International Journal of Agriculture, Environment & Biotechnology
Citation: IJAEB: 6(2): 301-304June 2013 .

Horticulture

Effect of Putrescine and Calcium on Colour Changes of Stored Peach Fruits

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Paper No. 116 Received: October 27, 2012 Accepted: May 3, 2013 Published: June 1, 2013

Abstract

Peach is a climacteric and highly perishable fruit and it losses its quality in a short time after harvesting. During storage browning of fruits deteriorates its quality. Pre-harvest sprays of putrescine (PUT) and calcium nitrate at three concentrations each *viz*. 1.0, 2.0, 3.0 mmol L^{-1} and 0.5, 1.0 and 2.0% respectively were done 10 and 20 days before harvesting to maintain the quality during 40 days of storage. Physiologically mature peach fruits were harvested from treated plants, packed in CFB boxes and stored at 0 to 1° C and 90-95 % RH. Results revealed that all the treatments significantly effected the fruit colour development during storage. The maximum colour development was observed in control fruits, followed by calcium nitrate @ 0.5% (sprayed 20 days before harvesting) treatment. Fruits treated with putrescine @ 3 mmol L^{-1} showed mean minimum values of "a" and "b", followed by putrescine @ 2 mmol L^{-1} and calcium nitrate @ 2% (sprayed 10 days before harvesting). It can be concluded that putrescine and calcium nitrate treatments slowed the colour development process during storage.

Highlights

Putrescine @ 2 mmol L^{-1} and calcium nitrate @ 2% (sprayed 10 days before harvesting) slowed the colour development process in peach fruits during storage.

Keywords: Peach, colour, storage, calcium and putrescine

Peach is a temperate stone fruit , but its low chill varities are grown successfully in sub-topical regions of the India. In Punjab varieties like Shan-i-Punjab, Partap and Earli-Grande are grown commercially and the ripening period of these fruits coincides with the hot months (April-May) in state. Peach is highly perishable and its fruit are sensitive to high temperature and low humidity, which prevails during its harvesting period and it leads to heavy post-harvest losses. During the growth and development of peach fruit till maturity and ripening, there are many physico-chemical changes taking place that governs their quality and post-harvest behavior. Change in colour is an important factor which attributes to the fruit quality. Browning of peaches is a common problem during storage, it can be checked by the use of some senescence and ripening delaying chemicals. Many growth regulators and chemicals are used in different fruits to delay ripening and maintain the fruit quality after harvesting (Khader *et al* 1988). Exogenous application of polyamines, delay the fruit senescence and physiological processes leading to the fruit ripening. A higher endogenous level of putrescine (PUT) is associated with delayed fruit ripening (Dibble *et al* 1988). Scott and wills (1975) reported that calcium also acts as

anti-senescent agent by preventing cellular disorganization by maintaining protein and nucleic acid synthesis. Treatment of fruits with calcium compounds to reduce post-harvest losses have proven to be effective by delaying fruit ripening and degradation caused by hydrolyzing enzymes (Dundar *et al* 1997). Keeping the above facts in view it was planned to study the effect of pre-harvest applications of putrescine and calcium nitrate on the colour changes of peach fruits.

Materials and methods

Uniform and healthy plants of peach cv. Shan-i-Punjab were sprayed with putrescine (PUT) and calcium nitrate at three concentrations each *viz*. 1.0, 2.0, 3.0 mmol L^{-1} and 0.5, 1.0 and 2.0% respectively 10 and 20 days before harvesting (DBH) in the New Orchard of Department of Horticulture, Punjab Agricultual University, Ludhiana. A total of thirteen treatments were given comprising three replications in each treatment. T_1 [PUT 1 mmol/L (20 DBH)] ,T_2 [PUT 2 mmol/L (20 DBH)], T_3 [PUT 3 mmol/L (20 DBH)], T_4 [$Ca(NO_3)_2$ (0.5%) (20 DBH)], T_5 [$Ca(NO_3)_2$ (1.0%) (20 DBH)], T_6 [$Ca(NO_3)_2$ (2.0%) (20 DBH)], T_7 [PUT 1 mmol/L (10 DBH)], T_8 [PUT 2 mmol/L (10 DBH)], T_9 [PUT 3 mmol/L (10 DBH)], T_{10} [$Ca(NO_3)_2$ (0.5%) (10 DBH)], T_{11} [$Ca(NO_3)_2$ (1.0%) (10 DBH)], T_{12} [$Ca(NO_3)_2$ (2.0%) (10 DBH)], T_{13} [Control]. Physiologically mature peach fruits of uniform size, disease and bruise free were picked randomly from all the four directions of the treated plants with the help of secateur in the early morning hours in the 1st week of may. The harvested fruits were immediately carried to the laboratory for sorting and packaging. The bruised and diseased fruits were sorted out and healthy fruits were washed and air dried at room temperature. After drying, the fruits were packed in corrugated fibre board (CFB) boxes of one Kg capacity in layers and subsequently placed in cold chamber (0 to 1° C and 90-95 % RH).). Fruit samples were analyzed for surface colour changes on the day of harvesting and after 10, 20, 30 and 40 days of storage. The colour of fruits was measured with colour difference meter (Model: Mini Scan XE Plus, Made: Hunter Lab, USA) and expressed as a, b hunter colour values (Hunter 1975). The data was analyzed by Factorial Randomized Block Design as described by Singh *et al* (1998).

