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Studies on the effect of modified atmosphere packing on shelf life of Banana Cv. grand naine at ambient condition

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ABSTRACT

Investigations were carried out to understand the effect of various post harvest packaging treatments like modified atmosphere packing on shelf life of banana Cv. Grand Naine by pack the fruits with different levels of perforations (0.5 mm) at ambient temperature condition. In the experiment, the fruits were packed in poly propylene bags with 5 Pores, 10 Pores, 15 Pores, 20 Pores, 25 Pores, 30 Pores, without Pores and unwrapped control kept under ambient storage condition and the packs were sealed with the help of electrical sealer. Among these treatments 5 Pores recorded lower physiological loss in weight, colour index, spoilage and higher firmness, total soluble solids and thereby recorded more shelf life (11 days) over control (8 days). It was observed that the physiological loss in weight, colour index, spoilage rates increased and fruit firmness decreased in all the experiments irrespective of the treatments with the advancement of duration. Total soluble solids, sugars increased initially and then decreased towards the end of the storage period.

Key words : *Modified atmoshere packing, perforation, shelflife*

Introduction

Banana is one of the most important sustaining fruits in our country. It is delicate and highly pershable fruit of tropics. In India, the total area under cultivation is 830 thousand hectares and production is 29280 thousand Metric tonnes (NHB 2011)

Banana is a classical climacteric fruit, having high metabolic activity. Shorter shelf-life is one of the limiting factors for local and export market. Decreased shelf-life (or) early onset of senescence in banana fruits is due to rapid ethylene production. Banana is highly perishable in nature, suffers from high post harvest losses to an extent of 30-40 percent (Salunkhe and Desai 1984). Post harvest losses in banana is due to improper handling, transport, storage and marketing as they are constantly subjected to spoilage caused by bruising, senescence and microbial decay while they remain in market channels. It is highly desirable to delay or postpone the ripening and senescence until they are to be consumed (Ramana *et al*, 1989). The shelf life of fruits can be extended by proper handling and storage methods. The storage of banana in polyethylene bags has been extensively reported to appreciably extend the stor-

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age life of fruits at around 20°C (Scott and Gandanegara, 1974). Senescence was effectively delayed by modified atmosphere storage of banana in perforated polyethylene bags, in which ripening process was normally continuous (Bai *et al.*, 1990). Therefore, the need of post harvest management of banana fruit in modified atmosphere packing (MAP) at ambient was realized to extend its quality and period of availability in market.

Material and Methods

The experiment was conducted in the Fruit research station, Sangareddy, Medak during 2010-2011. Banana Cv. Grand Naine fruits were harvested at 90-95% maturity. It can be judged by absence of angularity and easy removal of flower relicts at fruit apex. The fruits were cleaned with portable water and then allowed to dry in shade prior to imposition of the treatments. Polypropylene bags of 100 guage of size 28 x 22 cm with different perforations (5, 10, 15, 20, 25, 30) and without perforations taken as treatments against control (fruits without polypropylene packing). 4 fruits per each bag taken as replication. Circular perforations with 0.5 mm diameter were made on the bag to investigate the analysis.

The parameters taken were physiological loss in weight, fruit firmness, colour index, decay, total soluble solids during the storage period. Fruit samples were drawn periodically after 3,6,9 and 12 days of storage and analyzed for quality characteristics.

Physiological loss in weight (PLW) was calculated as cumulative per cent loss in weight based on the initial fruit weight (before storage) and loss in weights recorded at the time of periodical sampling during ambient storage. Penetrometer was used to record the fruit firmness (kg/cm^2). Visual appearance was expressed as an index on eight grade scale: Green-1, Breaker-3, Yellow, Green tip-5, Yellow flecked with brown-7, Over ripe-8. Decay was calculated as the number of fruits spoiled was counted and expressed in percentage. The spoilage was determined based on the following visual observations. 1. Fungal infection and subsequent rotting 2. Over ripening and physiological break down 3. Browning and discolouration of fruit surface area. The end of the shelf life was decided when more than 50 per cent of the fruits started shrivelling which was judged by visual scoring. The total soluble solids determined by hand refractrometer and expressed in percent. Reducing sugars and Total sugars were determined by the method of Lane and Eyon (AOAC). The experiment was carried out in CRD with factorial concept and the treatments were replicated thrice. Physical characters were recorded at specific day intervals to study the shelf life of banana fruit under ambient conditions with different perforation levels.

