Online www.hortflorajournal.com ICV: 27.39; GIF: 0.364

HortFlora Research Spectrum, 2(3): 247-250 (July-Sept. 2013) ISSN : 2250-2823

EFFECT OF VARIOUS POST HARVEST TREATMENTS ON PERCENTAGE OF SHRINKAGE AND SPOILAGE OF TOMATO (*Lycopersicon esculentum* Mill)

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ABSTRACT: The experiment was conducted in the laboratory of the Department of CIHAB, PSB (Institute of Agriculture), Visva-Bharati, Sriniketan (WB). The experiment was laid out in RBD with nine treatments each comprising of three replications and ten fruits per replication. The results indicated that ripening was initially delayed by MAP, NAA and NAA+MAP treatments. Fruits treated with NAA+MAP, NAA+PMAP and GA_3+MAP showed minimum percentage of shrinkage up to 16th day of storage. The shrinkage was significantly delayed by MAP and PMAP treatments at the beginning. Relatively less percentage of rotting was noted in PMAP and in combination of PMAP and GA_3 treatments. It is evident from the results that the fruits under NAA, GA_3 and PMAP exhibited promising results in extending the storage life of tomato at room temperature up to two weeks.

Key words: *Tomato, NAA, GA_3, MAP, PMAP.*

Tomato (*Lycopersicon esculentum* Mill), belonging to the family Solanaceae, is one of the most popular and widely grown vegetable crop in the world. Tomato is a warm season crop and highly susceptible to frost, high humidity and perishable in nature. The perishability of tomato is high and ranges up to 60 per cent (Shanmugasundaram, 7). The tomato suffers serious post harvest losses due to spoilage, shrinkage, pathogen attack and bruising owing to improper packaging during transportation and improper storage. The storage life of tomato can be extended by waxing, control of ripening, proper packaging, transportation, storage, irradiation and pre/post harvest application of certain chemicals. Modified atmosphere packaging (MAP) is also used in prolonging the shelf-life of fresh fruits & vegetables. The term MAP refers to the storage of perishable commodities in plastic films that restricts the transmission of respired gases. As a result of which CO_2 is accumulated and O_2 is depleted around the fruits or vegetables, which may extend the storage life (Kader *et. al*, 4). Polyethylene is used for shrink film packaging. Their permeability to gasses (including water vapour) varies with the type of material from which they are made, temperature, in some cases humidity, the accumulation and concentration of the gases and thickness of the packaging materials (Thompson, 8).

Keeping the above points in view the present experiment was carried out to minimize the losses due to shrinkage and rotting by use of different chemicals along with different packaging techniques.

MATERIALS AND METHODS

The present investigations were carried out in the laboratory of the Department of Crop Improvement, Horticulture & Agricultural Botany, Palli Sikshya Bhavana (Institute of Agriculture), Sriniketan, Visva-Bharati. There were nine treatments, i.e. T_0-Control, T_1-NAA (50 ppm), T_2-GA_3 (50 ppm), T_3-Modified Atmosphere Packaging (MAP), T_4-Perforated Modified Atmosphere Packaging (PMAP), T_5-NAA (50 ppm)

Received : 15.06.2013 Revised : 13.7.2013 Accepted : 26.7.2013

+ MAP, T_6-NAA (50 ppm) + PMAP, T_7-GA_3 (50 ppm) + MAP and T_8-GA_3 (50 ppm) + PMAP which were replicated thrice. Hybrid tomato fruits, free from any visible injuries and pink to yellow-red in colour were used for this experiment. The fruits were purchased from Bolpur local market of West Bengal. After bringing the fruits to laboratory, they were sorted out, wiped free of visible dust with moist cotton wool and air-dried in shade for half an hour.

The required quantity of NAA and GA_3were weighed with digital electronic balance and dissolved in little amount of ethyl alcohol (90%) and the volume was made up to 3 litres with distilled water. Fruits were dipped and kept submersed in the respective solution for 15 minutes. There after the fruits were taken out and surface was dried with clean tissue paper. Polyethylene packets of 200 gauge (15µm) and 1 kg capacity were used as modified atmosphere packaging material. A group of packets were perforated (3% of the total area) and used as perforated MAP. The mouth of each packet was tied after filling with treated fruits with rubber band. The treated fruits were then arranged on a clean table in a well ventilated room under ambient condition. The data obtained during the period of investigations were analysed by the analysis of variance method (Panse and Sukhatme, 5) and the significance of different source of variations was tested by error mean square by Fisher's 'F' test of probability levels at 0.5 per cent.

RESULTS AND DISCUSSION

The data on shrinkage of fruit surface as influenced by various chemical treatments (Table 1) reveraled that in general, shrinkage of fruits occured after harvest due to continuous loss of moisture from fruit surface without influx of moisture in it. The perusal of the data indicated that the fruits under control, NAA, GA_3, MAP, PMAP and GA_3+PMAP did not show any shrinkage of peel up to 6 days of storage. It is interesting to note that shrinkage was delay up to 12 days in treatment with NAA alone. On the other hand shrinkage occurred from the second day in fruits under NAA+MAP, NAA+PMAP and GA_3+MAP.

Maximum shrinkage was noticed after 10 days in fruits treated with GA_3+MAP. Treatment with NAA alone though showed promising results in the beginning up to 12 days but failed to exert its influence towards the end of the experiment i.e. 20 days after storage. Similar trend was also noticed in control though not as good as NAA treatment. Minimum shrinkage was observed in fruits treated with PMAP followed by GA_3 treatments at 20 days of storage, but the results were not statistically significant. These findings confirm the results reported by Jana and Chottopadhya (3), Gupta *et al.* (2) and Sharma & Bashera (6).

