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Full Length Research Paper

Effect of post-harvest treatments of putrescine on storage of Mango cv. Langra

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Mango is a perishable fruit and its ripening period coincides with the summer months under North Indian conditions. It has very short life at ambient temperature and high post-harvest losses. By keeping it in view, an experiment was planned to study the effect of putrescine on storage life and quality of mango fruits cv. Langra. Physiologically matured and uniform fruits of mango were treated with putrescine (0.0, 1.0, 2.0 and 3.0 mmol/L). Treated fruits were air dried in shade and stored at 13°C and 90- 95% relative humidity (RH) for four weeks. Results revealed that fruits treated with putrescine at 2.0 mmol/L retained the best quality in terms of high palatability rating, good blend of Total soluble solids (TSS) and acidity and low physiological loss in weight and spoilage percentage.

Key words: Polyamine, *Mangifera indica*, palatability rating, spoilage, quality.

INTRODUCTION

Mango (*Mangifera indica*), the king of fruits is grown in tropical and sub-tropical regions of India. It occupies the prime position due to its rich bio-diversity, wider adaptability, higher returns and excellent taste. However, heavy post-harvest loss in sub-tropical condition is a major constraint in its export. Rapid ripening process is responsible for short life of mango fruit and it represents a serious constraint for efficient handling and transportation. Therefore, techniques for storage of mango fruit have to be standardized and employed to enhance the storage life. Polyamines and low temperature are known to improve the shelf-life of fruits by inhibiting ethylene biosynthesis and delaying the ripening process, respectively.

Polyamines and ethylene has opposite effects on fruit ripening and senescence. Balance between the two is important to enhance and retard the ripening process of fruits. Usually, the concentration of polyamines decreases during tissue senescence with accelerated ethylene production (Valero et al., 2002*).* Pre and post harvest application of putrescine increased fruit firmness and also retarded colour development (Malik et al., 2003). Treatment with exogenous putrescine (PUT) inhibited ethylene production, thus, retarding the increase of MDA (malondialdehyde) content and membrane permeability and postponing the occurrence of chilling injury (Zhang et al., 2000). In Hayward kiwi fruit, 1 mM putrescine treatment resulted in inhibition of ethylene production, low respiration rate and higher flesh firmness (Wen et al., 2003). Exogenous application of polyamines was also found effective in many other fruits to reduce the ripening processes. But, no such information is available on the effect of polyamines on Mango cv. Langra. As such, the present studies were aimed to extend the storage life of 'Langra' mango fruit with putrescine treatments under low temperature storage conditions.

MATERIALS AND METHODS

Physiologically matured and uniform fruits of mango cv. Langra were harvested from FRS Gangian, PAU Ludhiana in July, 2010. Selected fruits were treated with an aqueous solution containing different concentrations of putrescine (Sigma-Aldrich Co., USA) at 1.0 (T_1), 2.0 (T_2), 3.0 (T_3) and 0.0 (T_4) mmol/L. Each treatment was replicated thrice and comprised of 2.0 kg fruit/ replication. Treated fruits were air dried in shade and packed in corrugated fibre board

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Table 1. Effect of post harvest treatments of putrescine on flesh colour of mango cv. Langra.

Treatment	Days after storage 'a'					Days after storage 'b'				
	7	14	21	28	Mean	7	14	21	28	Mean
T_1 Putrescine 1.0 mmol/L	5.6	14.31	10.01	20.03	12.48	35.39	38.56	42.62	44.80	40.34
T_2 Putrescine 2.0 mmol/L	3.17	13.21	15.64	18.32	12.58	29.80	35.05	39.20	41.03	36.27
T_3 Putrescine 3.0 mmol/L	3.20	13.50	15.92	19.50	13.03	30.18	36.42	40.43	42.60	37.40
T_4 Control	6.8	15.82	18.80	23.47	16.22	37.11	40.12	43.56	45.27	41.51
Mean	4.69	14.21	15.09	20.33		33.12	37.53	41.95	43.42	

CD at 5% level; treatment at 0.97 and 0.88; storage interval at 0.73 and 0.56 and treatment × storage interval at 1.01 and 1.12.

(CFB) boxes before storage at 13°C and 90-95% RH for four weeks. For various physico-chemical characters, the fruits were analyzed after one week interval. The percent loss in weight after each interval of cold storage was calculated by subtracting final weight from the initial weight of the fruits and then converted into percentage value. The cumulative loss in weight was calculated on fresh weight basis. The 'a' and 'b' values of flesh colour of 10 randomly selected fruit from each treatment at each storage interval was noted with the help of ColorFlex® (Hunter Lab, Hunter Associates Laboratory, Inc.). The 'a' and 'b' values represent the levels of tonality and saturation with *+a* (indicating red) and *+b* (indicating yellow).

