Plant Archives Vol. 24, Special Issue (GABELS), 2024 pp.630-633 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.SP-GABELS.098

EFFECT OF PACKAGING MATERIALS AND CHEMICAL TREATMENTS ON POST-HARVEST LIFE AND QUALITY OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.) IN STORAGE ENVIRONMENT

Garima Tiwari[1], Harish Chandra Yadav[2*], Anand Singh[2], Virendra Kumar Patel[3], Hari Baksh[5], Saurabh[4] and Satish Yadav[1]
[1]Integral Institute ofAgricultural Sciences and Technology (I.I.A.S.T.)
Integral University Lucknow. (U.P.) -226026, India
[2]Department of Fruit Science, College of Horticulture, Banda University of Agriculture and Technology, Banda. (U.P.) -210001, India
[3]S.D.J.P.G. College, Chandeshwar, Azamgarh (U.P.) – 276128, India
[4]College of Community Science, Banda University of Agriculture and Technology, Banda. (U.P.) -210001, India
[5]Department of Horticulture, Tilak Dhari P.G. College, Jaunpur -222002, Uttar Pradesh, India
*Corresponding author e-mail: harishyadav9453@gmail.com

ABSTRACT

The Department of Agriculture, Integral Institute of Agricultural Science and Technology, Lucknow (U.P.), undertook an experiment during 2019–2020 to examine the impact of postharvest treatments and packaging on shelf-life and quality of tomato in storage environments. Corrugated fibre boxes (CFB), paper bags, polyethylene bags, and jute bags were utilized for packing purposes. Three different chemical levels, calcium chloride, potassium permanganate, and boric acid were used as parts of treatment. Experiment was laid out in completely randomized design (CRD) and three replications. The tomato fruit was examined after a period of five days (0, 5, 10, and 15). Additionally, the combination of treatments significantly delayed changes in TSS, total sugar, acidity, colour, weight loss, and lycopene composition. There were significant losses in both quantity and quality between harvest and consumption. The experiment's results indicate that the most effective post-harvest treatment for tomato transportation and storage is the application of potassium permanganate in combination with a polythene bag. Research demonstrates that this treatment not only decreased tomato rotting and increased shelf life, but also enhances acidity, ascorbic acid, sugar, and lycopene content on the 15th day of storage.
Keywords: tomato rotting, lycopene, chemicals, packaging materials, and ascorbic acid.

Introduction

Lycopersicon esculentum Mill., is a significant and nutritious vegetable crops. China, the United States of America, India, Egypt, Turkey, Iran, Italy, Mexico, Brazil, and Indonesia are currently the world's top producers of tomatoes. It is liked for its flavour, nutritional value, and range of applications. Consuming tomato fruit in salads, both raw and cooked, or in processed forms like jam, jelly, juice, ketchup, pickles, sauce, preserved puree, paste, powder, and other goods, is quite popular. Thompson (1994) refers to tomato fruit as the "poor man's apple" due to its lovely beauty and extremely high nutritional value, which includes calcium, potassium, and vitamins A and C. According to Zhang *et al.* (1986), the nutritional content of 100g of ripe tomatoes is 18 kcal of energy, 4.0g of carbohydrates, 2.6g of sugars, 1.0g of dietary fibre, 0.2g of fat, 1.0g of protein, 95g of water, and 13mg of vitamin C. Tomatoes are a climacteric and perishable produce, with a typical lifespan of two to three weeks. Enhancing the quality of tomato fruits and extending their shelf life are highly needed outcomes. We refer to a clear plastic bag with tiny perforations which are available in a variety of sizes Pota & Associates (1987) for shelf-life extension. Gunny bags, named after burlap, serve a variety of purposes, including the export and conveyance of agricultural products. Irtwange (2006). Burlap is a woven fabric composed of natural fibres like jute. These sacks are environmentally beneficial due to their construction from natural fibres. Furthermore, the tightly woven nature of these bags makes them difficult to damage. Many studies have explained the reduction of postharvest deterioration by calcium chloride as it enhances quality, delays ripening or aging, and controls the development of physiological disorders (Grant *et al*., 1973; Stanly *et al*., 1995). It strengthens the skin by increasing the tissue's resistance to enzymes produced by bacteria and fungi, which in turn limits infection while regulating repining and storage breakdown, according to Mingani *et al.* (1995). Both decaying and rotting occur simultaneously (Conway and Sam, 1986). While in storage, vegetables undergo several physical and chemical changes. Additionally, water loss during storage impacts the quality of most fruits and vegetables.

