

Influence of storage temperature on decay loss and microbial quality of stored guava (*Psidium Guajava* L.)

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Abstract

The present investigation was carried out with the objective to find out the effect of modified atmosphere and its duration on pathological parameters of two cvs (Hisar Safeda and Lucknow- 49) of guava (*psidium guajava* L.). Results showed that the duration of modified atmosphere had significant effect on pathological parameters. There was no decay loss in the fruits up to 4th day of storage and thereafter fruit started decaying, which increased with increase in storage period. The minimum decay loss 6% and 7.50% was recorded on 8th day of storage in the fruits stored in modified atmosphere. The decay loss 20.75% and 29.93% was recorded in control fruits in cvs. Hisar safeda and L-49, respectively on 5th day of storage and it reached to 100% on 8th day of storage in both the cvs. Different types of fungi i.e *Phoma spp.*, *Penicilium spp.*, *Aspergillus spp.*, *Colletotrichum spp.* have been identified throughout the storage period that caused decay loss in guava in both the cvs Hisar Safeda and L-49 (Sardar).

Highlights

Guava was found to be very delicious and nutritious fruit but it decay very fast within 2-3 days in rainy season.

Storage temperature and modified atmosphere had a significant effect on decay loss and microbial quality of stored guava fruits.

No decay loss in the fruits up to 4th day of storage period and thereafter fruits started decaying, which increased with increase in storage period.

Keywords: Guava, modified atmosphere, decay loss, fungal identification, Hisar Safeda, Lucknow- 49

Guava 'Apple of tropics' (*Psidium guajava* L.) is one of the most delicious fruit belongs to family Myrtaceae. It is the 5th most important fruit crop of India with a production of 3.67 million tonnes from area 2.68 lakh hectares during the year 2012-13 (Anon. 2013). In India major guava producing states are Uttar Pradesh, Maharashtra, Bihar, West Bengal, Andhra Pradesh, Tamil Nadu and Haryana. In Haryana, area under guava cultivation is 10700 hectares with an annual production of 125,000 tonnes. Guava is consumed not only as a delicious and nutritious

fruit; it is also processed into several products in fruit processing industry. A number of delicious products like jam, jelly, cheese, and RTS beverages are being prepared from guava fruits (Lalit 2014).

There are three fruiting seasons of guava fruit i.e. Ambe bahar (spring season), Mrig bahar (rainy season) and Hasth bahar (autumn season). The yield varies with different seasons. Under North Indian conditions, the yield is more in rainy season as compared to other season but the shelf life of rainy

season fruit is lesser than other season fruits. The fruits decay fast within 2-3 days in rainy season. During peak harvesting time of rainy season crop, when there is a glut of its fruits in the local market, huge post harvest losses are observed. So there is great need to increase the shelf life of rainy season fruits so that the producer may get remunerative prices of the crop. Therefore, it is a demand of the time to find out some technology to increase the shelf life of rainy season guava.

Modified atmosphere storage is a condition, where various physiological and biochemical activities *viz.*, ripening, decay loss, acid content, sugar, fruit firmness, chlorophyll content, etc. are altered in fruits. Packing of fruits in sealed polybags is the simplest way to attain MA (Geetha *et al.* 2014), however, it may not always enhance the shelf life (Mahadeviah 2002). However, the guava when packed in sealed polythene bags (LDPE) for longer durations at low temperature, do not ripen and result in cricket ball syndrome (Archana and Siddiqui 2004).

Since very little information is available in the literature on the use of various MA regimes to enhance the shelf life of guava, a systematic study was conducted to find out the effect of various durations of MA and storage temperature on shelf life of rainy season guava cv. L-49 and Hisar Safeda to avoid development of cricket ball Syndrome.

Materials and Methods

The present investigation entitled “Studies on the effect of modified atmosphere and its durations on shelf life of guava (*Psidium guajava* L.)” was carried out in the post harvest laboratory of the Department of Horticulture, Chaudhry Charan Singh Haryana Agricultural University, Hisar. Ten years old uniform, healthy, disease free plants of each cv. Hisar Safeda and L-49 were selected at the orchard of the Department of Horticulture, CCS HAU, Hisar for the rainy season crop. Fifty kg uniform size fruits of each cultivar were harvested at green mature stage with the help of sharp secateurs, having a small pedicle intact on the fruit. Injured and diseased fruits were discarded.

