AcademicPres

Available online at www.notulaebiologicae.ro

Print ISSN 2067-3205; Electronic 2067-3264

Not Sci Biol 2 (3) 2010, 96-99

Notulae Scientia Biologicae

Influence of Maturity Stage on Fruit Quality during Storage of 'Earli Grande' Peaches

Navjot GUPTA, Sukhjit Kaur JAWANDHA

Punjab Agricultural University, Department of Horticulture, Ludhiana 141004, India; navjot_bti@yahoo.co.in

Abstract

Peach is a perishable fruit and to ensure the highest fruit quality peaches must be harvested at an appropriate stage of maturity. In the present study, effect of maturity stage at harvest and cold storage on the physical and chemical characteristics of peaches 'Earli Grande' were determined. The fruits for storage were harvested at three stages i.e. before, during and after predictable optimum harvest stage and kept in cold store at 0-20C and 85-90% relative humidity for a period of 21 days and at ambient conditions (28-300C, 65-70% RH) for 72 h. The fruits were evaluated for quality parameters at harvest and after 7, 14 and 21 days of storage. The post-cold storage ambient shelf-life was studied after 3 days to assess the market behavior of fruits. During investigation period fruit quality parameters changed according to stage of harvest. An increase in the spoilage, physiological loss in weight, TSS: acid ratio, anthocyanins was observed with the advancement of maturity and storage period. In contrast, Vitamin A content followed a linear decline with storage and advancement of maturity stages. There was a gradual decrease in reducing sugars of the fruits picked after optimum maturity with increase in storage period. Fruits harvested at optimum stage retained maximum TSS:Acid ratio and palatability rating during post-storage shelf life of three days at ambient temperature after cold storage of 21 days. Results revealed that peach fruits harvested at optimum stage can be stored for three weeks in cold store with post-storage shelf life of three days at ambient temperature.

Keywords: peach, harvesting stage, storage, maturity, fruit quality

Introduction

Different harvesting stages of peach fruits during harvest season may have significant impact on fruit quality. Peach is a perishable fruit and to ensure the highest fruit quality at the end of storage peaches must be harvested at an appropriate stage of maturity. Fruits that are picked before physiological maturity will not ripen satisfactorily (Robertson *et al.,* 1990), while those harvested at more mature stage have shorter shelf life (Meredith *et al.,* 1989) and did not ship well because of reduced shelf life (Murray *et al.,* 1998). Peaches, if harvested too early are small, very firm in texture, with low sugars, reduced flavour and colour while the later picked fruits are very soft, high in sugar and water content and all the physiological processes which complicate storage are underway. Once the fruit ripens, senescence begins; physical and chemical changes continue after optimum ripeness is reached including further softening, loss of desirable flavor and complete breakdown (Kader and Mitchell, 1989).Cold storage of peaches after harvest will retard ripening and lengthen storage life but only up to a certain point. Peaches held in cold storage too long will not ripen and will suffer from internal browning and wooly texture. According to ISO international standards for peaches, the optimum storage temperature for peaches is -1 to +2 OC and storage life of only 2-4 weeks can be expected for most cultivars. The objective of the present study was to determine the effect of stages of maturity and cold storage on the physical and chemical characteristics of peaches.

Materials and methods

Six-years-old trees of peach 'Earli Grande' were used for the experiment. The fruit were harvested three times at before, during and after predictable optimum harvest stage. The samples were handled carefully after harvest and were taken to the laboratory immediately. The fruit samples were selected for uniformity of size, free of diseases and defects. The fruits of each maturity stage were stored at temperature of 0-2oC and relative humidity was controlled between 85-90 percent for 21 days. The fruits were evaluated for quality parameters at harvest and after 7, 14 and 21 days of storage. The spoilage percentage was calculated based on number of fruits spoiled at each storage intervals. The physiological loss in weight (PLW) of the fruit was calculated on initial weight basis and expressed in per cent. The total soluble solids (TSS) were recorded a hand refractometer (Erma Japan) with correction at 200C. Acidity, reducing sugars and Vitamin A content were determined as per AOAC (2000). The anthocyanins were estimated by the method of Pirie and Mullins (1976). The post-cold storage ambient shelf-life was studied by measuring TSS, acidity and palatability rating for cold stored fruits after 48 and 72 h to assess the market behavior of fruits. The data was analyzed by factorial analysis in

Received 30 March 2010; accepted 10 June 2010

a randomized block design to test the effect of maturity level on storage of peach fruits using CPCS1 software as a statistical analysis tool (Cheema and Singh 1990).

