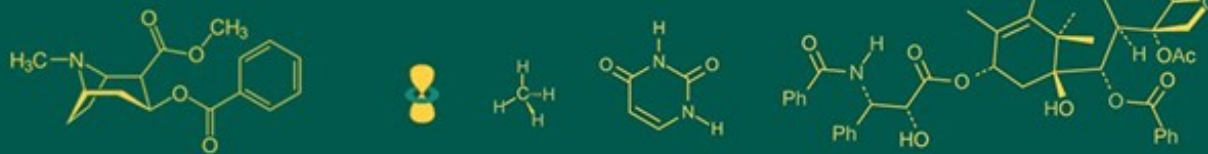


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Anil Anjana

PG Scholar, Department of
 Fruit Science, College of
 Horticulture, Mudigere Keladi
 Shivappa Nayaka University of
 Agricultural and Horticultural
 Sciences, Shivamogga,
 Karnataka, India

D Thippesha

Dean (Horticulture), College of
 Horticulture, Hiriyur,
 Karnataka, India

M Ravishankar Patil

Assistant Professor (Hort.),
 Department of Horticulture,
 College of Agriculture,
 Shivamogga, Karnataka, India

N Sudharani

Assistant Professor,
 Department of Food and
 Nutrition, ICAR-KVK,
 Shivamogga, Karnataka, India

R Girish

Scientist, (Plant Protection),
 ICAR-KVK, Shivamogga,
 Karnataka, India

NS Renukaswamy

Assistant Professor,
 Department of Crop
 Physiology, College of
 Agriculture, Shivamogga,
 Karnataka, India

**Corresponding Author:
Anil Anjana**

PG Scholar, Department of
 Fruit Science, College of
 Horticulture, Mudigere
 Keladi Shivappa Nayaka
 University of Agricultural
 and Horticultural Sciences,
 Shivamogga, Karnataka,
 India

Effect of different bagging materials on fruit yield, quality and storability of guava (*Psidium guajava* L.) cv. Taiwan Lite Pink Super Gold

Anil Anjana¹, D Thippesha², M Ravishankar Patil³, N Sudharani⁴, R Girish⁵, NS Renukaswamy⁶

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ABSTRACT

An investigation on “Effect of Different Bagging Materials on Fruit Yield, Quality and Storability of Guava (*Psidium guajava* L.) cv. Taiwan Pink Super Gold” was carried out at a farmer’s field in Kallaganguru village, Shivamogga district, Karnataka during the year 2025-26. The experiment was laid out in a Randomized Complete Block Design with three replications and ten treatments viz., T₁ - Control (Without bagging), T₂ - Newspaper bag, T₃ - Brown paper bag, T₄ - Non-woven bag, T₅ - Transparent polythene bag, T₆ - Black polythene bag, T₇ - Yellow polythene bag, T₈ - Blue polythene bag, T₉ - Foam net bag and T₁₀ - Parchment bag. Fruits were bagged at the marble stage of development. Among the treatments evaluated, T₄ (Non-woven bag) recorded significantly the maximum fruit length (8.70 cm), fruit diameter (9.87 cm), fruit volume (298.48 cc), fruit weight (283.76 g), fruit firmness (7.93 kg/cm²), yield per plant (12.77 kg), yield per hectare (22.18 t ha⁻¹) and shelf life (11.34 days). The highest TSS (12.85 °Brix), total sugars (8.50%), reducing sugars (4.97%), non-reducing sugars (3.53%), vitamin C content (243.70 mg/100 g) and lycopene content (6.00 mg/100 g), along with the lowest titratable acidity (0.36%), were recorded in T₄ (Non-woven bag). There were no incidence of thrips and anthracnose. The minimum fruit length, diameter, volume, weight, yield and lowest quality of fruit was recorded in T₁ fruit without bagging (control). Among the various bagging materials evaluated, bagging with non-woven bag was found to be the best for the overall improvement of fruit yield and quality of guava.

Keywords: *Psidium guajava* L., Bagging materials, Fruit yield, Post-harvest quality, Shelf life

Introduction

Guava (*Psidium guajava* L.) is an important tropical fruit crop belonging to the family Myrtaceae. It originated in tropical America and is now widely cultivated in tropical and subtropical regions owing to its adaptability, nutritional value and commercial importance. In India, guava is one of the major fruit crops and is popularly known as the “Apple of the Tropics” due to its excellent flavour and nutritional quality. The fruits are rich in vitamin C, pectin, minerals and other essential nutrients and are consumed both as a fresh fruit and in processed products such as pulp, juice, jam, jelly, nectar and syrup. In India, guava is cultivated over an area of 3.72 lakh hectares with a production of 55.23 lakh tonnes and an average productivity of 14.72 t ha⁻¹. Madhya Pradesh is the leading guava-producing state, followed by Uttar Pradesh and Andhra Pradesh (Anon., 2026) [1].

