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RESEARCH PAPER

Effect of HDPE packaging with perforation and chemicals on ambient storage of kinnow

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Abstract : Fruits of kinnow mandarin matures in the winter months under Punjab conditions, during that period there is low demand of fresh fruit in the market due to low temperature. So,there is need to enhance the shelf life of Kinnow fruits for the profitable marketing during the early summer months. Keeping this in view a study was conducted to enhance the post harvest life of Kinnow at ambient storage. Freshly harvested Kinnow fruits were washed and treated with sodium carbonate (2 and 3 %), boric acid (2 and 3 %) and packed in HDPE bags with perforation before packaging in CFB boxes. Sealed CFB boxes of Kinnow were placed at ambient conditions for 60 days and fruits were analysed for various physico-chemical characteristics after 15, 30, 45 and 60 days of storage. Results revealed that minimum rotting and maximum palatability rating were registered in boric acid @ 3 per cent + HDPE packaging with perforation during the entire storage period. TSS and PLW were found maximum in control fruits. Observations revealed that storage rots can be reduced by treating the Kinnow fruits with boric acid @ 3 per cent+HDPE packaging with perforation and fruit can be safely stored upto 45 days at ambient conditions with acceptable quality. However, after 60 days of storage a noticeable deterioration in fruit quality was recorded.

Key Words : Kinnow, Storage, Boric acid, Sodium carbonate, Packaging

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INTRODUCTION

Kinnow occupies the prime position amongst the citrus fruits grown in Punjab. It is precocious, prolific bearer and has excellent fruit quality with high juice content. Kinnow fruits mature from mid January to mid February There is often a glut like situation in the market at its peak harvest time. This results in low returns to the growers. There is a need to enhance the shelf-life of Kinnow fruit for its extended marketing during April and May. The incidence of microbial fruit rots of fungal and bacterial origin is a common problem in storage, which markedly deteriorate the keeping quality of fruits. Earlier, attempts have been made to keep the surplus fruit in cold storage for use during summer months(Vij, 1981). Most of the cold storages operate at near zero temperature, the Kinnow fruit may get pathological rotting during storage. The incidence of microbial fruit rots of fungal and bacterial origin is a common problem in storage, which markedly deteriorate the keeping quality of fruits. The species of *Penicillium, Alternaria, Aspergillus, Botrydiploidia and Geotrichum* etc. are particularly responsible for causing heavy losses (Kaur, 1999). The main factor governing storage life of citrus fruits are weight loss and decay. Individual seal packaging could significantly reduce weight loss and shrivelling, but the potential decay problem of sealed fruits need to be solved through perforation/ chemicals.

MATERIALS AND METHODS

The Kinnow fruits harvested in the month of January. Freshly harvested kinnow fruits were disinfected by washing in chlorinated water (100 ppm) and dried in air. After drying, following pre-storage treatments were given.

T_1 = Sodium carbonate(2%)+ HDPE packaging with

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perforation

T_2 = Sodium carbonate(3%)+ HDPE packaging with perforation

T_3 = Boric acid 2% + HDPE packaging with perforation

T_4 = Boric acid 3% + HDPE packaging with perforation

T_5 = HDPE packaging with perforation

T_6 = Control(unpacked, untreated)

Fruits were dipped for five minutes in the treatment solutions, then air dried under shade and individually seal - packed in perforated HDPE bags (5 pin holes per bag). The bags were sealed with an electric sealer and filled in corrugated fibre board (CFB) boxes and stored in well ventilated room at ambient temperature and relative humidity. For various physico-chemical characters the fruits were analysed after 30, 45 and 60 days at ambient storage. The physiological loss in weight was recorded by noticing the intial weight and final weight in each replication at each storage interval. The cumulative loss in weight was calculated on fresh fruit basis. Spoilage percentage of fruits was also calculated by counting the rotten fruits and total fruits in each treatment replication on each storage interval. The fruits were evaluated by a five member panel on a score card (maximum 10 points) based on physical appearance, taste and flavour. The fruits were rated excellent (8-10), very good (7 -8), Good (6-7), fair (5-6) and poor (below 5). The total soluble solids were determined with the help of hand refrectometer. One or two drops of juice were placed on the refrectometer plate and the per cent TSS on the scale were recorded. The reading was calibrated against a standard temperature of 20^0C (AOAC, 1989).Whereas, acidity was determined by titrating 2 ml of juice against 0.1 N NaOH using phenolphthalein as the indicator. The data obtained were subjected to statistical analysis by following CRD method.

