

EFFECT OF CHITOSAN AND SALICYLIC ACID ON QUALITATIVE PROPERTIES OF INDIAN ZIZIPHUS (*ZIZIPHUS MAURITIANA* LAM., CV. 'SEB')

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ABSTRACT

In this research the effect of chitosan and salicylic acid on the quality traits and postharvest life of the Indian Ziziphus (*Ziziphus mauritiana* Lam., cv. 'Seb') were investigated. Fruits separately were treated with chitosan (0.5, 1 and 1.5%) and salicylic acid (250 and 500 mgL⁻¹) and subsequently were stored for 20 days in proper storage conditions. In this period, Fruit quality characters including TSS, vitamin C, decay percentage, weight loss, and apparent quality were evaluated. Results showed that in comparison with control treatment, 500 mgL⁻¹ salicylic acid caused to significant enhancement of TSS and vitamin C values. The concentration of 250 mgL⁻¹ salicylic acid led to increasing of vitamin C and TSS value and recent treatment and control treatment had the best retention of apparent fruit quality. The concentration of 0.5% chitosan showed the lowest decay and in 1% concentration showed the least loss weight in comparison with other treatments.

Keywords: Indian Jujube, Chitosan, Salicylic Acid, Postharvest

INTRODUCTION

Ziziphus, which is among the important tropical and sub-tropical fruits, belongs to *Ziziphus* genus and Rhamnaceae family (Aazam-Ali *et al.*, 2006). Storage life of Ziziphus is short and at the time of full ripening, during harvest stages, handling and transportation to storage loses its quality and consequently its postharvest life become shorter and keeping possibility of fruit in the storage is not easily feasibly (Aboutalebi and Ramazani, 2014). Reduction of crop quality after harvesting can be arise to various factors such as metabolic agents, transpiration, mechanical damages and microorganisms. Recently, application of compatible compounds to plant, nature and human have been considered in production and keeping of agricultural crops (Tembo *et al.*, 2008). Therefore, in this study was evaluated the effect of salicylic acid and chitosan on some qualitative characters of Indian Ziziphus fruits after harvesting.

MATERIALS AND METHODS

In this experiment, Indian Ziziphus (*Ziziphus mauritiana* cv. Seb) fruit was used. The fruit was harvested in green ripening stage as handpick. Harvested fruits were washed and sorted. After treating of the fruits separately by salicylic acid (SA) 250 and 500 mgL⁻¹ and chitosan 0.5, 1.0 and 1.5%, the fruits were dried and placed within plastic vacuum packages and then were kept in proper storage for 20 days. During storing period, fruit qualitative characters consisting total soluble solid (TSS), decay percent, vitamin C amount, apparent quality and loss weight percent were measured. Obtained data was analyzed in randomized complete block design with three replicates by using MSTATC software and the means were compared by Duncan's multiple range test in $p < 0.05$.

RESULTS AND DISCUSSION

There was significant difference ($p < 0.01$) between treatments in relation to TSS (Table 1). Examination the influence of treatment type on evaluated traits showed the different treatments affected fruit TSS so that application of salicylic acid increased TSS amount and the greatest TSS observed in SA 500 mgL⁻¹. Application of chitosan led to reduction of TSS amount so that the lowest TSS observed in chitosan 1.5% (Figure 1). Regards to the analysis of variance table, there was significant difference between treatments in relation to vitamin C amount (Table 1). The highest vitamin C amount was in SA 500 mgL⁻¹ but had no

