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Effect of pre-harvest bagging on physical attributes of guava fruits (*Psidium guajava* L.) cv. Lalit

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Abstract

The present study titled "Effect of pre-harvest bagging on physical attributes of guava fruits (*Psidium guajava* L.) cv. Lalit" was conducted during the 2023-24 Rabi season at Precision Farming Development Centre (PFDC), Department of Fruit Science, College of Agriculture, IGKV, Raipur (C.G.). The experiment employed the statistical designs which is Two-Factor Factorial Experiment in a Randomized Block Design for physical parameters with each treatment replicated three times. Various bagging materials were utilized in the experiment, including: Yellow polythene (T₁), White polythene (T₂), Butter paper (T₃), Brown bag (T₄), English newspaper (60gsm) (T₅), Hindi newspaper (35gsm) (T₆), Muslin cloth (T₇). To ensure adequate ventilation necessary for fruit growth and development, perforations were made on both sides of the bags. Fruits that were 35 days post fruit set were selected for the bagging process. The study's results indicated that guava fruits which were bagged with Brown bags (T₄) exhibited the maximum fruit length (6.58cm), fruit weight (180.07g), fruit diameter(6.76cm), specific gravity (1.15 g/cc).

Keywords: Guava, bagging materials, physical properties

Introduction

Guava (*Psidium guajava* L.), renowned as the "Apple of the Tropics," belongs to the Myrtaceae family and originates from Tropical America. It is extensively cultivated across several countries worldwide, including India, the USA, Cuba, Taiwan, Mexico, Peru, China, Malaysia, and Bangladesh. In India, guava ranks as the fifth most important fruit in terms of acreage and production, following mango, banana, apple, and citrus. Its popularity in India has surged due to its prolific and early bearing nature, and its ability to thrive across diverse agro-climatic conditions (Dolkar *et al.*, 2014) [2]. Enhanced living standards and increased health awareness after-COVID-19 have led to a heightened demand for food safety and quality. This poses significant challenges for traditional agricultural methods. However, the adoption of bagging technology offers a promising solution to overcome these problems (Ali *et al.*, 2021) [1]. Pre-harvest fruit bagging presents several advantages over conventional production systems.

Materials and Methods

The current study was undertaken on 10-year-old guava trees of the "Lalit" variety, cultivated under ultra-High-Density Planting (UHDP) with a spacing of 2 × 1 meter at the Precision Farming Development Centre (PFDC), Department of Fruit Science, College of Agriculture, IGKV, Raipur (C.G.). The experiment employed the statistical designs: Two-Factor Factorial Experiment in a Randomized Block Design for physical parameters were, treatment and directions are the two factors with each treatment replicated three times. Various bagging materials were utilized in the experiment, including: Yellow polythene (T₁), White polythene (T₂), Butter paper (T₃), Brown bag (T₄), English newspaper (60gsm) (T₅), Hindi newspaper (35gsm) (T₆), Muslin cloth (T₇).

Results and Discussion

Effect of pre-harvest bagging on physical attributes of guava

Fruit weight (g): In fruit weight the interaction between Direction and treatment are significantly different thus the fruit weight for given interaction between direction and

treatment levels, we noted that for North direction the T₄ Brown bag (244.5 g) is having significantly higher Fruit weight compare to all other treatments, similarly T₀ control (73.3 g) is having lowest fruit weight compare to all other treatments.