Bagging is a physical protection technique, not only protects fruit from pests and diseases but also affects the quality of produce by changing micro-environment of fruit during development. Bagging of different fruits during development can reduce the chances of physical damage, improve color at harvest and yields high-quality fruit. Several countries have adopted this technique to control the damage caused by fruit fly. The pre-mature bagging reduces agrochemical residual effects, prevents sunburn, decreases the mechanical damage and controls the insect pest damage of the fruits. Therefore, the present study was undertaken with the following objectives to evaluate the effect of different bagging materials on the fruit yield and quality of guava and to study the influence of bagging materials on the incidence of pests and diseases of guava cv. Taiwan lite pink super gold.

Material and methods

The experiment was carried out in a farmer’s field at Kallaganguru village in Shivamogga district, Karnataka during the year 2025-26 on four years old guava (*Psidium guajava* L.) trees, cv. Taiwan Lite Pink Super Gold, spaced at 2.4 m x 2.4 m. The experiment was laid out in Randomized Complete Block Design (RCBD) with ten treatments and three replications.

The treatments comprised of ten different bagging materials viz., T₁ - Control (without bagging), T₂ - Newspaper bag, T₃ - Brown paper bag, T₄ - Non-woven bag, T₅ - Transparent polythene bag, T₆ - Black polythene bag, T₇ - Yellow polythene bag, T₈ - Blue polythene bag, T₉ - Foam net bag and T₁₀ - Parchment bag. Healthy and uniformly developed fruits were selected at marble stage for imposing the bagging treatments.

The observations recorded included fruit length, fruit diameter, fruit volume, fruit weight, fruit firmness, shelf life, fruit yield per plant and yield per hectare along with post-harvest quality parameters such as TSS, titratable acidity, total sugars, reducing sugars, non-reducing sugars, vitamin C and lycopene content. The collected data were subjected to statistical analysis using R Studio (2025) following the methodology outlined by Fischer and Yates (1963) [2].

Results and discussion

Fruit length (cm)

Significant variations were observed in fruit length among the different bagging materials in guava (Table 1 & Fig. 1). The maximum fruit length (8.70 cm) was recorded in T₄ (Non-woven bag), which was statistically on par with T₇ (Yellow polythene bag) (8.33 cm), whereas the minimum fruit length (6.50 cm) was recorded in T₁ (Control without bagging). The greater fruit length under non-woven bagging may be attributed to the favourable microenvironment created around the developing fruits. Its breathable nature may have maintained suitable temperature, humidity and aeration, thereby promoted cell enlargement and assimilate accumulation, resulting in better fruit growth. Similar findings were reported by Hossain *et al.* (2018) [3] and Bishnoi *et al.* (2023) [4] in guava. Similar observations were also reported by Islam *et al.* (2019) [5], who attributed the improvement in fruit size to the favourable microclimatic conditions created by fruit bagging.

Fruit diameter (cm)

Fruit diameter varied significantly among the different bagging treatments (Table 1 & Fig. 1). The highest fruit diameter (9.87 cm) was recorded in T₄ (Non-woven bag), which was statistically on par with T₇ (Yellow polythene bag) (9.38 cm), while the lowest fruit diameter (7.13 cm) was recorded in T₁ (Control without bagging). The greater fruit diameter under non-woven bagging may be due to the favourable microclimatic conditions maintained around the developing fruits, which could have enhanced cell expansion and accumulation of photosynthates. Similar findings were reported by Hossain *et al.* (2018) [3] in guava.

Fruit volume (cc)

Significant differences were observed among the bagging materials for fruit volume (Table 1). The maximum fruit volume (298.48 cc) was recorded in T₄ (Non-woven bag), followed by T₇ (Yellow polythene bag) (258.72 cc) and T₈ (Blue polythene bag) (239.77 cc), while the minimum (204.67 cc) was recorded in T₁ (Control). The higher fruit volume under non-woven bagging may be due to favourable temperature, humidity and aeration, which promoted fruit enlargement. Similar findings were reported by Abbasi *et al.* (2014) [6], Brar *et al.* (2019) [7] and Bishnoi *et al.* (2023) [4] in guava.

