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Effect of Post Harvest Chemicals on Fruit Physiology and Shelf Life of Tomato Under Ambient Conditions*

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Abstract

The present laboratory experiment was conducted at Department of Vegetable Science, Horticultural college and Research Institute, V.R.Gudem,W.G. Dist. A.P. during 2011-2012. Tomato cv. *Lakshmi* at breaker stage harvested and treated with Benzyl Adenine (50 ppm and 100 ppm), Sodium Benzoate **(**1000 and 2000 ppm), Calcium chloride ($CaCl_2$ @ 1.0% and 2.0%) and Gibberellic acid (GA_3 @ 0.1% and 0.3%) and stored at ambient conditions. Physiological parameters such as physiological loss in weight (PLW), fruit firmness and shelf life were evaluated. Among the treatments, fruits treated with 0.3% GA_3 recorded maximum shelf life (43 days) followed by $CaCl_2$ 2% (40 days) over control. However PLW has recorded increasing trend and fruit firmness is in decreasing trend, irrespective of post harvest chemical treatments over the storage period.

Keywords: Post harvest chemical treatments, PLW, Firmness, Shelf life, Tomato

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1. Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important commercial and dietary vegetable crops cultivated all over the world for its fleshy fruits. Tomato being climacteric fruit, rapid rise in rate of respiration leads to product deterioration during storage. Further transpiration losses makes the fruit shrivel and eventually becomes unmarketable. Many compounds such as GA_3 and calcium compounds have been tried to inhibit the biosynthetic pathway of ethylene. Among the growth regulating chemicals, gibberellins are known to retard ripening and senescence of fruits.

The effect of GA_3 seems to be mainly on colour development, although other aspects of ripening processes are also affected. According to John (1987), addition of calcium improves rigidity of cell walls and obstructs enzymes such as polygalcturonase from reaching their active sites, there by retarding tissue softening and ultimately delaying ripening.Thus, post harvest calcium application maintains cell turgor, membrane integrity, tissue firmness and delays membrane lipid catabolism. Similarly there are reports of anti oxidants like Sodium Benzoate and Benzyl Adenine also inhibit the ethylene production interfering essentially at the conversion of aminocyclopropane-1 carboxylic acid (ACC) to ethylene, thereby increasing the shelf life of tomato.

2. Material and Methods

Present laboratory investigation was conducted at Department of Vegetable Science, Horticultural college and Research Institute, V.R.Gudem, W.G. Dist. A.P. during 2011-2012. Well developed, uniform sized and injury free tomato fruits of cv. *Lakshmi* harvested from the field at breaker stage and brought to the laboratory for the experiment. The fruits were cleaned with tap water and then allowed to dry in shade prior to chemical dipping. The chemical treatments were imposed by dipping the tomato fruits in different chemical solutions for 15 minutes and stored under ambient room storage conditions. Total no. of treatments were nine viz., T_1-Benzyl Adenine (50 ppm), T_2 -Benzyl Adenine (100 ppm), T_3-Sodium benzoate (1000 ppm), T_4 - Sodium benzoate (2000 ppm), T_5-Calcium chloride (1.0%), T_6-Calcium chloride (2.0%), T_7-Gibberellic acid (0.1%) , T_8-Gibberellic acid (0.3%) and T_9-Control.The design of the experiment was factorial CRD with 3 replications. The data on physiological parameters were recorded at 4 days interval under ambient room storage conditions. The physiological loss in weight (PLW) was measured as the loss of weight in grams in relation to initial weight and expressed as percentage. The firmness of the fruit was recorded using a digital penetrometer and expressed as kg $cm^{-2}$and shelf life was calculated up to last day of deterioration and unmarketable stage.

3. Results and Discussion

3.1 Physiological Loss in Weight (PLW): Results from the table.1 shows significant differences between post harvest chemicals and storage days. There was a gradual increase in mean PLW values from 4^{th} day (3.82) to 28^{th} day (15.78) irrespective of

treatments. Among the chemical treatments, fruits treated with GA_3-0.3% recorded significantly lower mean PLW (7.90) followed by fruits treated with $CaCl_2$ 2% (7.96) which is on par with GA_3 0.3%. Control registered significantly highest mean PLW (10.58). This is due to uncontrolled ripening during ambient storage conditions due to increased rate of respiration and ethylene production. Gibberellic acid decreasing the tissue permeability there by reducing the rate of water loss leading to delayed fruit ripening and physiological loss in weight (Wills *et al.* (1998).Calcium application is effective in terms of membrane permeability and maintenance of cell wall integrity there by delaying ripening (Lester and Grusak,1999).

Table 1: Effect of post harvest chemical treatments on physiological loss of weight (%) in tomato cv. *Lakshmi* under ambient storage conditions.