In North direction the value of fruit weight(g) of T₄ Brown bag (244.5 g) is having at par effect with (T₁) Yellow polythene (213 g), and value of (T₂) White polythene (136.7 g) is having at par effect with (T₆) Hindi newspaper (127 g), (T₃) Butter paper (135 g), (T₇) Muslin cloth (146.7 g) and (T₅) English newspaper (151.5 g). In East direction T₀ control (91.7 g) is having at par effect with (T₂) White polythene (132.5 g) and the value of (T₁) Yellow polythene (155.2 g) is having at par effect with (T₆) Hindi newspaper (142.3 g), (T₃) Butter paper (146.7 g), (T₇) Muslin cloth (181 g), (T₅) English newspaper (158 g), and T₄ Brown bag (178.3 g). In West direction fruit weight of all treatment are significantly not different thus, T₀ control (110 g) is having at par effect with (T₂) White polythene (162.2 g), (T₁) Yellow polythene(178g), (T₆) Hindi newspaper (126.7g), (T₃) Butter paper (143.5 g), (T₇) Muslin cloth (152g), (T₅) English newspaper (148.3 g), and T₄ Brown bag (178.2g). In South direction fruit weight of all treatment are significantly not different thus, T₀ control (144 g) is having at par effect with (T₂) White polythene (143.5 g), (T₁) Yellow polythene(155.8 g), (T₆) Hindi newspaper (112.3 g), (T₃) Butter paper (125.7 g), (T₇) Muslin cloth (126.5 g), (T₅) English newspaper (155 g), and T₄ Brown bag (119.3 g). According to Dutta and Majumdar (2012) ^[3], pre-harvest fruit bagging enhanced fruit weight and size by creating favourable conditions such as higher relative humidity, thereby reducing water loss from the fruit.

Fruit length (cm)

The fruit bagging treatment was observed to have a significant effect on fruit length (cm). Since the interaction between treatment and direction is not significant therefore, the individual main effects should be considered for multiple comparison further among only treatment is having significant effect on the Fruit length not the direction. The highest fruit length (6.58 cm) was observed in Brown bag (T₄). while, minimum fruit weight was observed under control (T₀) which is without bagging (5.11 cm). This improvement is likely due to the favourable microclimate created around the fruits by bagging, which promotes increased fruit length. Similar result was obtained by Sarkar *et al.* (2009) that bagging mango fruits with brown paper bags improved physical fruit characteristics compared to unbagged fruits.

Fruit diameter (cm)

The interaction between treatment and direction is not significant therefore, the individual main effects should be considered for multiple comparison further among only treatment is having significant effect on the Fruit diameter not the direction. The maximum fruit diameter(cm) was recorded in (6.76 cm) which is Brown bag (T₄). While, minimum fruit diameter (cm) was recorded in (T₀) control (5.72 cm). The treatment value of (T₄) Brown bag (6.76 cm) having at par effect with (T₅) English newspaper(6.31cm). The increase in fruit diameter could be attributed to rapid cell division and expansion facilitated by the favourable microclimate created by the bagging process. The results are in line with the findings of Islam *et al.* (2019) ^[4] in guava

and Sarkar *et al.* (2009) in mango fruit reported improved fruit diameter as of fruit bagging.

Fruit volume (cc)

Since the interaction between treatment and direction is not significant therefore, the individual main effects should be considered for multiple comparison further among only treatment is having significant effect on the Fruit volume not the direction. The maximum fruit volume was observed in (T₁) Yellow polythene (159 ml). While, minimum fruit volume (cc) was recorded in (T₀) control (101 ml). the value of (T₁) Yellow polythene (159 ml) was found to have at par effect with (T₄) Brown bag (158 ml). Pre-harvest fruit bagging enhances fruit volume by increasing relative humidity and creating a favourable microclimate inside the bags, thereby promoting the growth and development of fruits. The present finding is in agreement with that of Meena *et al.* (2016) ^[6] who also found similar result in guava.

Specific gravity(g/cc)

only treatment is having significant effect on the Specific gravity not the direction. The maximum specific gravity (g/cc) was found in (T₄) Brown bag (1.15 g/cc). While, minimum specific gravity (g/cc) was recorded in (T₀) control (1.03 g/cc). the specific gravity, which is the ratio of the fruit's weight to its volume, tends to be higher in bagged fruits due to this denser tissue formation. The above findings are in accordance with the finding of Kireeti *et al.* (2018) ^[5] in guava.

Pulp weight (g)

Since the interaction between treatment and direction is not significant therefore, the individual main effects should be considered for multiple comparison further among only treatment is having significant effect on the pulp weight (g) not the direction. Significantly maximum pulp weight (149.6g) was observed in (T₄) Brown bag. While, minimum pulp weight (g) was noticed in (T₀) control (75.6 g). The value of (T₄) Brown bag 149.6 g having at par effect with (T₁) Yellow polythene (145.8 g). According to Meena *et al.* (2016) ^[6], yellow-coloured polythene might facilitate excellent light penetration, allowing for optimal light intensity and quality.