Fruit weight (g)

The influence of different bagging materials on fruit weight showed significant differences among the treatments (Table 1). The maximum fruit weight (283.76 g) was recorded in T₄ (Non-woven bag), followed by T₇ (Yellow polythene bag) (245.78 g) and T₈ (Blue polythene bag) (227.78 g), whereas the minimum fruit weight (194.44 g) was recorded in T₁ (Control without bagging). The increase in fruit weight under non-woven bagging might be due to enhanced fruit growth and better accumulation of photosynthates in the developing fruits. The favourable microenvironment created by the porous non-woven material may have supported efficient physiological activities and assimilate translocation towards the fruits. Similar results were reported by Abbasi *et al.* (2014) [6], Brar *et al.* (2019) [7], Bishnoi *et al.* (2023) [4] and Rawat *et al.* (2025) [8] in guava.

Fruit firmness (kg/cm²)

Fruit firmness was significantly influenced by different bagging materials (Table 1). The highest fruit firmness (7.93 kg/cm²) was recorded in T₄ (Non-woven bag), which was statistically on par with T₇ (Yellow polythene bag) (7.83 kg/cm²) and T₈ (Blue polythene bag) (7.73 kg/cm²) whereas the lowest fruit firmness (5.33 kg/cm²) was recorded in T₁ (Control without bagging). This may be due to favourable temperature and humidity conditions that reduced moisture loss and delayed cell wall degradation. The porous material also allowed adequate air movement, helping maintain fruit firmness. These findings agree with Bishnoi *et al.* (2023) [4] and Rawat *et al.* (2025) [8], who reported improved firmness and post-harvest quality in bagged guava fruits.

Shelf life (days)

Significant differences were observed among the bagging materials for shelf life of guava fruits (Table 1). The maximum shelf life (11.34 days) was recorded in T₄ (Non-woven bag), followed by T₇ (Yellow polythene bag) (10.44 days), while the minimum (6.45 days) was recorded in T₁ (Control). The longer shelf life under non-woven bagging may be due to reduced moisture loss and respiration, along with delayed ripening and senescence. Similar findings were reported by Rawat *et al.* (2025) [8] in guava and Sohag *et al.* (2023) [9] in tomato.

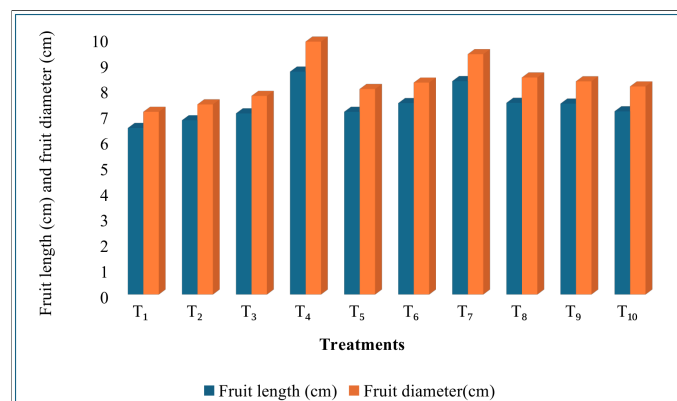


Figure 1. Effect of different bagging materials on fruit length and fruit diameter of guava cv.

Taiwan Lite Pink Super Gold

Table 1. Effect of different bagging materials on physical parameters of guava fruits cv. Taiwan Lite Pink Super Gold

Treatment	Treatment details	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cc)	Fruit weight (g)	Fruit firmness (kg/cm ²)	Shelf life (days)
T ₁	Control (Without bagging)	6.50	7.13	204.67	194.44	5.33	6.45
T ₂	Newspaper bag	6.80	7.42	219.41	208.44	5.63	7.44
T ₃	Brown paper bag	7.07	7.75	218.48	207.56	5.87	8.17

(continued on next page)