Results and Discussion

Perforations on polypropylene bags significantly affected the PLW of fruits during storage. The minimum PLW was recorded in the fruits packed in polypropylene bag of without Pores followed by 5 Pores and maximum recorded in control after 12 days of storage. (Table 1). PLW of fruits increased with the increase of pores on polypropylene bags. Unpacked control fruits loose moisture rapidly while polypropylene bags leads to less PLW by changing gaseous composition of O_2 and CO_2 concentrations around the packed fruits which is unfavourable for ethylene action to facilitate prolonged shelf life of fruits. Minimum fruit spoilage found in 5 Pore and 10 Pore packed fruits might be due to limited exposure of fruits to micro flora and atmospheric oxygen, whereas in control the fruits rotted maximum after 12 days of storage (Table 1).

TSS, reducing and total sugar contents were found to be increased initially during storage upto 9 days and later on decreased as the storage progressed. The maximum TSS was found in 5 Pores treatment and minimum TSS was recorded in control and fruits packed in polypropylene bag without Pores after 12 days of storage (Table 1). Maximum TSS in 5 pores treatment may be due to gradual increase of solubulization of the stored material. Reducing sugars and total sugars increased significantly till the 9th day, thereafter decreased significantly to reach a minimum on 12th day. The maximum reducing and total sugar were observed in the fruits packed in polypropylene bags with 5 Pores at 12 days after of storage (Table 2). This could be due to slow ripening process in the modified atmospheric packaging which leads to slow build up of the sugars. Similar results were reported in sapota by Magdalene *et al.*, (2001). In control, lower sugars were recorded resulting from the exposure of fruit to atmosphere and concomitant increased respiration.

The maximum fruit firmness was observed in

Table 1. Effect of modified atmosphere packing (MAP) on physiological loss in weight (%), Decay (%) and Total soluble solids (°Brix) of banana Cv. Grand Naine during ambient storage condition

Treatments (Perforations)	PLW (%)					Decay (%)					Total soluble solids (°Brix)				
	Storage interval (days)					Storage interval (days)					Storage interval (days)				
	3th day	6th day	9th day	12th day	Mean	3th day	6th day	9th day	12th day	Mean	3th day	6th day	9th day	12th day	Mean
5 Pores	0.34	0.50	0.59	0.67	0.53	0.00	0.00	4.17	55.57	27.09	6.17	14.67	23.23	22.20	16.57
10 Pores	0.34	0.50	0.59	0.67	0.53	0.00	0.00	4.17	55.57	27.09	6.23	14.67	23.2	21.67	16.44
15 Pores	0.35	0.53	0.62	0.70	0.55	0.00	0.00	8.33	79.17	43.75	6.27	14.83	23.13	21.6	16.46
20 Pores	0.35	0.54	0.62	0.68	0.55	0.00	0.00	8.33	79.17	43.75	6.33	14.87	23.2	21.47	16.47
25 Pores	0.36	0.54	0.63	0.69	0.56	0.00	0.00	12.50	83.33	45.83	6.37	15.1	23.23	21.2	16.48
30 Pores	0.38	0.62	0.74	0.80	0.64	0.00	0.00	33.33	91.67	62.50	6.43	15.2	23.3	21.17	16.53
WithoutPores	0.33	0.49	0.58	0.67	0.52	0.00	0.00	4.17	66.67	35.42	6.13	14.43	22.67	21.77	16.25
Control	8.51	14.90	18.02	21.45	15.72	0.00	5.55	66.67	100	83.33	10.4	22.67	18.6	13.33	16.25
Mean	1.37	2.33	2.8	3.30		0.00	0.69	17.71	76.39		6.8	15.8	22.57	20.55	

CD at 5% Perforation = 0.17; Days = 0.12; Treatments × Days = 0.34

CD at 5% Perforation = 7.2; Days = 3.6; Treatments × Days = 5.0

CD at 5% Perforation = 0.12; Days = 0.09; Treatments × Days = 0.25 Initial value 3.33

Table 2. Effect of modified atmosphere packing (MAP) on fruit firmness (kg/cm2), Reducing sugars (%) and Total sugars (%) of banana Cv. Grand Naine during ambient storage condition