RESULTS AND DISCUSSION

Mean minimum physiological loss in weight (PLW) was recorded in boric acid 3.0 per cent + HDPE packaging with perforation (Table 1). Reduction in PLW in sealed fruits was due to retardation in evaporation and respiration processes. The chemical application coupled with HDPE sealing was effective in reducing weight loss. It might due to blocking of stomatal apertures and lenticels, thereby reducing the rate of respiration and transpiration. A similar reduction in the physiological loss in weight (PLW) of individually seal packed grape fruit, Shamouti oranges and lemons with HDPE film was

Table 1 : Effect of chemicals and packaging on PLW of Kinnow mandarin during ambient storage

Treatments	PLW (%)				
	After 15 days	After 30 days	After 45 days	After 60 days	Mean
Sodium carbonate(2%) + HDPE packaging with perforation	1.33	2.37	3.52	5.12	3.09
Sodium carbonate(3%) + HDPE packaging with perforation	1.17	2.23	3.31	4.96	2.92
Boric acid (2%) + HDPE packaging with perforation	1.25	2.28	3.41	5.07	3.00
Boric acid (3%)+ HDPE packaging with perforation	1.08	2.18	3.22	4.84	2.83
HDPE packaging with perforation	1.42	2.41	3.68	5.57	3.27
Control(unpacked ,untreated)	8.50	17.40	25.42	33.63	21.24
Mean	2.46	4.81	7.09	9.87	

C.D. (P=0.05)
Dates: 0.27
Treatments: 0.42
Dates x Treatments: 1.12

Table 2 : Effect of chemicals and packaging on palatability rating of Kinnow mandarin during ambient storage

Treatments	Palatability rating				
	After 15 days	After 30 days	After 45 days	After 60 days	Mean
Sodium carbonate (2%)+HDPE packaging with perforation	8.71	8.00	7.05	4.33	7.02
Sodium carbonate (3%)+HDPE packaging with perforation	8.80	8.03	7.23	5.12	7.30
Boric acid (2%)+HDPE packaging with perforation	8.31	7.63	7.17	4.50	6.90
Boric acid (3%)+HDPE packaging with perforation	8.79	8.43	7.55	5.22	7.50
HDPE packaging with perforation	8.25	7.56	6.93	4.30	6.76
Control (unpacked ,untreated)	7.25	6.00	4.50	2.50	5.06
Mean	8.35	7.61	6.74	4.33	

C.D. (P=0.05)
Dates: 0.73
Treatments: 0.64
Dates x Treatments: 1.51

probably because of saturated humidity and no air circulation inside the seal package (Ben-Yehousha *et al.,* 1979, 1981 and 1983) Highest palatability rating was recorded in boric acid 3.0 per cent+HDPE packaging with perforation during the entire storage period (Table 2). Fruits were in acceptable quality up to 45 days of storage. The PR decreased with increase in storage period. Palatability was recorded more in HDPE packed fruits as compared to unpacked fruits during the entire storage period, it was due to low physiological loss in weight in packed fruits which lead to less shrinkage of fruit.

