IJPPHT ⇨ ISSN-0976-5638

Volume 11 | Issue 2 | December, 2020 | 27-33
■ Visit us: *www.researchjournal.co.in*

International Journal of Processing and Post Harvest Technology

RESEARCH PAPER

DOI: 10.15740/HAS/IJPPHT/11.2/27-33

Response of physical parameters of tomato against various kinds of packaging materials

■ Ankush Chandla*, Kulveer Singh Yadav, Monika **and** Sachin Kishor
School of Agricultural Sciences and Technology, R.I.M.T. University, **Mandi Gobindgarh (Punjab) India**
Email: ankushchandla17@gmail.com)

*Author for Correspondence

■ **Research chronicle : Received :** 05.07.2020; **Revised :** 20.08.2020; **Accepted :** 21.10.2020

SUMMARY :

The present study was conducted in Horticulture Lab at School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh, Punjab, India. This investigation was done to study the effect of different types of packaging materials on shelf-life, quality and storage of tomato cv. Heemsohna during the year 2020. The results revealed that out of the seven treatments, the treatment T_4 (Black Polythene) showed best result as compared to other treatments except treatment T_3 (Yellow Polythene) were recorded highest fruit weight, fruit length, fruit diameter and fruit pH. Thus, it can be concluded that packaging of tomato fruits in polyethylene bags resulted in longer shelf-life and improved quality of the produce followed by packaging in black polythene bags. It was concluded that tomatoes wrapped in polyethylene bags were better in quality with longer shelf-life.

KEY WORDS : Packaging material, Black polythene, Yellow polythene, Heemsohna

How to cite this paper : Chandla, Ankush, Yadav, Kulveer Singh, Monika and Kishor, Sachin (2020). Response of physical parameters of tomato against various kinds of packaging materials. *Internat. J. Proc. & Post Harvest Technol.,* **11**(2) : 27-33. **DOI: 10. 15740/HAS/IJPPHT/11.2/27-33.** Copyright@2020: Hind Agri-Horticultural Society.

Tomato (*Solanum lycopersicum*) is one of the most widely consumed fresh vegetables in the world both for fresh fruit market and for the processing industries. Tomato belongs to Solanaceae family having chromosome number 2n=12 and it is native to Peru, Mexico and is cultivated all over the country due to its wider adaptability to soil and climate. Tomato is commercially produced in Assam, Punjab, Jharkhand, Telangana, Gujarat, Orissa, West Bengal, Bihar, Maharashtra and Chhattisgarh (APEDA, 2017). Fresh tomato quality is determined by the appearance, colour, firmness and flavour (Garcia *et al*., 2014). Tomato is worldwide known as "No. 1 processing vegetable" because of its demand not only in processing sector but also as a vegetable and protective food (Pramanik *et al*., 2018). Tomato contains lycopene, a carotenoid, which is a powerful anti-oxidant and protects human from cancer and heart diseases (Singh *et al*., 2019).

Post harvest management of fruits comprises of different steps and packaging is one of them. Packaging is also important to maintain quality through tomato commercialization and distribution chain. Among the various techniques developed to extend fruit postharvest life, the use of plastic film is growing in importance because it is convenient in the many different conditions throughout the chain of handling from producer to consumer (Sualeh *et al*., 2016). Quality of most fruits and vegetables is affected by water loss during storage, which depends on the temperature and relative humidity conditions (Perez *et al*., 2003). Sealing of tomatoes in polyethylene film packages extended the length of time until ripening (Castro *et al*., 2005).

Packaging materials has been reported to affect the quality of farm produce, especially fruits and vegetables during storage. Packaging has been reported to significantly reduce fruit weight loss and that tomatoes sealed in plastic films have an extended marketable life. Polyethylene is the most commonly used polymer film used for packaging of fresh horticultural products (Sibomana *et al*., 2015). Sammi and Masud (2009) reported that packaging can significantly reduce fruit weight loss of tomatoes when sealed in plastic films and can extend the marketable life of many fresh fruits and vegetables through the inhibition of physiological deterioration and reducing weight loss (Mekonnen, 2017). The benefits of packaging have been extensively studied in extending shelf-life of many fruits and vegetables (Ayhan, 2011). The present study was designed to evaluate the effect of different packaging materials to improve the storage life and to access the quality of tomato fruits.

EXPERIMENTAL METHODS

Description of the study area :

The experiment was conducted in Horticulture Lab, School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh, Punjab during 2020, which is situated at 30 56' 11.90''N latitude and 76 18' 13.18''E at an elevation of 268 meters above mean sea level. The climate of Mandi Gobindgarh is typically semi-arid and sub-tropical with hot and dry summer (April to June), hot and humid monsoon period (July to September), mild winter (October to November) and cold winter (December to February). The mean daily maximum and minimum temperature during the growing season of tomato fluctuated between 23ºC and 19ºC, respectively and relative humidity ranged from 62 to 66 per cent. There was a total rainfall of 70 mm during experimentation.

Treatments and experimental design :

Our experiments were carried out as a lab experiment. The experiment was planned with seven treatments *viz.,* Control (T_1), White transparent polythene (T_2), Yellow polythene (T_3), Black polythene (T_4), Newspaper (T_5), Tissue paper (T_6), Paddy straw (T_7) in a Completely Randomized Design (CRD) with three replications. Three tomato fruits were kept in each replication according to the treatments.

Experimental materials :

Matured red coloured tomatoes cv. Heemsohna was bought from local market. The tomato fruits had medium size. The tomato fruits were free from defects such as sun scorch and pest or disease damage. Initially, tomatoes were cleaned, washed, dried before preparing for experiment. Then tomatoes were divided into seven treatments. Six types of packing material were taken *i.e.* White transparent polythene, Yellow polythene, Black polythene, Newspaper, Tissue paper, Paddy straw were used.