Treatments (Perforations)	Fruit firmness (kg/cm²)					Reducing sugars (%)					Total sugars (%)				
	Storage interval (days)					Storage interval (days)					Storage interval (days)				
	3th day	6th day	9th day	12th day	Mean	3th day	6th day	9th day	12th day	Mean	3th day	6th day	9th day	12th day	Mean
5 Pores	5.34	4.28	1.73	0.28	2.91	3.3	6.67	12.24	11.17	8.35	4.46	10.67	18.24	17.84	12.8
10 Pores	5.33	4.24	1.7	0.22	2.87	3.3	6.7	12.33	10.91	8.31	4.463	10.7	18.33	17.52	12.75
15 Pores	5.27	4.13	1.6	0.15	2.79	3.3	6.72	12.41	10.78	8.3	4.5	10.72	18.35	17.4	12.74
20 Pores	5.27	4.07	1.58	0.1	2.76	3.31	6.73	12.42	10.68	8.28	4.5	10.73	18.43	17.13	12.7
25 Pores	5.27	3.73	1.47	0.05	2.63	3.4	7.23	12.46	10.14	8.31	4.537	10.98	18.47	16.76	12.68
30 Pores	5	3.67	1.4	0.03	2.53	3.44	7.37	12.48	9.86	8.29	4.637	11.43	18.49	16.17	12.68
WithoutPores	5.37	4.3	1.74	0.2	2.9	2.84	5.79	10.98	9.64	7.31	3.7	10.14	17.79	17.04	12.17
Control	3.8	2	0.37	0	1.54	4.21	10.01	8.94	6.02	7.3	5.537	16.52	14.13	12.43	12.15
Mean	5.08	3.8	1.45	0.13		3.39	7.15	11.78	9.9		5.58	15.07	21.05	16.69	

CD at 5% Perforation = 0.04; Days = 0.29; Treatments × Days = 0.08 Initial value 5.66

CD at 5% Perforation = 0.08; Days = 0.056; Treatments × Days = 0.16 Initial value 1.09

CD at 5% Perforation = 0.12; Days = 0.09; Treatments × Days = 0.26 Initial value 1.32

Table 3. Effect of modified atmosphere packing on colour change in of banana Cv. Grand Naine during ambient storage condition

Treatments (Perforations)	Colour change				
	Storage interval (days)				
	3th day	6th day	9th day	12th day	Mean
5 Pores	1.17	5.08	6.08	7.08	4.85
10 Pores	1.17	5.08	6.17	7.08	4.88
15 Pores	1.25	5.67	6.25	7.17	5.08
20 Pores	1.25	5.67	6.58	7.50	5.25
25 Pores	1.50	6.17	7.00	7.67	5.58
30 Pores	1.50	6.25	7.25	7.83	5.77
Without Pores	1.00	5.17	5.92	7.33	4.85
Control	2.00	6.75	7.58	8.00	6.08
Mean	1.35	5.73	6.60	7.44	

CD at 5% Perforation = 0.098;
Days = 0.069;
Treatments × Days = 0.195

fruits packed in polypropylene bags with 5 Pores then without pores and the lowest firmness was observed in unpacked control after 12 days of storage. On 12th day, 5 Pores treatment exhibits maximum firmness followed by 10 Pores. Maximum firmness in 5 pores due to low rate of respiration and transpiration. (Table 2).

In ambient storage, 5 Pores and without Pores recorded the lower value of Colour index compared to the other treatments (Table 3). This may be due to retarded evolution of ethylene, which in turn is being seen as a resistance factor in ripening.

There was a significant difference among the Poration treatments on shelf life of banana fruits. The highest shelf life was recorded in 5 Pores (11 days), which was on par with 10 Pores (10.60 days), while the lowest shelf life was recorded in control (8 days).

Conclusion

The results revealed that, among the different perforation treatments, 5 Pores treatment recorded the lowest PLW, colour index, spoilage and higher firmness, acidity, total soluble solids and also recorded that the highest shelf life over control at ambient condition.

References

AOAC 1965. Associate of official Agricultural chemists, Official methods of Analysis, AOAC, Washington DC.

Bai, J.H. Ueda, Y. and Iwata, T. 1990. Effect of packing with polyethylene bags on shelf-life and volatiles production of ripening initiated bananas. *J. Jpn. Soc. Food Sci.Technol.* 37 : 971-977.

Magdaline, E.E., Sreenarayanana, V.V. and Parvath, R. 2001. Physco-chemical response of sapota packed under modified atmosphere. Madras. *Agril Journal.* 88(4-6): 271-273.

NHB National Horticultural Board Area & Production Report 2011.

Ramana, S.V., Mohan Kumar, B.L. and Jayaraman, K.S. 1989. Effect of Post-harvest treatments and modified atmosphere on the storage life of fresh banana and guava under ambient temperature. *Indian Food Packer* 43(1) : 29-35.

Salunkhe, D.K. and Desai, B.B. 1984. Postharvest Biotechnology of fruit vol.1 and 2 C R C Press Boca Raton.

Scott, K.J. and Gandanegara, S. 1974. Effect of Temperature on the Storage life of Banana held in Polythene bags with Ethylene absorbent. *Trop. Agric.* (Trinidad), 51:23-26..