Palatability rating of the fruits was done by the hedonic scale as per method of Peryam and Pilgrim (1957). Panel of five judges evaluated the sensory fruit quality by using 9 point Hedonic scale that is, 9 (like extremely), 8 (like very much), 7 (like moderately), 6 (like slightly), 5 (neither like nor dislike), 4 (dislike slightly), 3 (dislike moderately), 2 (dislike very much) and 1 (dislike extremely). Spoilage percentage of fruits was calculated by counting the rotten fruits and total fruits in each treatment replication on each storage interval. Total soluble solids (TSS) were determined with the help of a hand refractometer at room temperature and expressed in percentage. These reading were corrected with the help of temperature correction chart at 20°C temperature, whereas, titratable acidity was estimated as per standard procedure of AOAC (2000). The data obtained were subjected to statistical analysis by following the CRD method.

RESULTS AND DISCUSSION

Maximum physiological loss in weight was recorded in untreated fruits, whereas minimum physiological loss in weight was found in putrescine (2.0 mmol/L) treated fruits during the entire storage period (Figure 1). All the treatments showed significantly less physiological loss in weight as compared to the control. Pre-storage dip application of polyamines retarded reduced weight loss during storage in Mango cv. Kensington Pride (Malik and Singh, 2005). Malik et al. (2006) reported that polyamine application retarded colour development and reduced physiological weight loss during storage in Mango cv. Kensington Pride. The control pomegranate rotting was noted respectively only in untreated fruits fruits had significantly higher weight loss during storage whereas polyamine treatment retarded the maturation process by reducing softening as well as the loss of weight (Mirdehghan et al., 2007). Polyamine treatments led to reduced weight loss of fruits during storage, which might be due to comparatively lower rates of respiration in treated fruit as compared to the control.

Putrescine treated lemon fruit showed lower weight loss than non treated fruit during storage (Valero et al., 1998). Putrescine effects on weight loss could possibly be due to changes in the biophysical properties of the fruit. Putrescine might have modified the properties of cell wall and the permeability of tissues to water (Martinez et al., 2002). The lower weight loss in polyamine treated fruit could be attributed to stabilization or consolidation of both cell integrity and the permeability of the tissues, ameliorating chilling injury; the latter induces tissue disruption and connection between the skin and the external atmosphere allowing the transference of water vapour (Woods, 1990).

Palatability of stored fruits was improved up to two weeks of storage and afterwards a decline was noted in all the treatments (Figure 2). After one week of storage, highest palatability rating (PR) was recorded in untreated fruits that were found with moderately acceptable quality. After two weeks of storage, fruits under all the treatments showed an improvement in quality and were observed in the range of moderate to very good fruit quality in T_1, T_3, T_4 treatments, whereas the fruits in T_2 were found in excellent conditions. However, after 3 weeks of storage, a decline in sensory quality was recorded in all the treatments, but the highest PR was obtained by fruits kept under T_2. Up to three weeks of storage, fruits treated with T_2 and T_3 were found in very good and moderate quality.

The retardation of fruit colour development by polyamine treatment indicates lower chlorophyll degradation and carotenoids biosynthesis and a delay in senescence processes. Earlier, pre-storage infiltrations by polyamines have been reported to reduce colour development in lemons and apricot (Valero et al., 1998; Martinez, 2001). Putrescine treatments appeared to retard fruit skin colour development, as evident from the data (Table 1). During the entire storage period, untreated fruits retained the higher values of 'a' and 'b', whereas minimum values for 'a' and 'b' were recorded in putrescine at 2.0 mmol/L treated fruits. Polyamines may inhibit chlorophyll degradation in skin tissues by inhibition