Results and discussion

Spoilage: The spoilage loss was maximum (2.91%) in fruits harvested at later stage of maturity (Fig. 1). The spoilage losses increased progressively with increase in storage period. The maximum spoilage losses (5.00%) was recorded after 21 days of storage in fruits harvested at post-optimum stage while it was minimum after 7 days of storage in the fruit harvested at pre-optimum stage. The higher spoilage in later harvested fruits might occur due to increased respiration rate, enzyme activities and dissolution of cell wall which ultimately lead to softening and ripening of fruits. Similar results were observed in apple by Juan *et al*. (1999).

Physiological loss in weight: Loss in weight during storage depends on stage of maturity (Fig. 1). The fruits picked at post-optimum stage showed significantly higher weight loss (4.72%).The fruits picked at optimal harvest time lose less weight during storage than fruits picked too early. Similar results were obtained by Elgar *et al*. (1999). The PLW increased progressively with increase in storage period. The minimum loss (2.23%) occurred at 7 days and the maximum (5.76%) at 21 days of storage. The higher PLW in the fruits harvested at later stage of maturity could be due to higher respiration and transpiration losses with advancement of the harvest maturity.

TSS:Acid ratio: The Maximum TSS:acid ratio (21.94) was recorded in fruits harvested at post-optimum stage of maturity followed by the fruits at optimum maturity stage (19.68). TSS:Acid ratio increased progressively with the increase in storage period. This might be attributed to the increase in total soluble solids and reduction in acidity of fruits with the increase in storage period. The results of the present study were in accordance with the earlier findings of Hussein *et al*. (2001) in apple. With the delay in harvesting, rapid increase in TSS:Acid ratio was observed. It might be due to sharp increase in TSS and corresponding decrease in acidity with maturity. These results are in line with the earlier findings of Dhillon and Cheema (1991) in peach 'Flordasun' .

Reducing Sugars content: The fruits picked at post-optimum stage of harvest recorded higher (6.55%) sugar content which was followed by sugar content of fruits at optimum stage of maturity (Fig. 1). There was a progressive increase in reducing sugar content of fruits picked at pre-optimum and optimum stages with the increase in storage period. However, there was a gradual decrease with increase in storage period of the fruits picked at post-optimum stage of maturity. It might be due to the reason that the fruits harvested later received more nutrients and metabolites which get accumulated while there is disruption in the flow of nutrients and other metabolites in the fruits picked earlier. There was a progressive increase in the