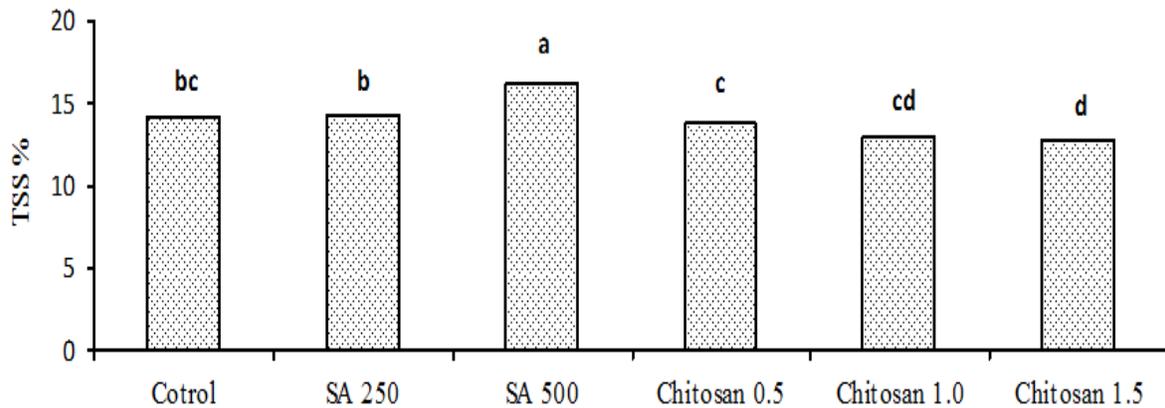
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significant difference to SA 250 mgL⁻¹. Results of variance analysis also indicated significant effects of various treatments on fruits loss weight percent during storing period (Table 1). Fruit loss weight observed in all treatments but the least and the highest loss weight noticed in chitosan 1.0% and 1.5% respectively than other treatments (Figure 2). There was significant difference (p<0.01) between treatments in relation to fruit apparent quality (Table 1). The greatest effect on keeping of apparent quality observed in SA 250 mgL⁻¹ but had no significant difference to the control treatment (Figure 3). Apparent quality of the treated fruits by chitosan 1.5% severely decreased. There was significant difference (p<0.01) between treatments in relation to fruit decay percent (Table 1). The highest and the lowest fruit decay percent observed in chitosan 1.5% and 0.5% respectively (Figure 4).

Table 1: Analysis of variance (MS) in relation to evaluated characters

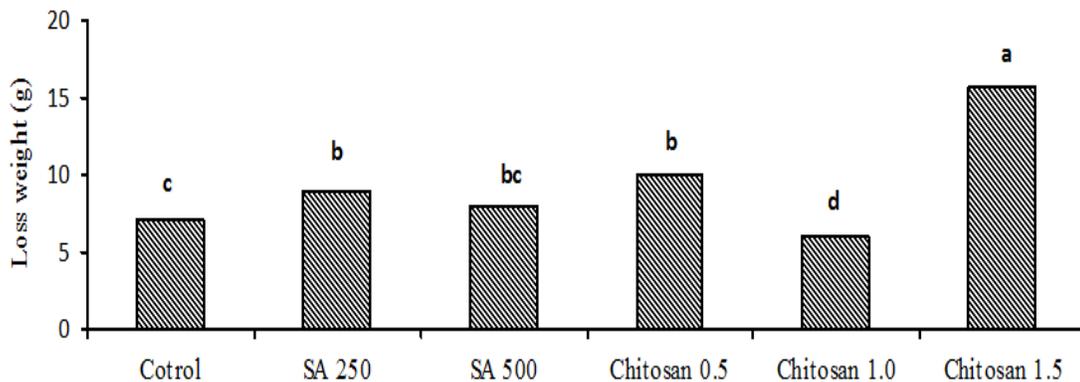
S.V	D.F	Mean Square (MS)	Fruit apparent quality	Fruit decay %	Vitamin C	TSS	Fruit loss weight
Replication	2	0.81 ^{ns}	5.05 ^{**}	0.94 ^{ns}	34.81 ^{ns}	23.19 ^{ns}	
Treatment	5	48.12 ^{**}	198.71 ^{**}	22.23 ^{**}	592.97 ^{**}	442.13 ^{**}	
Error	10	0.50	1.03	0.78	47.88	87.43	
C.V %		13.2	20.0	13.0	18.7	17.2	

^{ns}, ^{**} not significant and significant in p<0.01 respectively



Means in each column having same letter have not significant difference (p<0.01) according to DMRT.