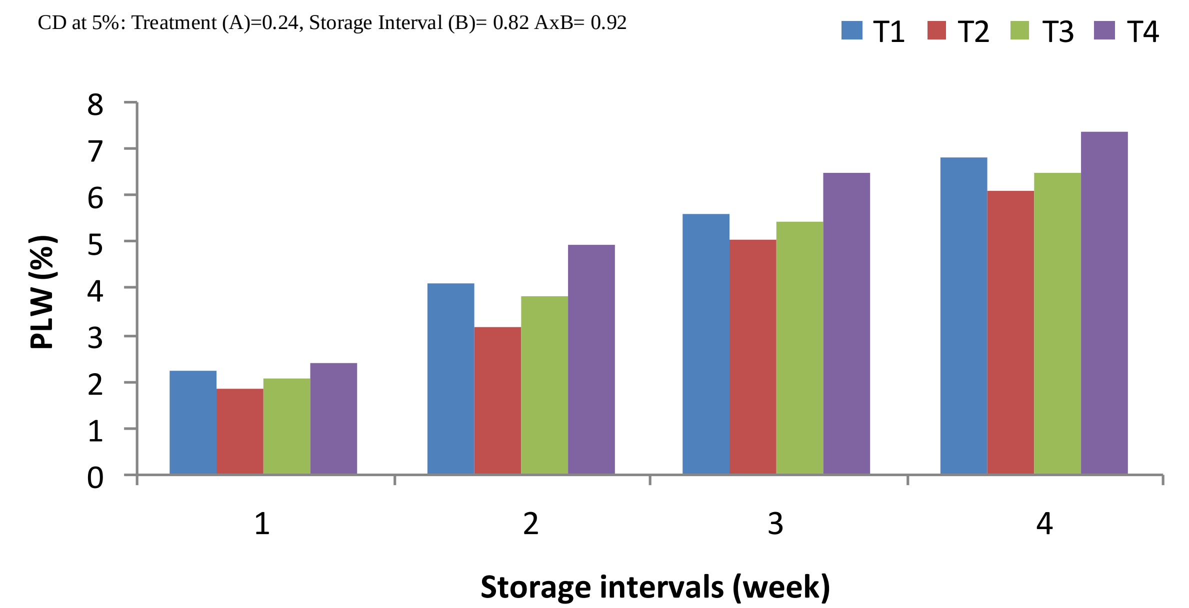

Figure 1. Effect of putrescine on physiological loss in weight of stored mango fruits.

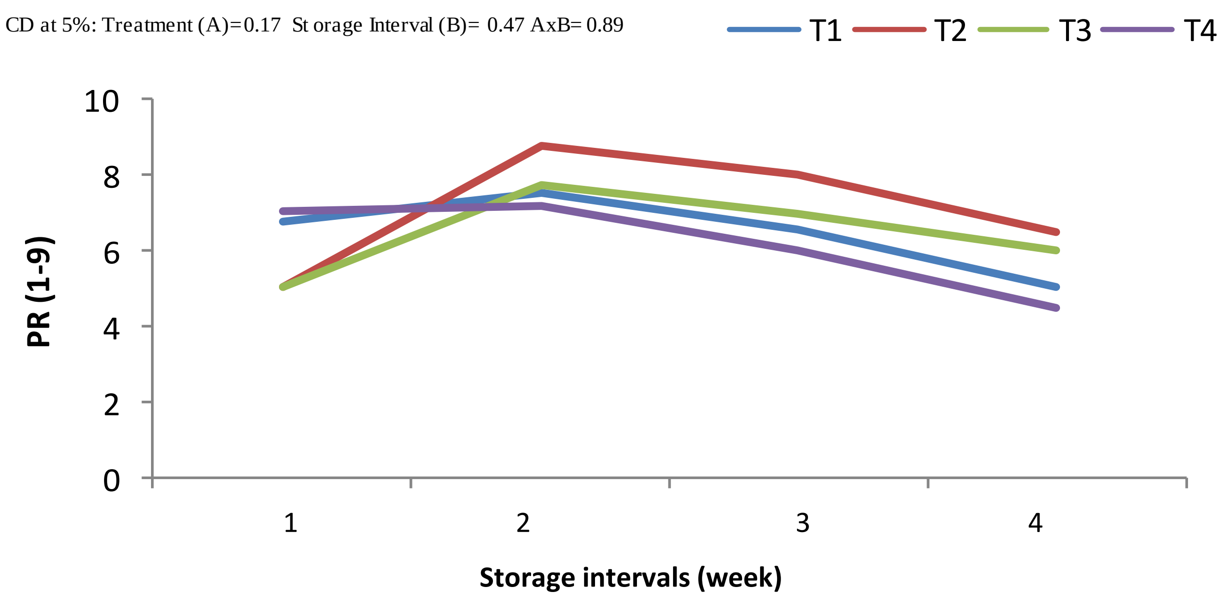

Figure 2. Effect of putrescine on palatability rating (PR) of stored mango fruits.

of peroxidase activity (Ma-Jun et al., 1996). Earlier, the retardation of chlorophyll loss in musk melon with exogenous application of polyamines has been attributed to reduced hydrolytic activities acting on chloroplast thylakoid membranes (Lester, 2000).