Two kg fruits were packed in each imperforated polythene bag (LDPE) of thickness 300 gauge under normal atmospheric conditions with the help of packaging machine (Roscher Geba, Germany) and then stored at 8°C in a BOD incubator for the periods as mentioned in treatments below. Each treatment comprised of four replications under complete randomized design. Each bag served as one replicate. After respective durations of storage under MA at 8°C, fruits were removed from MA and packed in corrugated fiber board (CFB) boxes and stored at ambient temperature conditions (28±5°C, 85±5% RH) to facilitate ripening till they were marketable. Control fruits were packed directly in corrugated fiber board (CFB) boxes with news paper lining and stored at ambient temperature conditions till they became unmarketable. The per cent decayed fruits were calculated by the formula given below.

$$\text{Decay loss (\%)} = \frac{\text{No. of decayed fruits}}{\text{Total no. of fruits at the time of packing}} \times 100$$

Fruits during storage period, decayed fruits were observed for identification of organism responsible for decaying of fruits under different packing treatments. Decay organisms were identified in association with the Department of Plant Pathology, CCS Haryana Agricultural University, Hisar. The data obtained in the present investigation was subjected to statistical analysis of variance (ANOVA) techniques using single factorial completely randomized designs (CRD) at 5% level.

Results and Discussion

Decay Loss (%)

Decay loss of the guava fruits was recorded on different days of storage and the data obtained has been presented in Table 1. There was no decay loss in the fruits up to 4th day of storage and thereafter fruit started decaying, which increased with increase in storage period. In both the cultivars, the decaying of fruits started first in control fruits i.e. fruits stored at ambient temperature without storing in modified atmosphere and fruits stored in MA for one day and thereafter stored at ambient temperature. The decay



Table 1. Effect of modified atmosphere on decay loss (%) of different cvs. of guava fruits during storage

MA (Days)*	Period of storage (days)								
	0	1	2	3	4	5	6	7	8
Hisar Safeda									
0	--	--	--	--	--	29.93 (33.11)	49.25 (44.52)	78.50 (62.41)	100.00 (90.00)
1	--	--	--	--	--	5.57 (13.76)	13.00 (21.05)	30.00 (33.17)	59.50 (50.47)
2	--	--	--	--	--	0.00 (4.05)	0.00 (4.05)	16.50 (23.93)	33.25 (35.19)
3	--	--	--	--	--	0.00 (4.05)	0.00 (4.05)	5.50 (13.41)	17.00 (24.14)
4	--	--	--	--	--	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	7.50 (20.79)
CD at 5%						1.60	2.34	2.16	2.94
Lucknow-49									
0	--	--	--	--	--	20.75 (27.06)	51.03 (45.51)	76.25 (60.85)	100.00 (90.00)
1	--	--	--	--	--	10.48 (18.84)	28.85 (32.46)	65.75 (54.12)	91.25 (75.09)
2	--	--	--	--	--	0.00 (4.05)	8.50 (16.36)	26.25 (30.73)	49.75 (44.84)
3	--	--	--	--	--	0.00 (4.05)	0.00 (4.05)	8.00 (16.30)	12.50 (20.65)
4	--	--	--	--	--	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	6.00 (16.36)
CD at 5%						1.40	2.34	2.77	7.35

* at 8°C, Figures in parenthesis denotes the angular transformed values

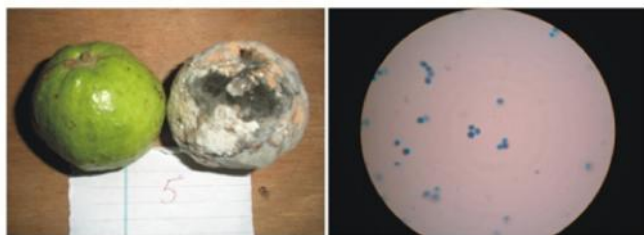
loss 20.75% and 29.93% was recorded in control fruits in cvs. Hisar safeda and L-49, respectively on 5th day of storage and it reached to 100% on 8th day of storage in both the cvs. In comparison to fruits stored in MA for one day, decay loss was 10.48% and 5.57% on fifth day of storage and reached to 91.25 % and 59.50% in cv Hisar Safeda and L-49, respectively on 8th day of storage. The decay loss reduced significantly in the fruits stored in modified atmosphere for two, three and four days. The minimum decay loss 6% and 7.50% was recorded on 8th day of storage in the fruits stored in modified atmosphere for four days in cv Hisar Safeda and L-49, respectively but