Treatment	Treatment details	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cc)	Fruit weight (g)	Fruit firmness (kg/cm ²)	Shelf life (days)
T ₄	Non-woven bag	8.70	9.87	298.48	283.76	7.93	11.34
T ₅	Transparent polythene bag	7.13	8.02	233.92	222.22	6.20	8.91
T ₆	Black polythene bag	7.47	8.27	226.20	214.89	6.23	9.05
T ₇	Yellow polythene bag	8.33	9.38	258.72	245.78	7.83	10.44
T ₈	Blue polythene bag	7.48	8.47	239.77	227.78	7.73	9.79
T ₉	Foam net bag	7.45	8.32	206.08	195.78	7.03	9.43
T ₁₀	Parchment bag	7.15	8.12	235.08	223.33	5.63	8.32
	S.Em. ±	0.36	0.47	5.06	4.81	0.25	0.36
	CD @ 5%	1.14	1.52	16.18	15.37	0.81	1.14

Yield per plant (kg) and yield per hectare (t ha⁻¹)

The highest yield per plant (12.77 kg) and yield per hectare (22.18 t ha⁻¹) were recorded in T₄ (Non-woven bag), which was significantly superior to all other treatments and followed by T₇ (Yellow polythene bag) with 11.06 kg plant⁻¹ and 19.20 t ha⁻¹ and T₈ (Blue polythene bag) with 10.25 kg plant⁻¹ and 17.80 t ha⁻¹. The lowest yield per plant (8.75 kg) and yield per hectare (15.19 t ha⁻¹) were recorded in T₁ (Control without bagging) (Table 2).

The higher yield under non-woven bagging might be due to the favourable microenvironment around the fruits, which promoted better photosynthetic activity and translocation of photosynthates, resulting in improved fruit growth, size and weight and consequently, higher yield. Similar findings were reported by Rawat *et al.* (2025) [8], Meena *et al.* (2016) [10], Hossain *et al.* (2018) [3] and Bishnoi *et al.* (2023) [4] in guava and Akter *et al.* (2020) [11] in mango.

Table 2. Effect of different bagging materials on yield parameters of guava cv. Taiwan Lite Pink Super Gold

Treatment	Treatment details	Yield per plant (kg)	Yield per ha (t)
T ₁	Control (Without bagging)	8.75	15.19
T ₂	Newspaper bag	9.38	16.29
T ₃	Brown paper bag	9.34	16.22
T ₄	Non-woven bag	12.77	22.18
T ₅	Transparent polythene bag	10.00	17.36
T ₆	Black polythene bag	9.67	16.80
T ₇	Yellow polythene bag	11.06	19.20
T ₈	Blue polythene bag	10.25	17.80
T ₉	Foam net bag	8.81	15.29
T ₁₀	Parchment bag	10.05	17.45
	S.Em. ±	0.42	0.74
	CD @ 5%	1.36	2.36

Total soluble solids (°Brix)

The data pertaining to total soluble solids (TSS) as influenced by different bagging materials are presented in Table 3. The TSS content was significantly influenced by different bagging treatments. The highest TSS (12.85 °Brix) was recorded in T₄ (Non-woven bag), which was statistically on par with T₇ (Yellow polythene bag) (12.67 °Brix) and followed by T₈ (Blue polythene bag) (12.40 °Brix), whereas the lowest TSS (10.82 °Brix) was recorded in T₁ (Control without bagging). The higher TSS under non-woven bagging may be attributed to the favourable microenvironment created around the developing fruits, which promoted carbohydrate accumulation and conversion of complex carbohydrates into soluble sugars during fruit maturation. Similar findings have been reported by Rawat *et al.* (2025) [8] and Meena *et al.* (2016) [10] in guava and Islam *et al.* (2019) [5] in mango.

Titrateable acidity (%)

The titrateable acidity of guava fruits was significantly influenced by different bagging materials (Table 3). The minimum titrateable acidity (0.36%) was recorded in T₄ (Non-woven bag), which was statistically on par with T₇ (Yellow polythene bag) (0.36%) and T₈ (Blue polythene bag) (0.38%), whereas the maximum titrateable acidity (0.54%) was recorded in T₁ (Control without bagging). The lower acidity in non-woven bagged fruits may be associated with advanced fruit maturity and increased utilization of organic acids during respiration and ripening. The resulting lower acidity along with higher TSS contributed to improved fruit taste and palatability. Similar reductions in titrateable acidity due to fruit bagging were reported by Joshi *et al.* (2016) [12] in guava. Comparable findings were also reported by Justus *et al.* (2006) [13] in peach, Pastor *et al.* (2007) [14] in grapes and Jangid *et al.* (2021) [15] in date palm.

