11.28

Table 3: Effect of different bagging treatment on insect damaged fruit (%), seed weight (g) and specific gravity of fruit.

Symbol	Insect damaged fruit (%)	Seed weight (g)	Specific gravity (g cc-1)
T_0	14.39	8.13	0.93
T_1	1.05	5.45	1.25
T_2	3.39	7.95	1.08
T_3	4.72	7.69	1.05
T_4	5.37	8.19	1.01
T_5	2.72	6.11	1.09
T_6	4.05	7.5	1.00
T_7	4.39	6.97	1.08
T_8	4.72	7.15	1.04
F test	S	S	S
S.Em±	1.25	0.31	0.03
CD (P=0.05)	0.56	0.14	0.01
CV	75.53	12.94	8.29

Table 4 showed that the in general, bagging treatments had better effect on ascorbic acid (vitamin C) content of guava fruits. The guava fruits under treatment T_4 (bagging with white perforated polythene bag)(30 days) had the highest vitamin C (201.13 mg 100 g-1) followed by T_3. The guava fruits under treatment T_2 also had the minimum acidity of guava fruits followed by T_3, but were statistically at par and the maximum acidity of guava fruits was observed in treatment T_0 (0.47%). However, the TSS: Acid ratio was found better in the fruits under the treatment T_1 among the various fruit bagging treatments under the study which clearly showed the better palatability or acceptability of guava fruits and ultimately improved the fruit quality. On the basis of general attractiveness and acceptability due to its fruit size and fruit weight it was seen that the fruits covered with yellow cloth bagging (T_1) (15 days) were the best.

The present study revealed that the application of bagging improved the fruit quality of guava in general as compared to control i.e. unbagged fruits in terms of physico-chemical quality. The bagging during the October month (15 days after fruit set) improved the physico-chemical quality of fruits by bagging with yellow cloth bag (T_1).

Table 4: Effect of different bagging treatment on quality parameter of guava fruit.

Symbol	TSS (°Brix)	Acidity (%)	TSS: Acid	Ascorbic acid	Reducing sugar (%)	Non Reducing Sugar	Total sugar (%)
T_0	9.81	0.47	21.01	177.04	3.54	3.88	7.01
T_1	12.85	0.38	34.12	180.72	5.09	1.98	8.36
T_2	12.58	0.4	31.46	182.26	4.84	2.9	7.75
T_3	11.75	0.46	25.55	198.68	3.45	3.87	7.32
T_4	11.38	0.47	24.04	201.13	3.7	3.68	7.37
T_5	12.64	0.39	32.69	182.78	4.86	2.15	7.43
T_6	12.55	0.4	31.64	184.27	4.49	3.09	7.07
T_7	12.5	0.41	30.48	183.05	4.72	3.65	7.58
T_8	11.75	0.42	27.97	191.5	4.4	3.58	7.98
F test	S	S	S	S	S	S	S
S.Em±	0.32	0.01	2.21	2.78	0.21	0.24	0.14
CD (P=0.05)	0.14	0.01	6.32	1.25	0.09	0.11	0.39
CV	8	8.66	8.91	4.47	14.32	22.61	11.36

3.3 Effect of bagging on Organoleptic properties of guava fruit

Fruits bagging with yellow cloth bag were found significantly superior in organoleptic test with highest scores in terms of taste, colour and flavour respectively and rated as very good.

The maximum score for colour, taste, flavour and overall acceptability was recorded in Yellow cloth bag Bagging

(15days) T_1 with value 7.8, 8, 8 and 8 respectively and the minimum score was recorded in T_0 control without bagging. Similarly, earlier workers have also reported that the fruit bagging can improve fruit quality mainly by keeping fruit appearance and preferable uniform coloration of the fruit as reported by Sarker *et al*. (2009) [12] and Singh *et al*. (2017) [13].

Table 5: Effect of different bagging treatment on organoleptic properties of guava fruit.

Symbol	Color	Taste	Flavour	Overall acceptability
T_0	5.8	5.8	6	6
T_1	7.8	8	8	8
T_2	7.8	7.6	7.6	7.8
T_3	6.4	6.8	6.8	6.8
T_4	6.8	6.6	6.6	6.8
T_5	7.4	7.8	7.6	7.8
T_6	7.4	7.4	7	7.6
T_7	7.2	7.4	7.2	7.4
T_8	6.8	7.2	6.8	7.2
F test	S	S	S	S
S.Em±	0.22	0.23	0.2	0.21
CD (P=0.05)	0.1	0.1	0.09	0.1
CV	9.39	9.49	8.61	8.81

4. Conclusion

All the treatments were found better than control in terms of organoleptic test, quality and yield parameters of fruit with yellow cloth bag was found superior to increase the quality & yield parameters of fruit and organoleptic quality than all other treatments. This treatment was found to have very low spots and no infestation. Hence it should be practiced in guava crop to produce fruits with better quality, good size and weight and better colour as well as texture and aroma with excellent taste.

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