the fruits stored in modified atmosphere for two days, had no decay loss in cv L-49 and had 8.50% in cv Hisar Safeda on 6th day of storage. Similar result was Decay loss is mainly due to infestation of microbes during storage. During storage, the fruits become soft and susceptible to microbes infestation. These fruit ripened earlier and became soft, as a result the infestation of microbes started at faster rate. The decay loss was either not observed or observed to be lesser extent when the fruits were stored for four days in MA condition. In both the cvs Hisar Safeda and L-49, fruits stored for four days in MA conditions had minimum decay loss due to presence of unfavorable conditions (reduced oxygen availability) inside the package and fruit remained hard and showing 'cricket ball' syndrome, thereby resisting the attack of decay pathogens. Similar the effect of modified atmosphere packaging reduced decay loss in banana (Kudachikar *et al.* 2011) and in Citrus lemon L. (Jawandha *et al.* 2014). The elevated levels of O₂ and CO₂ have also been reported to delay growth of aerobic and anaerobic micro-organisms present on the fruit surface (Neelima and Singh 2002). The decreased decay loss in guava fruits wrapped by polyethylene bags has also been reported by Jitender *et al.* (2003). Kulkarni and Joshi (2014) also found a significant effect of storage temperature on chemical and microbial quality of carotene rich pumpkin powder and reported pumpkin was found to be more stable upto only 75 days, if stored at 30°C. However, it can be safely stored for almost 180 days, if stored at 7°C

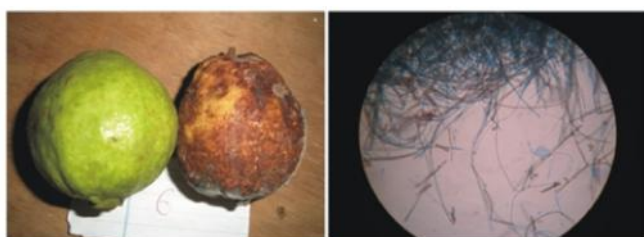
Fungus Identification

Due to the perishable nature of the fruit, several post-harvest diseases due to attack of several pathogens that caused considerable decay loss in the guava fruits. Different types of fungi i.e. *Phoma* spp., *Penicillium* spp., *Aspergillus* spp., *Colletotrichum* spp. have been identified (Figure) through out the storage period that caused decay loss in guava in both the cvs Hisar Safeda and L-49 (Sardar). Some other fungi were isolated in guava fruits by other worker during storage were *Colletotrichum gloeosporioides* (Silva *et al.* 2006) and *Colletotrichum gloeosporioides* and *Glomerella cingulata* (Rozwalka *et al.* 2008).

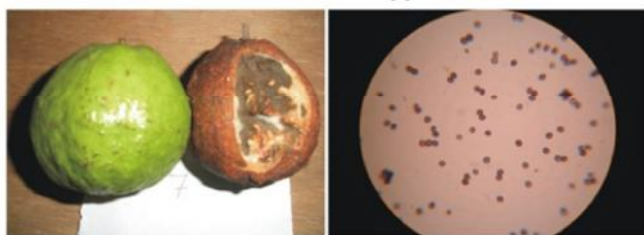
Identification of different fungi spp. in Guava during storage in cvs. Hisar Safeda and L-49 (Sardar)



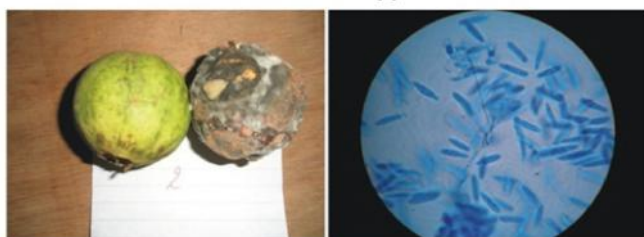
Aspergillus spp.



Colletotricum spp.



Penicillium spp.



Phoma spp.



Phoma spp.

Conclusion

Based on the results obtained in the present investigation, it can be concluded that different MA conditions effectively reduced decay loss and

infection of fruits from different types of fungi during storage in both the cvs Hisar Safeda and L-49. There was no decay loss in the fruits up to 4th day of storage and there after fruits started decaying, which increased with increase in storage period. In both the cultivars, the decaying of fruits started first in control fruits.

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