Results and discussion

The data on the effect of pre-harvest putrescine and calcium nitrate treatments on colour of peach fruits is given in table 1. A perusal of the data revealed that the application of putrescine and calcium nitrate delayed the loss of green colour in peach fruits. The fruits treated with putrescine @ 3 mmol L^{-1} (sprayed 10 days before harvesting) showed minimum average "a" (7.36) and "b" (25.54) values, while the maximum "a" (8.10) and "b" (26.21) were observed in control fruits. The colour development was improved with the progression of storage period. The mean minimum values for "a" (4.13) and "b" (23.24) were observed at the time of storage. All the treatments showed a continuous increase in values of "a" and "b" with the increase in storage period and attained maximum values (9.39 and 27.69 respectively) at the end of storage period. After 10 days of storage, the control fruit showed maximum "a" (8.24) and "b" (26.04) values, while the minimum values for "a" (7.45) and "b" (25.37) were obtained in putrescine @ 3 mmol L^{-1} (sprayed 10 days before harvesting) treated fruits, followed by putrescine @ 2 mmol L^{-1} and calcium nitrate @ 2% (sprayed 10 days before harvesting) treatments. A similar trend was followed after 20, 30 and 40 days of storage and after 40 days of storage, the fruits kept under control recorded maximum "a" (9.97) and "b" (28.28) values, while the fruits treated with putrescine @ 3 mmol L^{-1} (sprayed 10 days before harvesting) registered minimum "a" (8.90) and "b" (27.13) values, followed by putrescine @ 2 mmol L^{-1} (sprayed 10 days before harvesting) treatment. The interaction between the treatments and storage period was observed significant. In contrast to control, all the treatments showed a significant effect on colour development. In general, all the treatments showed significant effect on colour development over the control. The maximum values of "a" and "b" were observed in control fruits after 40 days of cold storage and the minimum values of "a" and "b" were found in fruits treated with putrescine @ 3 mmol L^{-1} (sprayed 10 days before harvesting), followed by putrescine @ 2 mmol L^{-1} and calcium nitrate @ 2% (sprayed 10 days before harvesting).

In general, the improvement in colour during storage might be due to the degradation of the chlorophyll pigments of the fruits and increased synthesis of carotenoids and anthocyanin pigments (Wankier *et al* 1970; Wang *et al* 1971). The results obtained in the present studies are in agreement with the findings of Novita and Purvoko (2004) who reported that polyamines inhibited the change in fruit colour of papaya during storage. Valero *et al* (1998) also reported that vacuum infiltration of lemon fruit with putrescine and calcium chloride resulted in delayed colour change. Byun and Choi (1988) reported a reduced fruit

Table 1: Effect of pre-harvest putrescine and calcium nitrate treatments on colour of peach fruits under cold storage.

Treatment	Colour (colour flex) Storage interval (Days)											
	a*						b**					
	0	10	20	30	40	Mean	0	10	20	30	40	Mean
T_1 PUT 1 mmol/L (20 DBH)	4.17	7.82	8.48	9.12	9.62	7.84	23.30	25.76	26.31	26.72	27.94	26.00
T_2 PUT 2 mmol/L (20 DBH)	4.14	7.72	8.38	8.93	9.46	7.72	23.28	25.67	26.22	26.61	27.79	25.91
T_3 PUT 3 mmol/L (20 DBH)	4.13	7.69	8.32	8.86	9.38	7.67	23.26	25.63	26.16	26.57	27.72	25.86
T_4 $Ca(No_3)_2$ (0.5%) (20 DBH)	4.21	8.04	8.60	9.25	9.82	7.98	23.34	25.89	26.43	26.81	28.17	26.12
T_5 $Ca(No_3)_2$ (1.0%) (20 DBH)	4.19	7.94	8.53	9.18	9.70	7.90	23.32	25.81	26.38	26.76	28.03	26.06
T_6 $Ca(No_3)_2$ (2.0%) (20 DBH)	4.15	7.75	8.41	9.03	9.54	7.77	23.29	25.70	26.27	26.66	27.86	25.95
T_7 PUT 1 mmol/L (10 DBH)	4.09	7.57	8.13	8.68	9.15	7.52	23.18	25.49	25.98	26.42	27.42	25.69
T_8 PUT 2 mmol/L (10 DBH)	4.04	7.48	8.09	8.56	8.97	7.42	23.13	25.39	25.89	26.32	27.26	25.59
T_9 PUT 3 mmol/L (10 DBH)	4.00	7.45	7.98	8.49	8.90	7.36	23.11	25.37	25.85	26.28	27.13	25.54
T_{10} $Ca(No_3)_2$ (0.5%) (10 DBH)	4.13	7.64	8.20	8.79	9.31	7.61	23.23	25.59	26.11	26.53	27.61	25.81
T_{11} $Ca(No_3)_2$ (1.0%) (10 DBH)	4.12	7.61	8.16	8.74	9.23	7.57	23.21	25.54	26.04	26.49	27.53	25.76
T_{12} $Ca(No_3)_2$ (2.0%) (10 DBH)	4.07	7.52	8.09	8.61	9.06	7.47	23.15	25.47	25.93	26.38	27.35	25.65
T_{13} Control	4.25	8.24	8.71	9.36	9.97	8.10	23.37	26.04	26.50	26.88	28.28	26.21
Mean	4.13	7.72	8.31	8.89	9.39		23.24	25.64	26.16	26.57	27.69	

CD at 5%		a*	b**
Treatment	:	0.10	0.23
Storage	:	0.04	0.17
Storage×Treatment	:	0.14	0.43

a*Redness value, b**Yellowness

PRINT ISSN.: 0974-1712 ONLINE ISSN.: 2230-732X

colour development in apples with calcium treatments. Drake and Spyad (1983) reported that calcium chloride treated "Golden Delicious" apples maintained colour development up to five months of cold storage. These findings are also in agreement with results of Schirra *et al* (1997) in Cactus pear.

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