Materials and Methods

Experiment entitled "Effect of packaging materials and chemical treatments on post-harvest life and quality of tomato (*Lycopersicon esculentum* Mill.) in storage environment " was undertaken at the Department of Agriculture, Integral Institute of Agricultural Science and Technology, Lucknow, Uttar during 2019–2020. Uniform sized, fully grown tomatoes on the campus farm were used as experimental material. Bruised and immature fruits were discarded from the study. Fruits were cleaned using tap water. Corrugated fiber boxes (CFB), paper bags, polyethylene bags, and jute bags for packing purposes were taken as packaging materials. Three different chemical levels, calcium chloride, potassium permanganate, and boric acid were used to enhance the shelf life of tomatoes under study. Observations were noted at 0-, 5-, 10-, and 15-days interval in storage period. Additionally, the combination of treatments significantly affected the TSS, total sugar content, pH, fruit color, lycopene content etc. There were 13 treatments T1P1- Calcium Chloride with Polythene bag, T1P2- Calcium Chloride with Gunny bag, T1P3- Calcium Chloride with Corrugated Boxes, T1P4- Calcium Chloride with Paper bag, T2P1- Potassium permanganate with Polythene Bag, T2P2- Potassium permanganate with Corrugated boxes, T2P3- Potassium permanganate with Corrugated boxes, T2P4- Potassium permanganate with Paper bag, T3P1- Boric acid with Polythene bag, T3P2- Boric acid with Gunny bag, T3P3- Boric acid with corrugated boxes, T3P4- Boric acid with Paper bag, T0P0- Absolute Control, replicated thrice, using a randomized design (CRD).

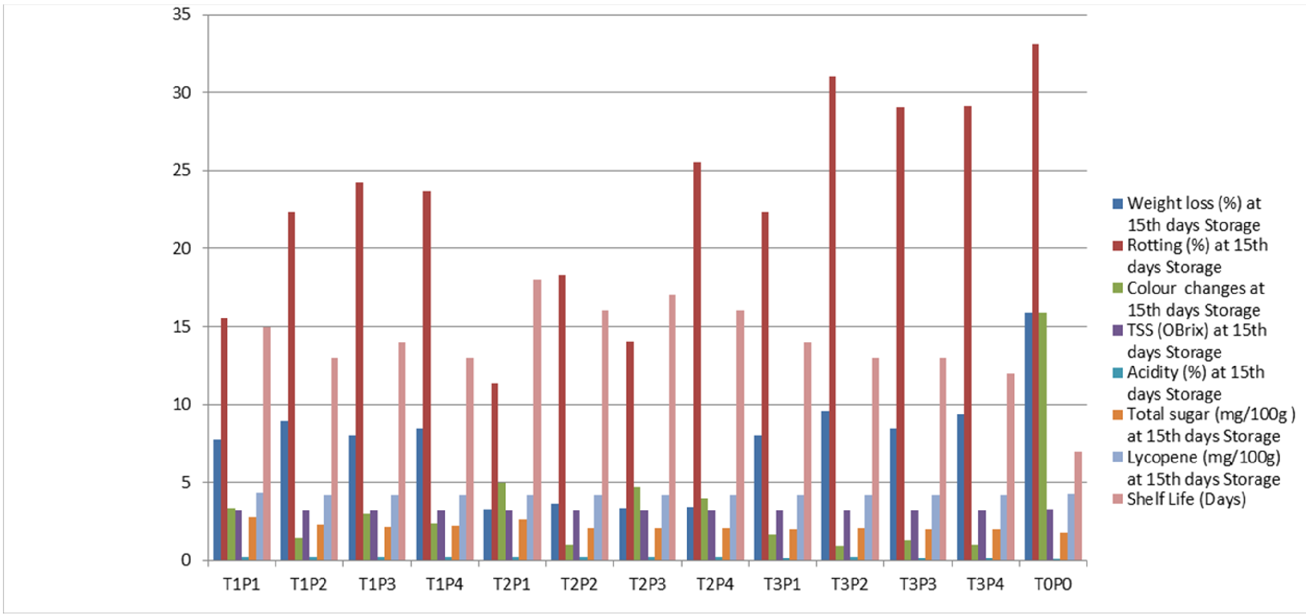
Results and Discussion

The observations finding recorded of the present study have been enumerated in technical manner. Experimental data on usage of different chemicals, packaging materials, and their combination impacted the weight loss of tomato fruits during storage, as well as the physiological weight loss.