The data pertaining to rotting of fruits in storage (Table 2) revealed that the post harvest spoilage of fruits occurred due to microbial attack as well as enzymatic reaction. The conditions which favoured the growth of microbes could hasten the spoilage of fruits. The temperature also plays vital role in enzymatic degradation of the produce. In the present experiment, the fruits treated with NAA showed no sign of rotting up to 12^{th} day. The maximum rotting in the beginning i.e. up to 8^{th} day in the storage was recorded for the treatment with NAA+MAP followed by GA_3+MAP (on 14^{th} day of storage). Minimum rotting was noted with NAA and GA_3 though results were not significant. On 16^{th} day of storage all the fruits kept under MAP were found rotten. On 18^{th} day minimum percentage of rotting was noted in GA_3+MAP treated fruits. On 20^{th} in storage all most all the fruits were rotted irrespective of treatment. These results are in conformation with the findings of Gupta *et al.* (2), Sharma and Basera (6), Geeson and Browne (1), and Wills *et al.* (9).

CONCLUSION

The fruits under control, NAA, GA_3, MAP, PMAP and GA_3+MAP treatments showed no shrinkage up to 6^{th} day after storage whereas shrinkage occurred from the 2^{nd} day of storage in

Table 1: Percentage shrinkage of peel as influenced by various post harvest chemicals and MAP treatments.

Treatments	Shrinkage Percentage									
	Days in storage									
	2	4	6	8	10	12	14	16	18	20
Control	0	0	0	0	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	17.2(18.9)	30.5(38.5)
NAA 50ppm	0	0	0	0	0	0	10.5(18.9)	10.5(18.9)	10.5(18.9)	30.5(38.5)
GA3 50ppm	0	0	0	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	17.2(18.9)	
MAP	0	0	0	0	10.5(18.9)	10.5(18.9)	20.5(26.2)			
PMAP (3%)	0	0	0	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)		
NAA 50ppm + MAP	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	30.5(33.5)	30.5(33.5)		
NAA 50ppm + PMAP	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	10.5(18.9)	30.5(33.5)	30.5(33.5)	30.5(33.5)	30.5(33.5)	
GA_3 50ppm+ MAP	10.5(18.9)	10.5(18.9)	17.5(23.8)*	17.5(23.8)	20.5(26.2)	20.5(26.2)	30.5(33.5)	30.5(33.5)	30.5(33.5)	
GA_3 50ppm+ PMAP	0	0	0	0	10.5(18.9)	10.5(18.9)	20.5(26.2)	30.5(33.5)	30.5(33.5)	30.5(33.5)
CD (P=0.05)	6.3	6.3	6.3	NS	NS	NS	NS	NS	NS	NS

(Angular transformed values are presented in parenthesis)

Table 2: Spoilage of tomato fruits as affected by various post harvest chemicals and MAP treatments.

Treatments	Rotting Percentage									
	Days in storage									
	2	4	6	8	10	12	14	16	18	20
Control	0	0	0	0	0	5.5(13.6)	10.5(18.4)	12.2(20.0)	65.5(56.3)	95.5(77.7)
NAA 50 ppm	0	0	0	0	0	0	5.5(13.6)	8.8(16.8)	65.5(56.3)	95.5(77.7)
GA_3 50 ppm	0	0	0	0	5.5(13.6)	5.5(13.6)	12.2(20.0)	95.5(77.7)		
MAP	0	5.5(13.6)	5.5(13.6)	5.5(13.6)	8.8(16.8)	12.2(20.0)	95.5(77.7)			
PMAP (3%)	0	0	0	5.5(13.6)	5.5(13.6)	8.8(16.8)	95.5(77.7)			
NAA 50 ppm + MAP	5.5(13.6)	5.5(13.6)	8.8(16.8)*	10.5(18.4)*	10.5(18.4)	15.5(23.2)	55.5(50.5)	95.5(77.7)		
NAA 50 ppm + PMAP	0	0	0	5.5(13.6)	5.5(13.6)	5.5(13.6)	12.2(20.0)	65.5(56.3)	95.5(77.7)	
GA_3 50 ppm + MAP	5.5(13.6)	5.5(13.6)	5.5(13.6)	8.8(18.8)	10.5(18.4)	10.5(18.4)	50.5(45.7)	55.5(48.1)	95.5(77.7)	
GA_3 50 ppm + PMAP	0	0	0	5.5(13.6)	5.5(13.6)	5.5(13.6)	35.5(35.0)	50.5(45.6)	55.5(48.2)	95.5(77.7)
CD (P = 0.05)	4.5	6.2	3.2	4.3	NS	NS	NS	NS	NS	NS

(Angular transformed values are presented in parenthesis)

other treatments. The maximum shrinkage was noted in fruits treated with GA_3 + MAP. The fruits treated with 50 ppm NAA, though showed better results in the initial part of the experiment, but failed to show its influence towards the end of the experiment. The minimum shrinkage was noted in fruits treated with PMAP followed by GA_3 treatment after 10 days of storage. The fruits treated with NAA at 50 ppm showed no sign of rotting up to 12 days, whereas maximum rotting was recorded in the fruits treated with NAA+MAP followed by GA_3+MAP on 14^{th} day.

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