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Effect of packaging and storage on shelf-life and quality of banana cv. Karpuravalli

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INTRODUCTION

Banana is highly perishable fruit with post-harvest losses as high as 30-40% (Salunkhe and Desai, 3). These losses occur on account of various reasons such as lack of storage facilities, improper handling, lack of packaging and refrigerated storage facilities. The storage of banana in polyethylene bags has been extensively reported to appreciably extend the storage life of fruits at around 20°C (Scott and Gandanegara, 5; Satyan *et al.* 4). Emerald and Sreenarayanan (1) reported that shelf-life of Rasthali banana was extended by packaging in 300 gauge LDPE bags under air and vacuum. Waskar and Roy (8) reported that storage of banana in zero energy cool chamber is advantageous over cool store as it does not require any electrical energy and is easily installable. However, refrigerated storage of banana at 13°C temperature was found to extend the storage life of banana beyond 2 weeks (Salunkhe and Desai, 3). Therefore, an experiment was conducted to see the effect of packaging (400 gauge LDPE bag) with 0.5% ventilation and without ventilation on shelf-life and quality of Karpuravalli banana at ambient, zero energy cool chamber and 13.5°C.

MATERIAL AND METHODS

Matured Karpuravalli banana were harvested from the research farm of the National Research Centre for Banana, Trichy. The bunches were dehanded, washed and treated with 500 ppm Bavistin for 10 min. and the surface moisture was dried under shade. The hands were later packed in 400 gauge polyethylene bags with 0.5% ventilation and without ventilation. An unpacked sample was kept as the control. All the treatments were stored under three different storage conditions viz., ambient, zero energy cool chamber and 13.5°C (in BOD). Each treatment had three replications and each replication had six hands each. The data were recorded for green life, yellow life, TSS, acidity, reducing sugar, total sugar, starch and spoilage percentage. The data were also recorded for physico-chemical parameters at initial stage (A stage), end of green life (B stage) and end of yellow life (C stage). The green life was the duration in days from harvesting till it turned yellow, while yellow life was number of days from turning yellow till rotting. The TSS, acidity, reducing sugar, total sugar and starch were determined according to

the standard procedures outlined by Ranganna (2). The data were statistically analyzed adopting factorial randomized block design (Snedecor and Cochran, 7).

RESULTS AND DISCUSSION

The results indicated that green life of fruits in unvented polybags was maximum (19.33 days) at 13.5°C followed by zero energy cool chamber (7.33 days) and ambient condition (6.67 days). When ventilation (0.5%) was provided in polybags green life was 8.67 days, 4 days and 4.33 days respectively under 13.5°C, zero energy cool chamber and ambient conditions. There was no significant variation in green life of fruits in the control and ventilated polybags under all the three conditions of storage. Significantly higher yellow life was recorded only in ventilated polybags (10.33 days) stored at 13.5°C, while non-significant variation was observed at zero energy cool chamber and ambient conditions. Scott and Gandanegara (5) also recorded that as temperature was lowered, the storage life of banana increased in all the treatments. Similar results were reported by Satyan *et al* (4).

The TSS content increased gradually in fruits at all the storage condition and the highest (26.6°Brix) was recorded in the control fruits stored in zero energy cool chamber at the end of yellow life. The fruits in unvented polybags showed lower TSS content at ambient and zero energy cool chamber while those at 13.5°C showed significantly higher values. TSS of fruits in vented polybags and control at ambient and 13.5°C showed non-significant variation whereas those in zero energy cool chamber showed significant difference. Observations of Emerald and Sreenarayanan (1) are also in agreement with these findings.

The acidity increased gradually up to the end of green life and then decreased in unvented polybags under all the storage conditions. In vented polybags and control either it remained the same or increased slightly. Similar results were also reported

Table 1. Effect of packaging and storage conditions on green life, yellow life and storage life of Karpuravalli banana.

Storage condition	Life (days)	Treatment			CD (5%)
		Unvented	Vented	Control	
Ambient	Green life	6.67	4.33	4.33	1.51
	Yellow life	2.00	3.33	1.33	1.19
	Storage life	8.67	7.67	5.67	1.19
Zero energy	Green life	7.33	4.00	3.67	1.31
cool chamber	Yellow life	1.00	4.33	4.00	0.76
	Storage life	8.33	8.33	7.67	NS
13.5°C	Green life	19.33	8.67	8.33	4.31
	Yellow life	0.00	10.33	7.00	1.51
	Storage life	19.33	19.00	15.33	NS

Table 2. Effect of packaging on quality changes in Karpuravalli banana during storage at ambient condition.