Various combinations of chemical and packing material treatments significantly reduced fruit weight loss during storage (Table-1). However, a number of chemicals and packaging materials greatly slowed the rate at which weight loss increased. Among all the treatments tested, a 0.1% potassium permanganate + polythene bag (T_2P_1) yielded the least weight loss (5.26%), while an absolute control showed the highest weight loss (15.86%), followed by a 0.5% Boric acid + Gunny bag (T_2P_2) with a weight loss of 9.60% until the fifteenth day of storage. Sammi and Masud, T. (2007), and Rajput *et al.* (2008), provide evidence to support these findings. The amount of fruit rotting during storage has decreased. We found the lowest percentage of rotting (11.36%) in a polythene bag (T_2P_1) containing 0.1% potassium permanganate, and the highest percentage (33.12%) in an absolute control. The findings of Mehta *et al.* (1987) and Wills *et al.* (1981) corroborated the same conclusions. The combined application of chemicals and packaging materials impacted tomato fruit colour development during storage. Conversely, the absolute control yielded the maximum dark red tomato, while a polythene bag containing 0.1% potassium permanganate yielded the maximum pink tomatoes. Rite's and Narciso's (2006) observations were similar. The TSS concentration of the fruit decreased during storage, but there was no significant interaction between the chemicals and the packaging at any point. The T_1P_1 treatment with calcium chloride and polythene bag produced a minimum TSS of 3.216°Brix on the fifteenth day, while the absolute control showed a maximum TSS of 3.27°Brix. The outcomes concur with the findings of Wang and Morris (1993) and Sadler *et al.* (1990). The mixture of chemicals and packaging material had no discernible effect on the fifteenth day of storage. On the fifteenth day of storage, the calcium chloride + polythene bag (T_1P_1) treatment showed the highest lycopene concentration (4.37 mg/100 g fruit), while the potassium permanganate treatment with corrugated boxes and paper bags showed the lowest (4.20 mg/100 g fruit). The results corroborate the findings of Sompoch and Chanthaporn (2006), who discovered that simultaneous application of chemicals and packing materials increased the shelf life of tomato fruits during storage. However, when packaged in a polythene bag, 0.1% potassium permanganate showed the greatest shelf life of 18 days, while perfect control showed the shortest shelf life of 7 days. Mignani *et al.* (1995) reported that this was the minimum shelf life.

Table 1 : Combined effect of chemicals and packaging materials on physiological and chemical characteristics of tomato fruits in storage environment.

Treatments	**Weight loss (%) at 15^{th}days Storage**	**Rotting (%) at 15^{th}days Storage**	**Colour changes at 15^{th}days Storage**	**TSS (^{O}Brix) at 15^{th}days Storage**	**Acidity (%) at 15^{th}days Storage**	**Totalsugar (mg/100g) at 15^{th}days Storage**	**Lycopene (mg/100g) at 15^{th}days Storage**	**Shelf Life (Days)**
T_1P_1	7.72	15.52	3.33	3.21	0.27	2.76	4.37	15
T_1P_2	8.96	22.33	1.42	3.23	0.26	2.28	4.22	13
T_1P_3	8.02	24.28	3.00	3.24	0.23	2.17	4.21	14
T_1P_4	8.43	23.71	2.33	3.24	0.24	2.24	4.22	13
T_2P_1	3.26	11.36	5.0	3.24	0.24	2.66	4.21	18
T_2P_2	3.67	18.28	1.00	3.24	0.21	2.09	4.22	16
T_2P_3	3.33	14.05	4.67	3.24	0.24	2.10	4.20	17
T_2P_4	3.41	25.52	4.00	3.25	0.21	2.08	4.20	16
T_3P_1	8.02	22.33	1.67	3.24	0.19	2.01	4.23	14
T_3P_2	9.60	31.07	0.92	3.25	0.21	2.09	4.21	13
T_3P_3	8.43	29.05	1.33	3.25	0.17	2.01	4.22	13
T_3P_4	9.37	29.12	1.00	3.25	0.14	2.01	4.22	12
T_0P_0	15.86	33.12	15.86	3.27	0.13	1.80	4.25	7
S.EM+	0.23	0.41	0.23	0.09	0.00	0.06	0.12	0.4
CDat5%	0.69	1.22	0.69	NS	0.01	0.19	NS	NS