Seed weight (g)

The study found no significant differences in seed weight (g) due to fruit bagging treatments. Similarly, the interaction between treatment and direction was not found to be significant. As a result, all treatments can be considered equivalent to each other.

Pulp: Seed ratio

Since the interaction between treatment and direction is not significant therefore, the individual main effects should be considered for multiple comparison further among only treatment is having significant effect on the pulp: seed ratio not the direction. The maximum pulp: seed ratio was recorded in (T₅) English newspaper (6.33g). While, minimum pulp: seed ratio was noticed in (T₀) control (3.47 g). The value of pulp: seed ratio of (T₅) English newspaper (6.33 g) having at par effect with (T₄) Brown bag (6.27 g) and (T₁) Yellow polythene (5.98 g). This observation may be attributed to the fact that pulp: seed ratio characteristics

play a significant role in the growth and development of fruits. These findings align with similar conclusions from previous studies of Kireeti *et al.* (2018)^[5] in guava.

Fruit Grading: The harvested bagged guava fruits were

graded as 'A' and 'B' according to the fruit size(diameter) and qualitative traits and fruit appearance shown in Table 4.1.9. Were, grade 'A' is assigned to those fruits which diameter is ≥ 6.1 cm while other fruits whose fruit diameter is ≤ 6.1 is assigned as 'B' grade.

Table 1: Effect of pre- harvest bagging on Fruit weight (g) of guava

Notations	Treatment details	Directions			
		N	E	W	S
T ₀	Control (no bagging)	73.3 ^a	91.7 ^a	110 ^{ab}	144 ^{abc}
T ₁	Bagging with Yellow polythene	213 ^{bc}	155.2 ^{abc}	178.8 ^{abc}	155.8 ^{abc}
T ₂	Bagging with White polythene	136.7 ^{abc}	132.5 ^{ab}	162.2 ^{abc}	143.5 ^{abc}
T ₃	Bagging with Butter paper	135 ^{abc}	146.7 ^{abc}	143.5 ^{abc}	125.7 ^{ab}
T ₄	Bagging with Brown bag	244.5 ^c	178.3 ^{abc}	178.2 ^{abc}	119.3 ^{ab}
T ₅	Bagging with English newspaper	151.5 ^{abc}	158 ^{abc}	148.3 ^{abc}	155 ^{abc}
T ₆	Bagging with Hindi newspaper	127 ^{ab}	142.3 ^{abc}	126.7 ^{ab}	112.3 ^{ab}
T ₇	Bagging with Muslin cloth	146.7 ^{abc}	181 ^{abc}	152 ^{abc}	126.5 ^{abc}
S.E.m $\pm$		19.5			
CD at 5 % level		55.12			

Table 2: Effect of pre- harvest bagging on average Fruit length (cm) of guava

Notations	Treatment details	Fruit length(cm)
T ₀	Control (no bagging)	5.11 ^a
T ₁	Bagging with Yellow polythene	5.89 ^{bc}
T ₂	Bagging with White polythene	5.91 ^{bc}
T ₃	Bagging with Butter paper	5.98 ^c
T ₄	Bagging with Brown bag	6.58 ^d
T ₅	Bagging with English newspaper	6.22 ^{cd}
T ₆	Bagging with Hindi newspaper	5.58 ^b
T ₇	Bagging with Muslin cloth	6.03 ^c
S.E.m $\pm$		0.088
CD at 5 % level		0.24

Table 3: Effect of pre-harvest bagging on average Fruit diameter (cm) of guava

Notations	Treatment details	Fruit diameter(cm)
T ₀	Control (no bagging)	5.72 ^a
T ₁	Bagging with Yellow polythene	6.08 ^{ab}
T ₂	Bagging with White polythene	6.10 ^{ab}
T ₃	Bagging with Butter paper	6.09 ^{ab}
T ₄	Bagging with Brown bag	6.76 ^c
T ₅	Bagging with English newspaper	6.31 ^b
T ₆	Bagging with Hindi newspaper	5.92 ^{ab}
T ₇	Bagging with Muslin cloth	6.00 ^{ab}
S.E.m $\pm$		0.092
CD at 5 % level		0.26