Mean minimum rotting was noticed in boric acid 3.0 per cent+HDPE packaging with perforation (Table 3). It might be due to disinfectant, bactericide and cell wall strengthening action of boric acid. The spoilage in seal packed fruits without perforation was more as compared to sealed fruits with perforation. It may be due to accumulation of more humidity

Table 3 : Effect of chemicals and packaging on rots of Kinnow mandarin during ambient storage

Treatments	Rotting (%)				
	After 15 days	After 30 days	After 45 days	After 60 days	Mean
Sodium carbonate (2%) +HDPE packaging with perforation	0	4.11	6.25	13.25	5.90
Sodium carbonate (3%) +HDPE packaging with perforation	0	3.34	5.03	12.55	5.23
Boric acid (2%)+HDPE packaging with perforation	1.24	4.35	6.78	14.80	6.79
Boric acid (3%)+HDPE packaging with perforation	0	0	4.25	10.80	3.76
HDPE packaging with perforation	2.57	5.45	7.33	16.50	7.96
Control(unpacked ,untreated)	4.85	13.73	20.26	28.63	16.87
Mean	1.44	5.16	8.32	16.09	

C.D. (P=0.05)
Dates: 1.87
Treatments: 2.24
Dates x Treatments: 2.75

Table 4 : Effect of chemicals and packaging on total soluble solids (%) of Kinnow mandarin during ambient storage

Treatments	TSS(%)				
	After 15 days	After 30 days	After 45 days	After 60 days	Mean
Sodium carbonate (2%) + HDPE packaging with perforation	11.23	11.47	11.69	12.03	11.61
Sodium carbonate (3%) + HDPE packaging with perforation	11.03	11.27	11.46	12.00	11.44
Boric acid (2%) + HDPE packaging with perforation	11.27	11.59	11.83	12.27	11.74
Boric acid (3%) + HDPE packaging with perforation	11.06	11.13	11.37	11.96	11.38
HDPE packaging with perforation	11.31	11.67	12.08	12.36	11.86
Control(unpacked ,untreated)	12.12	12.43	12.87	13.23	12.66
Mean	11.34	11.59	11.88	12.31	

C.D. (P=0.05)
Dates: 0.23
Treatments: 0.38
Dates x Treatments: NS

Table 5 : Effect of chemicals and packaging on total acidity (%) of Kinnow mandarin during ambient storage

Treatments	Acidity(%)				
	After 15 days	After 30 days	After 45 days	After 60 days	Mean
Sodium carbonate (2%) + HDPE packaging with perforation	0.68	0.60	0.54	0.40	0.56
Sodium carbonate (3%) + HDPE packaging with perforation	0.73	0.67	0.58	0.42	0.60
Boric acid (2%) + HDPE packaging with perforation	0.70	0.67	0.52	0.40	0.57
Boric acid (3%) + HDPE packaging with perforation	0.78	0.70	0.64	0.48	0.65
HDPE packaging with perforation	0.73	0.69	0.58	0.37	0.59
Control(unpacked ,untreated)	0.63	0.52	0.37	0.28	0.45
Mean	0.71	0.64	0.54	0.39	

C.D. (P=0.05)
Dates: 0.02
Treatments: 0.03
Dates x Treatments: NS

in the vicinity during storage of fruits which may aggravates spoilage due to microbial attack. Data also showed that as the storage period increased, the spoilage increased. It might be due to the weakening of the defense system against fungal attack. Similar observations on spoilage over longer period of storage have been reported by Iidis and Travert (1956).

An increase in TSS was recorded with advancement of storage period irrespective of the treatments (Table 4).The increase in total soluble solids with prolongation of storage period may probably be due to increased hydrolysis of polysaccharides and concentration of juice due to dehydration. At the end of storage maximum TSS was recorded in control fruits. It may be due to maximum water loss in these fruits. Similar results were reported by Salunkhe *et al.* (1968) on peach and apricot and Singhrot *et al.* (1987) and Dhatt *et al.* (1991) on Kinnow. At the end of storage, maximum acidity was recorded in boric acid 3.0 per cent+HDPE packaging with perforation and minimum was recorded in control fruits (Table 5). The decrease in acidity with the storage period might be due to utilization of organic acids in respiration process. A gradual decrease in acidity has also been reported by Josan *et al.* (1983), Huelin (1942) and El-Aswah *et al.* (1975).

Conclusion:

It may be concluded from the study that Kinnow fruits can be safely stored up to 45 days at ambient storage without much deterioration in quality after treating with boric acid 3.0 per cent+HDPE packaging with perforation before storage.

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