Conclusion

On the basis of result obtained in the present investigation we can conclude that the combination of potassium permanganate and polythene bag is the most effective post-harvest treatments for transporting and storing tomatoes, considering factors such as PWL

(%), rotting, and fruit shelf life. Furthermore, this treatment maintained the fruit quality in terms of total soluble solids (TSS), acidity, ascorbic acid, sugar, and lycopene content during the 15th day of storage. It may therefore be recommended that before storage, growers and retailers may pack the tomato fruits in a potassium permanganate + polythene bag treatment. Store the tomato fruits at ambient room temperature (25°C, 35°F, i.e., average minimum and maximum, and RH 65 to 85%) to extend their shelf life for up to 15 days.

References

Irtwange, S.V. (2006). Application of modified atmosphere packaging and relatedtechnologyin post harvesthandling offreshfruits and vegetables.*Agric. Eng. International*: The CIGRE. *J. Invited Overview*, 4(8), 72-76.

Mehta, A.M.R., Jordan, C., Mattoo, A.K., Solger, M. and Anaderson, J.D. (1987). ACC synthase from tomato fruit identification general occurrence and development regulation using monoclonal antibodies. *Plant Physiology,* 83, 114.

Mignani, I., L. C. Greve, R. Ben-Arie, H.U., Stotz, C.L., Shakel, K. and Labavitch, J. (1995). The effect of GA and divalent cations on aspects of pectinmetabolism and tissue softening of ripening tomato pericarp *Physiol. Physiol Plant*., 93, 108-115.

Pota, S., Ketsa, S. and Thongtham, M.L.C. (1987). Effect of packing materialand temperatures on quality and storage life of pomegranate fruits (*Punicagranatum*L.). *Kasetsart J., Natural Science,* 21(4), 328 333.

Rajput, B.S., Lekhe, R., Sharma, G.K. and Singh, L. (2008). Effect of pre andpostharvest treatments on shelf- life and quality of guava fruits. *(Psidium guajava* L.) cv. Gwalior-27. *The Asian Journal of Horticulture,* 3(2), 368-371.

Ritenour, M., Narciso, J.A. (2006). Postharvest calcium chloride dips of wholetomato fruit reduce postharvest decay under commercial conditions. *Hort Science*, 41(4), 1016-1017.

Sadler, G., Davis, J. and Deyman, D. (1990). Rapid extraction of lycopene andbeta carotene from reconstituted tomato paste and pink grape fruit homogenate. *J.Food Sci.,* 55, 1460-1465.

Sammi and Masud, T. (2007). Effect of different packaging systems on storagelife and quality of tomato *(Lycopersicon esculentum* var. Rio Grande) during different ripening stages. *International J. of Food Safety*, 9, 37-40.

Sompoch G. and Chanthaporn, C. (2006). Effect of calcium chloride infiltration quality and storage life of tomato *(Lycopersicon esculentum* Mill). Proceeding of the 32nd Congress on Science and Technology of Thailand.

Thompson, J.F. (1994). Ethylene control in storage facilities. Perishables handlingnewsletter. Issue No.80.P.7. http:/crops. Calpoly. Edu/Brown/Postharvest 1/ lecmaterials/Ethylene.Pdf.Updateon 2004 January. Accessed 2004March 22.

Wang, S. and Morris, S.C. (1993). Effects of Borax and Guazatine on ripening and postharvest diseases of Tomato (cv. Flora-dade). *Acta. Hort*. (ISHS) 343(1), 331-333.

Wills. R.H.H., Lee, T.H., Graham, D., McGlasson, W.B. and Halls, E.G. (1981). Postharvest: An Introduction of Physiology and Handling of Fruits and 1999. Review on the studies on tomato storability. *Acta Hort*. (ISHS) 487(1), 163-163.

Zhang, O.C., Huang. J.W. Tan, D.F. and Ye, W. (1986). A brief report on thestudy of fresh litchi preservation. *Pl. Physiol. Communications* No. 1, 35-36.