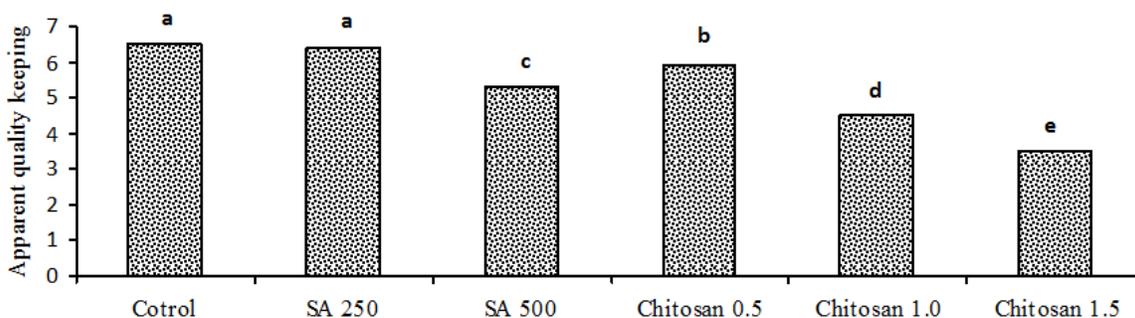
Figure 1: Effect of different treatments on total soluble solid (TSS) in Ziziphus fruit



Means in each column having same letter have not significant difference (p<0.01) according to DMRT.

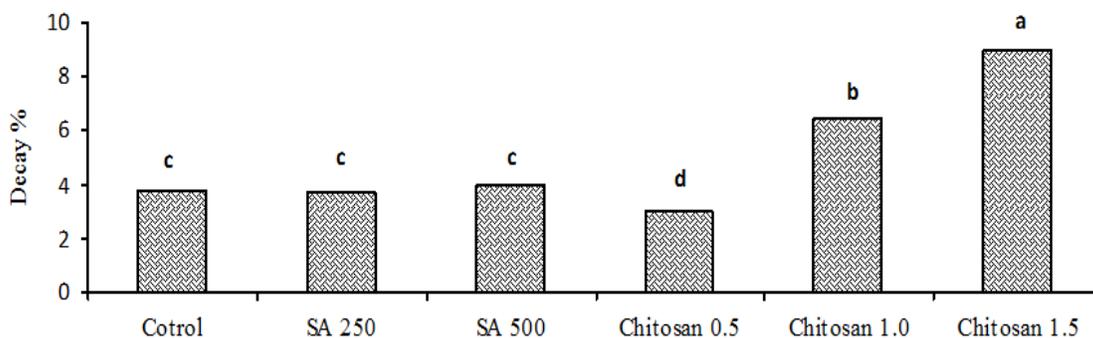
Figure 2: Effect of different treatments on loss weight of Ziziphus fruit

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Means in each column having same letter have not significant difference ($p < 0.01$) according to DMRT.

Figure 3: Effect of different treatments on keeping of apparent quality of Ziziphus fruit



Means in each column having same letter have not significant difference ($p < 0.01$) according to DMRT.

Figure 4: Effect of different treatments on decay percent of Ziziphus fruit

Salicylic acid and chitosan are the known compounds that are effective in reduction of fruit decay and keeping and improving of fruit qualitative characters. In the present study, high concentrations of chitosan were not effective and it is better in the next experiment evaluate the effect of its lower concentrations on postharvest life of Indian Ziziphus because improved the fruit qualitative characters in lower concentrations.

The lowest decay percent and loss weight observed in chitosan 0.5 and 1.0% respectively in comparison with control treatment. This is due to waxy cover of chitosan on fruit surface so that it is leading to reduction of water loss and help to keeping of fruit water and weight.

In addition, anti-fungal property of chitosan inhibits mold growth on fruit and prevents the progression of infection compared with the other treatments. Obtained results of this experiment in relation to keeping of apparent quality, lower loss weight and lower infection by using low concentration of chitosan is according to the findings of Shiri *et al.*, (2009) on the effect of chitosan cover on quality keeping and storage life of Thompson and Blood sweet oranges.

Salicylic acid phenolic compound is one of the most important compounds, which is including as a new group of plant growth regulators and plays an important role in regulating plant growth and development. It has been reported that application of salicylic acid lead to activity of systemic acquired resistance system and synthesis of metabolites and anti-oxidant enzymes.

Salicylic acid as a natural compound has high potential in preventing from production and effect of ethylene (Tembo *et al.*, 2008).

Means comparison of salicylic acid levels on fruit qualitative characters showed that application of Salicylic acid was better than chitosan. Salicylic acid 250 mgL⁻¹ led to improving of fruit qualitative characters and postharvest life in comparison with control and other treatments.

Conclusion

Salicylic acid and chitosan in proper concentration can help and improve of quality characters of Indian Ziziphus fruit.

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