Total sugars (%)

Significant differences were observed among the different bagging treatments with respect to total sugar content (Table 3). The maximum total sugar content (8.50%) was recorded in T₄ (Non-woven bag), followed by T₇ (Yellow polythene bag) (8.00%) and T₅ (Transparent polythene bag) (7.78%), whereas the minimum total sugar content (6.30%) was recorded in T₁ (Control without bagging). The higher sugar content in non-woven bagged fruits may be attributed to the favourable microenvironment created by the porous material, which promoted carbohydrate synthesis and translocation to the developing fruits. During ripening, the conversion of starch into soluble sugars may have further contributed to higher total sugar content. Similar findings were reported by Abbasi *et al.* (2014) [6], Joshi *et al.* (2016) [12] and Meena *et al.* (2016) [10] in guava.

Reducing sugars (%)

The reducing sugar content of guava fruits was significantly influenced by bagging materials (Table 3). The highest reducing sugar content (4.97%) was recorded in T₄ (Non-woven bag), followed by T₇ (Yellow polythene bag) (4.68%) and T₅ (Transparent polythene bag) (4.55%), while the lowest (3.64%) was recorded in T₁ (Control). The higher reducing sugar content under non-woven bagging may be due to enhanced carbohydrate metabolism and conversion of stored carbohydrates into simple sugars during fruit development and ripening. Similar findings were reported by Joshi *et al.* (2016) [12] and Meena *et al.* (2016) [10] in bagged guava fruits.

Non-reducing sugars (%)

The non-reducing sugar content also varied significantly among the different bagging treatments (Table 3). The highest non-reducing sugar content (3.53%) was recorded in T₄ (Non-woven bag), followed by T₇ (Yellow polythene bag) (3.32%) and T₅ (Transparent polythene bag) (3.23%), whereas the minimum non-reducing sugar content (2.66%) was recorded in T₁ (Control without bagging). The higher non-reducing sugar content in non-woven bagged fruits may be attributed to better carbohydrate accumulation and translocation under the favourable microclimate created by the bagging material. Similar in

provements in sugar content of bagged guava fruits were reported by Abbasi *et al.* (2014) [6], Joshi *et al.* (2016) [12] and Meena *et al.* (2016) [10].

Vitamin C (mg/100 g)

The vitamin C content of guava fruits was significantly influenced by different bagging materials (Table 3). The highest vitamin C content (243.70 mg/100 g) was recorded in T₄ (Non-woven bag), which was statistically on par with T₇ (Yellow polythene bag) (239.77 mg/100 g), T₅ (Transparent polythene bag) (237.10 mg/100 g) and T₈ (Blue polythene bag) (236.23 mg/100 g), whereas the lowest vitamin C content (191.07 mg/100 g) was recorded in T₁ (Control without bagging). The higher vitamin C content in non-woven bagged fruits may be attributed to the favorable microenvironment created by the bagging material, which reduced oxidative degradation and helped retain ascorbic acid. Protection from environmental stress may have further contrib-

uted to better nutritional quality. Similar findings were reported by Brar *et al.* (2019) [7], Naik *et al.* (2026) [16] and Sohag *et al.* (2023) [9].

Lycopene content (mg/100 g)

The lycopene content of guava fruits was significantly influenced by bagging materials (Table 3). The maximum lycopene content (6.00 mg/100 g) was recorded in T₄ (Non-woven bag), which was on par with T₇ (Yellow polythene bag) (5.95 mg/100 g) and T₈ (Blue polythene bag) (5.78 mg/100 g), while the minimum (3.82 mg/100 g) was recorded in T₁ (Control). The higher lycopene content under non-woven bagging may be due to favourable microclimatic conditions that promoted normal ripening and carotenoid accumulation. Similar findings were reported by Sohag *et al.* (2023) [9] in pre-harvest bagged tomato fruits.