Table 4: Effect of pre- harvest bagging on average Fruit volume (cc) of guava

Notations	Treatment details	Fruit volume(cc)
T ₀	Control (no bagging)	101 ^a
T ₁	Bagging with Yellow polythene	159 ^b
T ₂	Bagging with White polythene	133 ^{ab}
T ₃	Bagging with Butter paper	128 ^{ab}
T ₄	Bagging with Brown bag	158 ^b
T ₅	Bagging with English newspaper	137 ^{ab}
T ₆	Bagging with Hindi newspaper	119 ^{ab}
T ₇	Bagging with Muslin cloth	139 ^{ab}
S.E.m $\pm$		9.33
CD at 5 % level		26.37

Table 5: Effect of pre- harvest bagging on average Specific gravity (g/cc) of guava

Notations	Treatment details	Specific gravity(g/cc)
T ₀	Control (no bagging)	1.03 ^a
T ₁	Bagging with Yellow polythene	1.12 ^{bc}
T ₂	Bagging with White polythene	1.08 ^{abc}
T ₃	Bagging with Butter paper	1.07 ^{abc}
T ₄	Bagging with Brown bag	1.15 ^c
T ₅	Bagging with English newspaper	1.12 ^{bc}
T ₆	Bagging with Hindi newspaper	1.08 ^{abc}
T ₇	Bagging with Muslin cloth	1.09 ^{abc}
S.E.m $\pm$		0.015
CD at 5 % level		0.043

Table 6: Effect of pre- harvest bagging on average Pulp weight (g) of guava

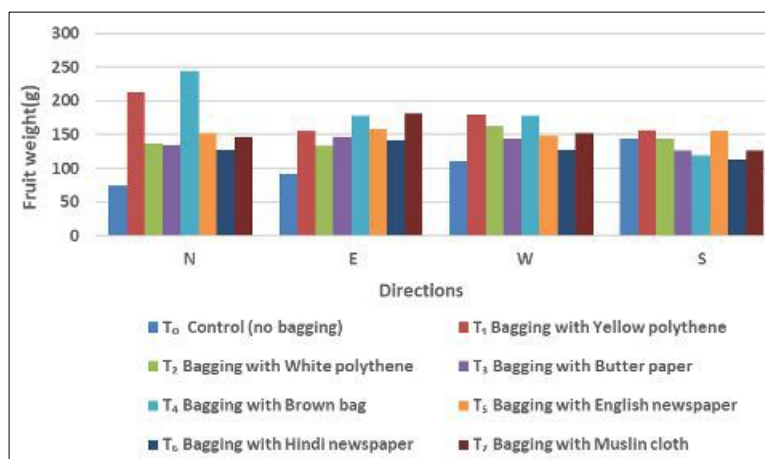
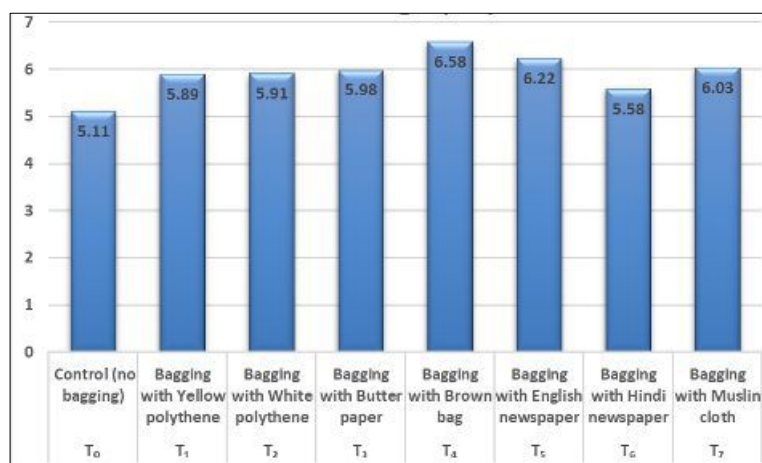
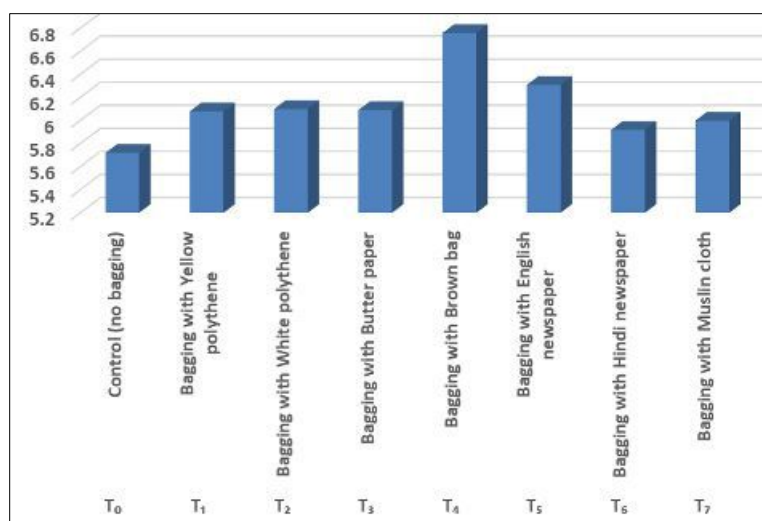
Notations	Treatment details	Pulp weight (g)
T ₀	Control (no bagging)	75.6 ^a
T ₁	Bagging with Yellow polythene	145.8 ^c
T ₂	Bagging with White polythene	117.5 ^{bc}
T ₃	Bagging with Butter paper	110.4 ^{abc}
T ₄	Bagging with Brown bag	149.6 ^c
T ₅	Bagging with English newspaper	127.9 ^{bc}
T ₆	Bagging with Hindi newspaper	99.6 ^{ab}
T ₇	Bagging with Muslin cloth	122.9 ^{bc}
S.E.m $\pm$		9.28
CD at 5 % level		26.23