Parameter	Stages	Treatments			CD (5%)
		Unvented	Vented	Control	
TSS	A	4.87	4.87	4.87	Treatment = 0.12
	B	18.67	24.93	24.47	Stages = 0.12
	C	22.13	26.13	24.80	Interaction = 0.20
Acidity	A	0.09	0.09	0.09	Treatment = 0.01
	B	0.37	0.36	0.37	Stages = 0.01
	C	0.19	0.35	0.35	Interaction = 0.02
Reducing sugar (%)	A	0.86	0.86	0.86	Treatment = 0.22
	B	6.70	4.62	5.08	Stages = 0.22
	C	9.96	8.12	8.08	Interaction = 0.38
Total sugars(%)	A	3.47	3.47	3.47	Treatment = 0.68
	B	13.47	18.33	17.09	Stages = 0.68
	C	18.72	21.77	21.80	Interaction = 1.18
Starch (%)	A	22.10	22.10	22.10	Treatment = NS
	B	5.55	4.85	4.93	Stages = 0.94
	C	1.36	1.90	1.40	Interaction = NS

Table 3. Effect of packaging on quality changes in Karpuravalli banana during storage in zero energy cool chamber.

Parameter	Stages	Treatments			CD (5%)
		Unvented	Vented	Control	
TSS	A	4.87	4.87	4.87	Treatments = 0.13
	B	18.53	23.47	22.67	Stages = 0.13
	C	24.27	25.93	26.60	Interaction = 0.23
Acidity (%)	A	0.09	0.09	0.09	Treatment = 0.23
	B	0.36	0.27	0.36	Stages = 0.23
	C	0.25	0.35	0.39	Interaction = 0.28
Reducing Sugar(%)	A	0.86	0.86	0.86	Treatment = 0.25
	B	7.16	4.67	4.75	Stages = 0.25
	C	7.83	7.83	7.99	Interaction = 0.44
Total sugars(%)	A	3.47	3.47	3.47	Treatment = 0.52
	B	14.03	16.67	16.67	Stages = 0.52
	C	17.81	19.02	19.99	Interaction = 0.89
Starch (%)	A	22.10	22.10	22.10	Treatment = NS
	B	14.94	*5.15*	5.67	Stages = 0.76
	C	1.86	1.56	1.44	Interaction = NS

Table 4. Effect of packaging on quality changes in Karpuravalli banana during storage at 13.5°C.

Parameter	Stages	Treatments			CD (5%)
		Unvented	Vented	Control	
TSS	A	4.87	4.87	4.87	Treatment = 0.23
	B	19.13	16.73	20.80	Stages = 0.23
	C	24.93	22.13	22.93	Interaction = 0.39
Acidity (%)	A	0.09	0.09	0.09	Treatment = 0.01
	B	0.32	0.24	0.31	Stages = 0.01
	C	0.28	0.23	0.31	Interaction = 0.02
Reducing Sugar(%)	A	0.86	0.86	0.86	Treatment = 0.31
	B	6.11	6.87	7.11	Stages = 0.31
	C	6.22	9.33	9.21	Interaction = 0.54
Total Sugars(%)	A	3.47	3.47	3.47	Treatment = 0.32
	B	14.34	14.31	13.89	Stages = 0.32
	C	15.45	18.73	18.29	Interaction = 0.55
Starch (%)	A	22.10	22.10	22.10	Treatment = NS
	B	4.85	5.09	4.70	Stages = 0.86
	C	4.56	4.45	4.10	Interaction = NS

by Shantha Krishnamurthy and Kushalappa (6) in Robusta banana and Waskar and Roy (8) in Basrai banana.

The reducing and total sugars showed an increase during the storage. The differences were non-significant in the control and ventilated polybags at all the storage conditions, while at 13.5°C and ambient it was significantly lower for unvented polybags by the end of yellow life. The starch content was 22.10% initially which reduced to a minimum of 1.36% in fruits of polybags stored at ambient condition. The variation in the starch percentage among different treatment was non-significant at all the storage conditions. However, among the storage conditions the fruits at 13.5°C showed relatively higher starch percentage compared to ambient and zero energy cool chamber. A gradual decrease in the starch content and increase in the sugar content of banana fruits stored in vented and unvented polybags was also recorded by Shantha Krishnamurthy and Kushalappa (6). They also observed no significant variations in the starch content in vented and unvented polybags after complete ripening of fruits. The spoilage was maximum in unvented polybags especially under ambient and zero energy cool chamber conditions, while in ventilated and control fruits the spoilage was less than 10% under all the storage conditions. It is therefore, concluded that storing the Karpuravalli banana fruits in unvented polybags at low temperature (13.5°C) could significantly increase the green life while storage under ZECC or ambient condition essentially requires ventilation (0.5%) to reduce the spoilage.

SUMMARY

The shelf-life of fruits in unvented polybags was maximum (19.33 days) at 13°C followed by zero energy cool

chamber (7.33 days) and the least was under ambient conditions (6.67 days) as compared to 19, 8.33 and 7.67 days respectively with ventilation. Non-significant variation was observed for TSS of fruits under all the three storage conditions.. The acidity increased gradually up to the end of green life and then decreased (in unvented polybags) or remained same (in ventilated and control) till the end of yellow life. Reducing sugars and total sugars increased gradually throughout the storage period and was maximum in control and ventilated bags than the unvented polybags. Spoilage was maximum in unvented polybags especially under ambient and zero energy cool chamber conditions. Storing of Karpuravalli banana fruits in unvented polybags at low temperature could significantly increase the green life up to 19.33 days while storage under zero energy cool chamber or ambient condition requires ventilation (0.5%) to reduce spoilage.

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