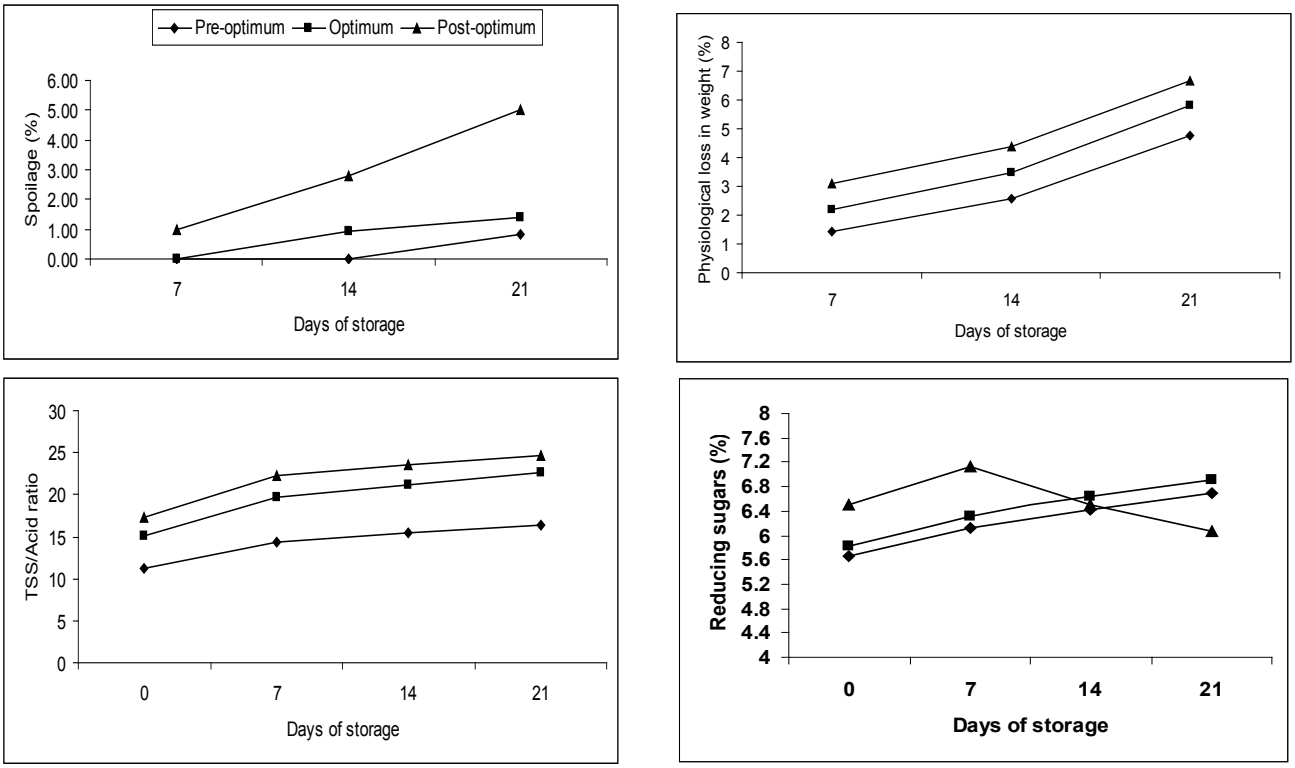

Fig. 1. Effect of harvesting stage on the spoilage percentage , physiological loss in weight, TSS/Acid ratio and reducing sugars (%) of peach fruits during cold storage

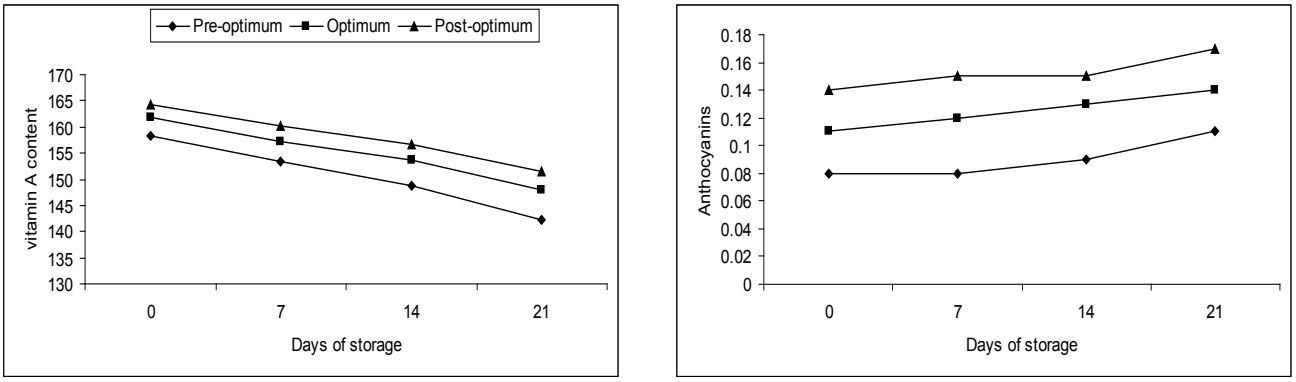

Fig. 2. Effect of harvesting stage on the vitamin A content and anthocyanins content of peach fruits during cold storage

reducing sugars during earlier period of storage. This could probably be due to hydrolysis of starch to simple sugars and rate of conversion was higher than utilization but, at later stages sugars are utilization for respiration at much faster rate. Similar trend with respect to reducing sugars content during storage was also observed by Prashant and Masoodi (2009).