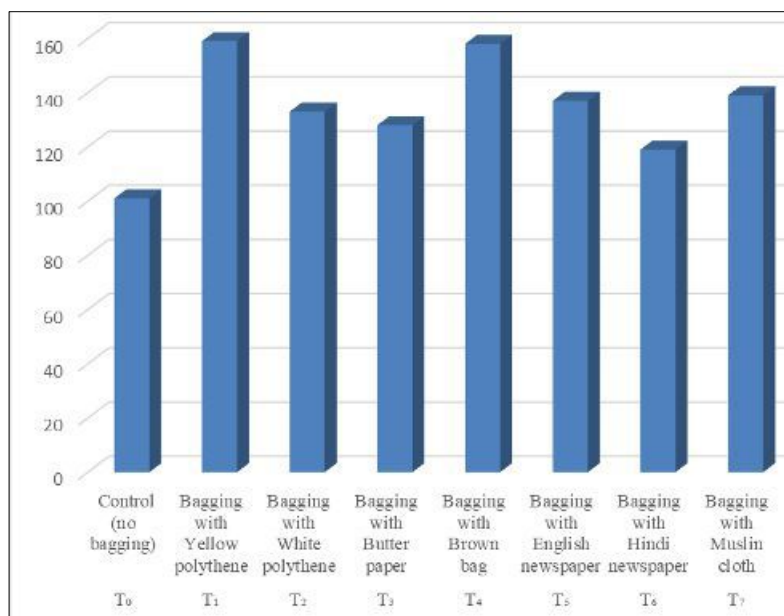
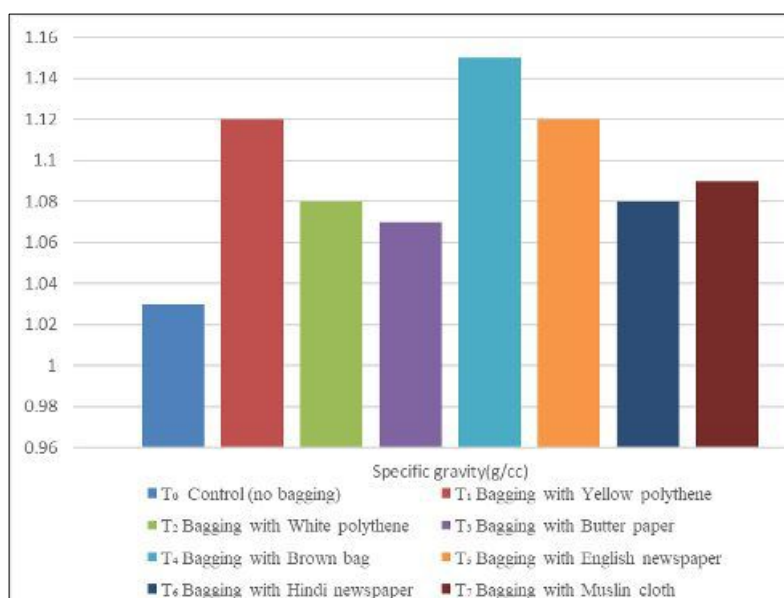
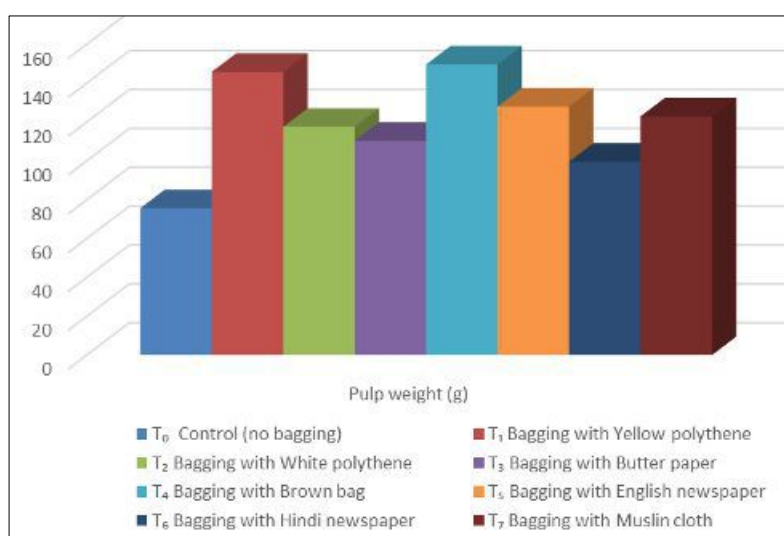
Table 7: Effect of pre- harvest bagging on average Pulp: seed ratio of guava