Fruit rotting was found significantly less in treated fruits as compared to untreated. After two and three weeks of storage 5.6 and 19.5% rotting was noted respectively only in untreated fruits (Figure 3). At the end of the storage, 12.2% rotting was also recorded in putrescine (1.0 mmol/L) treated fruits, but in untreated fruits, 24.6% rotting was observed and this may be due to the delay of senescence in putrescine treated fruits.

Total soluble solids of fruits increased with the advancement of storage period in all the treatments.(Figure 4). During the entire storage period, highest TSS content was recorded in the control fruits. Total titratable acidity decreased in all the treatments

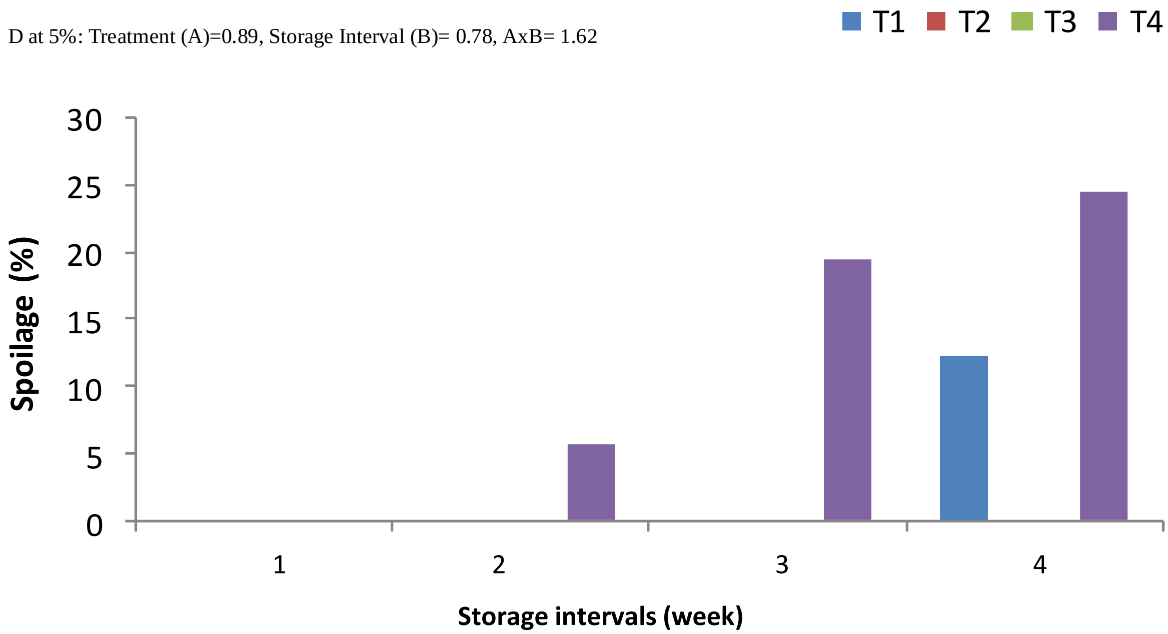

Figure 3. Effect of putrescine on spoilage of stored mango fruits.