Table 3. Effect of different bagging materials on quality parameters of guava cv. Taiwan Lite Pink Super Gold

Treatment	Treatment details	TSS (° Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non reduc- ing sugars (%)	Vitamin C (mg/100g)	Lycopene content (mg/100g)
T ₁	Control (Without bagging)	10.82	0.54	6.30	3.64	2.66	191.07	3.82
T ₂	Newspaper bag	11.32	0.48	6.77	3.92	2.85	204.27	4.28
T ₃	Brown paper bag	11.62	0.46	7.06	4.08	2.98	210.13	4.75
T ₄	Non-woven bag	12.85	0.36	8.50	4.97	3.53	243.70	6.00
T ₅	Transparent polythene bag	11.96	0.43	7.78	4.55	3.23	237.10	5.62
T ₆	Black polythene bag	11.73	0.45	6.89	4.03	2.86	197.57	5.78
T ₇	Yellow polythene bag	12.67	0.36	8.00	4.68	3.32	239.77	5.95
T ₈	Blue polythene bag	12.40	0.38	7.10	4.15	2.95	236.23	4.89
T ₉	Foam net bag	11.29	0.48	6.65	3.89	2.76	199.37	4.31
T ₁₀	Parchment bag	12.11	0.41	7.35	4.30	3.05	228.60	5.24
	S.Em. ±	0.09	0.01	0.15	0.09	0.06	2.24	0.11
	CD @ 5%	0.29	0.02	0.49	0.29	0.21	7.17	0.35

Incidence of pests

Thrips incidence (%)

Significant differences were observed among the bagging treatments for thrips incidence in guava cv. Taiwan Lite Pink Super Gold (Table 4). No thrips damage (score 0) was recorded in T₄ (Non-woven bag), T₇ (Yellow polythene bag), T₈ (Blue polythene bag) and T₃ (Brown paper bag). The lowest damage score of 1 was recorded in T₂, T₅, T₆, T₉ and T₁₀, while the highest damage (score 3) with 24.00 per cent fruit damage was observed in T₁ (Control without bagging). The absence of thrips damage in brown paper, non-woven, yellow polythene and blue polythene bags may be due to their effective physical barrier, which restricted pest entry. Higher damage in other treatments may be due to less effective exclusion, while unbagged fruits recorded the highest damage due to direct pest exposure. Similar findings were reported by Amani *et al.* (2014) [17] in banana.

Incidence of disease

Incidence of anthracnose (%)

Anthracnose incidence was significantly influenced by different bagging materials (Table 4). No disease incidence (0.00%) was recorded in T₃, T₄, T₇, T₈ and T₁₀. The lowest incidence was observed in T₅ (2.67%) and T₂ (3.33%), followed by T₉ (8.67%) and T₆ (11.33%). The highest incidence was recorded in T₁ (Control without bagging) at 14.67%, indicating the effectiveness of fruit bagging in reducing anthracnose infection. The absence of anthracnose in the bagged treatments may be attributed to the protective barrier that restricted fungal spores, rain splash and insect injury. Higher disease incidence in unbagged fruits was due to continuous exposure to environmental inoculum and favourable infection conditions. Similar findings were reported by Islam *et al.* (2019) [5] in mango who observed that bagging effectively reduced anthracnose incidence.

Table 4. Effect of different bagging materials on pest and disease incidence of guava cv. Taiwan Lite Pink Super Gold

Tr. No.	Treatments	Thrips damage		Incidence of anthracnose (%)
		Score	%	
T ₁	Control (Without bagging)	3	24.00	14.67
T ₂	Newspaper bag	1	3.33	3.33
T ₃	Brown paper bag	0	0.00	0.00
T ₄	Non-woven bag	0	0.00	0.00
T ₅	Transparent polythene bag	1	2.67	2.67
T ₆	Black polythene bag	1	5.33	11.33
T ₇	Yellow polythene bag	0	0.00	0.00

(continued on next page)

Tr. No.	Treatments	Thrips damage		Incidence of anthracnose (%)
		Score	%	
T ₈	Blue polythene bag	0	0.00	0.00
T ₉	Foam net bag	1	7.33	8.67
T ₁₀	Parchment bag	0	0.00	0.00
	S.E.m. ±		0.46	0.43
	CD @ 5%		1.46	1.37

Conclusion

Based on the results of the present investigation, it can be concluded that different bagging materials significantly influenced the fruit growth, yield, quality and storability of guava cv. Taiwan Lite Pink Super Gold. Among the treatments, T₄ (non-woven bag) performed the best, recording the highest fruit growth parameters, fruit weight, firmness, yield, and shelf life, along with better overall fruit quality. It also resulted in higher TSS, total sugars, reducing sugars, non-reducing sugars, vitamin C and lycopene content, while recording lower titratable acidity. In addition, non-woven bagging was effective in reducing the incidence of thrips and anthracnose. Therefore, T₄ (non-woven bag) can be recommended as an effective bagging treatment for improving fruit yield, quality, pest and disease protection and storability of guava cv. Taiwan Lite Pink Super Gold.

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