Vitamin A content: The fruits picked at post-optimum maturity stage recorded maximum Vitamin A content (158.13) which was at par with Vitamin A content (155.13) of fruits harvested at optimum stage (Fig. 2). The Vitamin A content of the fruit harvested at different stages exhibited linear declining trend with storage period and it was recorded lowest (147.12) after 21 days of storage. This might be due to the increased in activity of certain enzymes like polyglacturonase and polyphenol oxidase with enhanced storage time that might be responsible for the break down of carotenoids during storage. Such a trend was also observed in guava by Jain *et al.* (2001).

Anthocyanins content: The maximum total anthocyanins (0.143 absorbance units) were observed in fruits at post-optimum stage of harvesting followed by the fruits harvested at optimum stage. The results are in conformity with the findings of Cascales *et al.* (2005) who have reported increased colour intensity with ripening. There was a significant increase in anthocyanins of peach fruits as the storage progressed. After 21 days of storage the mean anthocyanins content was significantly higher (0.129 absorbance units) than those of 7 and 14 days of storage. The increase in anthocyanins during storage might possibly be due to increased ripening and softening of fruits as evidenced by the decrease in firmness of fruits. Similarly Amoros *et al.* (1989) reported that the onset of softening coincide with an increase in red colour of peaches.

Post-cold storage shelf life: The post-cold storage shelf life studies at ambient temperature and RH (28-30^{0}C, 65-70% RH) for 72 h were conducted to study the behavior of fruits in retail market (Tab. 1). The TSS of the fruits during ambient storage was significantly lower (11.93%) in fruits harvested at pre-optimum stage of maturity after 3 days however, it was maximum in fruits harvested at optimum stage (13.27%). A decline in TSS of the fruits was observed after 3 days of storage in the fruits harvested at later stages of maturity. The acidity of fruits also varied significantly during post-cold storage shelf life. The fruits harvested at pre-optimum stage of maturity recorded maximum acidity (0.55%) as compared to the fruits harvested at other stages after 3 days of storage. The acidity of the fruits also showed declining trend with the advancement of storage period. The peach fruits harvested at optimum stage of maturity recorded the maximum palatability rating of 8.00 after 3 days whereas the minimum

Tab. 1.Total soluble solids, acidity and Palatability rating of peach fruits during post-cold storage ambient shelf life after 48 and 72 hours

Storage hours	TSS (%)				Acidity (%)				Palatability rating			
	Treatments				Treatments				Treatments			
	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean	H_1	H_2	H_3	Mean
0	11.82	13.19	12.88	12.63	0.80	0.63	0.56	0.66	7.50	8.43	6.90	7.61
48	11.91	13.24	12.97	12.71	0.65	0.47	0.44	0.52	7.51	8.42	6.18	7.37
72	11.93	13.27	12.93	12.71	0.55	0.39	0.36	0.43	7.13	8.00	5.25	6.79
CD at 5%	Treatments (A): 0.128				Treatments (A): 0.048				Treatments (A): 0.103			
	Hours (B): NS				Hours (B): 0.006				Hours (B): 0.007			
	AXB: NS				AXB: 0.010				AXB: 0.013			

Note: H_1, H_2 and H_3 denotes the stages of maturity of fruits at harvest i.e., pre-optimum, optimum and post-optimum at harvest

palatability rating was observed under the fruits harvested at post-optimum stage of maturity.

Conclusions

From the above study it can be concluded that peach fruits harvested at optimum stage, can be stored for three weeks in cold storage (0-20^{0}C with 85-90%RH) with post-storage shelf life of 3 days at ambient conditions (28-30^{0}C, 65-70 % RH) with maximum edible quality of fruits.

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