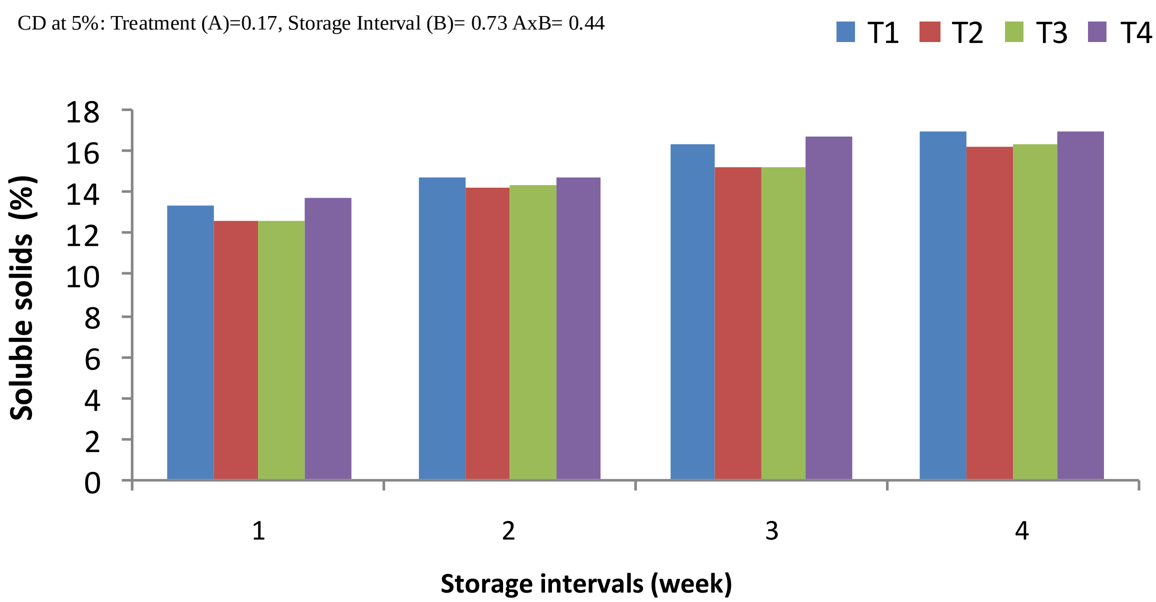

Figure 4. Effect of putrescine on soluble solids content of stored mango fruit.

during storage, but the decline was rapid in control and putrescine (1.0 mmol/L) treated fruits. At the end of the storage, highest acidity was retained in putrescine at 2.0 mmol/L treatment and a good blend of TSS and acidity was also maintained by this treatment (Figure 5). Similarly, Khan et al. (2008) reported that putrescine treated fruit stored at low temperature exhibited lower soluble solid content, delayed respiration rate and higher titratable acidity than untreated fruits in Angelino plum. Khosroshahi and Ashari (2008) also found out that there was low soluble solid content and high acidity in putrescine treated strawberry, apricot and peach fruits during storage than untreated fruits. Results revealed that fruits treated with putrescine at 2.0 mmol/L retained best quality up to three weeks of storage in terms of high palatability rating, good blend of TSS and acidity and low

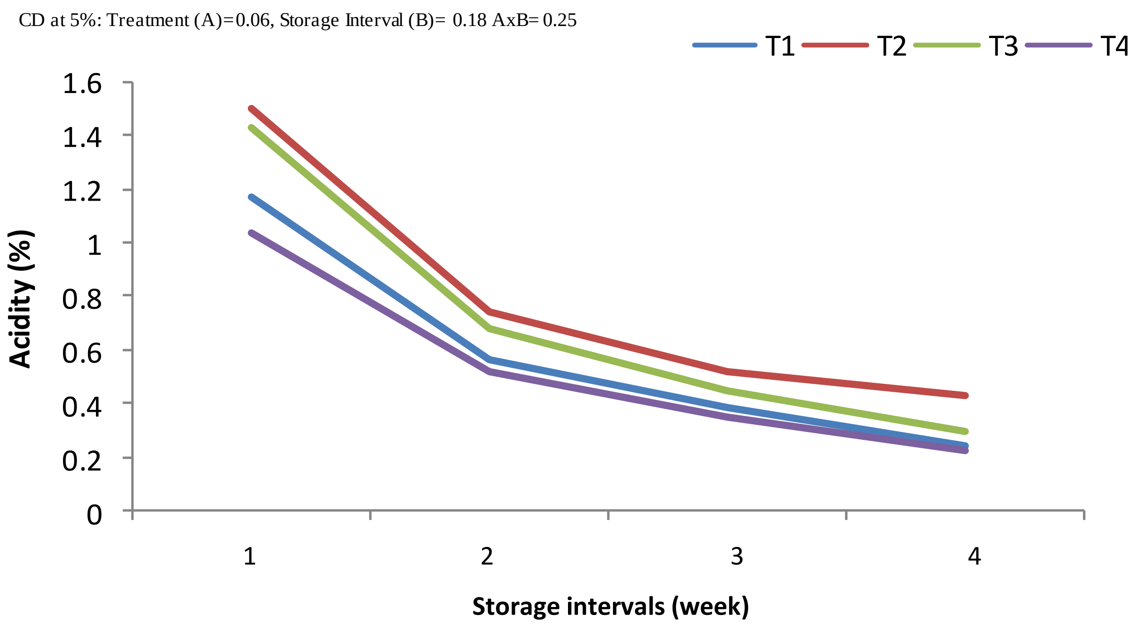

Figure 5. Effect of putrescine on acidity of stored mango fruits.

physiological loss in weight and spoilage percentage.

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