Treatments	Physiological loss in weight (%)							
	Storage Period (Days)							MEAN
	4	8	12	16	20	24	28	
T_1-Benzyl Adenine 50 ppm	3.96	6.42	7.90	8.10	10.12	12.19	16.55	**9.32**
T_2-Benzyl Adenine 100 ppm	4.16	5.62	6.84	7.15	8.10	12.90	15.55	**8.61**
T_3-Soduim Benzoate 1000 ppm	3.90	5.98	7.99	8.50	9.55	15.99	16.99	**9.84**
T_4-Soduim Benzoate 2000 ppm	3.87	6.50	7.95	8.20	10.24	11.90	18.65	**9.61**
T_5- Calcium chloride 1.0%	4.30	6.85	8.80	9.25	11.34	13.54	15.02	**9.87**
T_6- Calcium chloride 2.0%	3.02	5.80	6.80	8.40	9.65	10.65	11.45	**7.96**
T_7- Gibberellic acid 0.1%	3.93	5.38	7.22	8.55	9.55	15.06	17.66	**9.62**
T_8- Gibberellic acid 0.3%	2.81	5.62	6.68	8.18	9.55	10.90	11.56	**7.90**
T_9-Distilled Water	4.50	7.14	8.00	9.55	11.06	15.16	18.66	**10.58**
MEAN	**3.82**	**6.14**	**7.57**	**8.43**	**9.90**	**13.14**	**15.78**	
	S.Em±	CD (P=0.05)						
Storage days(D)	0.102	0.286						
Treatments (T)	0.090	0.252						
Interaction (D x T)	0.270	0.757						

3.2 Fruit firmness (Kg cm^{-2}): Table. 2 show significant differences between post harvest chemicals and storage period. There was a gradual decrease in fruit firmness from 4^{th} day (3.92) to 28^{th} day (2.26) of storage in all the treatments. Fruits treated with GA_3 0.3% recorded significantly higher mean fruit firmness value (3.25) followed by $Cacl_2$ 2% (3.15) over control(2.82).Interaction between treatments and storage period was found to be non significant. These results indicating that non degradation of cell wall and carbohydrate metabolism during storage is due to effective maintenance of cell wall integrity and membrane permeability by both GA_3 and $Cacl_2$(Yiwei *et al.* 2008).

Table 2 : Effect of post harvest chemical treatments on Fruit firmness (Kg/cm^2) and shelf life (days) in tomato cv. *Lakshmi* under ambient storage conditions

Treatments	Fruit firmness (Kg/cm^2)								Shelf life (days)
	Storage Period (Days)								
	4	8	12	16	20	24	28	MEAN	
T_1-Benzyl Adenine 50 ppm	3.90	3.20	3.10	3.00	2.60	2.80	2.20	**2.97**	28
T_2-Benzyl Adenine 100 ppm	4.00	3.69	3.42	3.20	2.89	2.50	2.30	**3.14**	38
T_3-Soduim Benzoate 1000 ppm	3.90	3.30	3.00	2.90	2.80	2.60	2.30	**2.97**	30
T_4-Soduim Benzoate 2000 ppm	4.00	3.20	3.10	3.00	2.80	2.60	2.30	**3.00**	32
T_5- Calcium chloride 1.0%	4.00	3.66	3.55	3.03	2.30	2.27	2.06	**2.98**	28
T_6- Calcium chloride 2.0%	4.00	3.66	3.48	3.08	2.91	2.69	2.25	**3.15**	40
T_7- Gibberellic acid 0.1%	4.00	3.66	3.44	3.13	2.80	2.20	2.18	**3.06**	35
T_8- Gibberellic acid 0.3%	4.00	3.69	3.50	3.20	2.99	2.80	2.60	**3.25**	43
T_9-Distilled Water	3.50	3.30	3.00	2.80	2.60	2.40	2.20	**2.82**	26
MEAN	**3.92**	**3.48**	**3.28**	**3.03**	**2.74**	**2.54**	**2.26**		
	S.Em±	CD (P=0.05)						S.Em±	1.532
Storage days(D)	0.061	0.171						CD (P=0.05)	4.586
Treatments (T)	0.053	0.151							
Interaction (D x T)	0.161	N.S							

3.3 Shelf life(days): It is evident from the data (table 2) that among the various chemical treatments imposed, tomato fruits treated with GA_3 0.3% recorded significantly highest shelf life of 43 days under ambient storage conditions followed by $CaCl_2$ 2% (40 days) and Benzyl adenine 100 ppm (38 days). However GA_3 0.3% and $CaCl_2$ 2% were statistically at par with each other. The lowest shelf life was observed in control (26 days). Delay in conversion of starch to sugars there by reducing the peroxidase activity and ethylene production might be the cause for extended shelf life in GA_3 treated fruits. Similar results of delayed conversion of starch to sugars resulting in highest shelf life also reported by Rao and Chundawat (1988). Calcium chloride controlled the ripening by reducing PG activity and production of pectic oligomers which induces ripening might be the reason for increase shelf life in $CaCl_2$ treated fruits. These results also supports the view of Cheour *et al.*(1990) and Luna-Guzman *et al.*(1999) in Strawberry and cantaloupe respectively.

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