Notation	Treatment details	Pulp: seed ratio
T ₀	Control (no bagging)	3.47 ^a
T ₁	Bagging with Yellow polythene	5.98 ^b
T ₂	Bagging with White polythene	5.49 ^{ab}
T ₃	Bagging with Butter paper	4.66 ^{ab}
T ₄	Bagging with Brown bag	6.24 ^b
T ₅	Bagging with English newspaper	6.33 ^b
T ₆	Bagging with Hindi newspaper	5.10 ^{ab}
T ₇	Bagging with Muslin cloth	5.25 ^{ab}
S.E.m $\pm$		0.46
CD at 5 % level		1.32

Table 8: Effect of pre- harvest bagging on Fruit grading of guava

Notation	Treatment details	Fruit grade
T ₀	Control (no bagging)	B
T ₁	Bagging with Yellow polythene	B
T ₂	Bagging with White polythene	B
T ₃	Bagging with Butter paper	B
T ₄	Bagging with Brown bag	A
T ₅	Bagging with English newspaper	A
T ₆	Bagging with Hindi newspaper	B
T ₇	Bagging with Muslin cloth	B

**Fig 1:** Direction**Fig 2:** Fruit length (cm)**Fig 3:** Fruit diameter (cm)

**Fig 4:** Fruit volume(cc)**Fig 5:** Specific gravity (g/cc)**Fig 1:** Pulp weight (g)

Conclusion

Upon completion of the research, it is concluded that pre-harvest bagging of guava fruits, the treatment T₄ (bagging with Brown bag) followed by T₅ (bagging with English newspaper) and T₁ yellow polythene showed the best results with regard to physical parameters viz, fruit weight, fruit length, fruit diameter, specific gravity, pulp weight and pulp: seed ratio. Therefore, the treatment T₄ (bagging with Brown bag) should be considered for pre-harvest bagging in guava fruits for improving the physical attributes.

Bagging plays a crucial role in extending the shelf life of fruits as it provides a physical barrier that protects fruits from physical damage, abrasions, and scratches during growth and handling. This helps maintain their appearance and prevents moisture loss.

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