Statistical analysis :

The data on various physical characters were recorded and statistically analysed. The qualitative characters were analyzed by the analysis of variance (ANOVA) technique. The data to be recorded will be analyzing using MS-excel and OPSTAT as per the design of experiment for working out the values. The critical difference values were calculated at 1 per cent level of significance.

EXPERIMENTAL FINDINGS AND ANALYSIS

A lab experiment was conducted to determine the effect of different types of packaging materials on shelf-life, quality and storage of tomato cv. Heemsohna. Data depicted in tables showed that different packaging materials had significant effect on fruit weight, fruit diameter, fruit length, fruit colour, fruit shrinkage, fruit decay, physiological weight and specific gravity of tomato fruit during storage.

Fruit weight :

The results indicated that the effect of packaging materials on fruit weight as significantly different at various levels of storage. Data about fruit weight is presented in Table 1. In the day one of experiment, maximum fruit weight (71.33 g) was recorded with T_4 (Black Polythene) which was followed by T_3 (69.45 g), T_6 (68.69 g) and T_2 (63.33 g). While the minimum fruit weight (57.89 g) was recorded in T_1 (control). During the seventh day of experiment, treatment T_4 (Black Polythene) resulted utmost fruit weight (59.89 g) and it was followed by T_3 (58.11 g), T_7 (58.00 g) and T_2 (57.78 g). Lowest fruit weight was noticed in T_1 (control). In the fourteenth day of experiment, T_4 (Black Polythene) noticed with greater fruit weight (46.84 g) which was followed by T_3 (45.33 g), T_1 (44.66 g) and T_2 (38.15 g). Whereas, T_7 (Paddy straw) resulted lesser fruit weight (34.42 cm) in comparison of all other treatments. During the twenty first day of experiment, treatment T_3 (Black Polythene) reported highest fruit weight (24.55 g) followed by T_4 (23.40 g), T_6 (22.47) and T_2 (20.93). The lowest fruit weight was noticed in T_2 (White transparent polythene) while, treatment T_1, T_5 and T_7 were unable to produce fruit weight. These results are in coincide with result of Wills *et al*. (2007) and Kumar *et al*. (2003) in guava who found that, maximum fruit weight was obtained with the polyethylene bags.

Fruit length :

Data about fruit length are presented in Table 1. The results indicated that the effect of packaging materials on fruit length as significantly different at various levels of storage. The data pertaining to the length of tomato fruit indicates that maximum length of tomato (6.30 cm) was noted with T_4 (Black polythene) which was followed by T_3 (6.26 cm), T_7 (6.20 cm) and T_1 (5.74 cm). Whereas, lowest fruit length (4.94 cm) was reported in T_2 (White transparent polythene). During the seventh day of experiment, treatment T_4 (Black polythene) reported maximum fruit length (6.05 cm) and it was followed by T_1 (5.27 cm), T_3 (5.70 cm) and T_7 (5.69 cm). Minimum fruit length was noticed in T_2 (White transparent polythene). In the fourteenth day of experiment, T_4 (Black polythene) found with highest fruit length (5.40 cm) which was followed by T_3 (5.17 cm), T_1 (44.80 cm) and T_7 (4.66 cm). Whereas, T_2 (White transparent polythene) resulted lowest fruit length (3.97 cm) in comparison of all other treatments. During the twenty first day of experiment, greater fruit length (4.37 cm) was noticed under treatment T_4 (Black polythene) followed by T_3 (3.90 cm), T_6 (3.58 cm) and T_2 (2.90 cm). The lesser fruit length (2.90 cm) was noticed in T_2 (White transparent polythene) while, treatment T_1, T_5 and T_7 were unable to produce fruit length. It was also conformity of Prasad *et al*. (2015) in banana who recorded maximum fruit length with the use of tissue paper, Pratap *et al*. (2017) in sapota who observed maximum fruit length with the use of high density polythylene (20μ) and Miano *et al*. (2016) in cucumber was obtained maximum fruit length when packaged in newspaper.

Fruit diameter :

Data about fruit diameter are depicted in Table 2. The results shows that maximum fruit diameter of tomato (4.40 cm) was noted where the tomato packed in T_4 (Black polyethylene bags) under ambient temperature which was followed by T_2 (4.20 cm), T_7 (3.90 cm) and T_6 (3.67cm) in the day one of experiment. While lowest fruit diameter (2.87 cm) was found in T_3 (Yellow polythene). During the seventh day of experiment,

Table 1: Response of physical parameters of tomato against various kinds of packaging materials

Treatments	Fruit weight (g)				Fruit length (cm)			
	Day 1	Day 7	Day 14	Day 21	Day 1	Day 7	Day 14	Day 21
Control	57.89	52.11	44.66	0.00	5.74	5.27	4.80	0.00
White transparent polythene	63.33	57.78	38.15	20.93	4.94	4.37	3.97	2.90
Yellow polythene	69.45	59.89	45.33	24.55	6.30	5.70	5.40	3.90
Black polythene	71.33	58.11	46.84	23.40	6.26	6.05	5.17	4.37
News paper	62.33	50.11	36.09	0.00	5.09	4.67	3.98	0.00
Tissue paper	68.69	52.45	36.83	22.47	5.61	4.93	4.33	3.58
Paddy straw	59.33	58.00	34.42	0.00	6.20	5.69	4.66	0.00
S.E. ±	0.68	0.69	0.58	0.58	0.15	0.16	0.24	0.20
C. D. (P=0.01)	2.87	2.89	2.45	2.42	0.64	0.66	1.00	0.85

treatment T_4 (Black polythene) resulted maximum fruit diameter (4.17 cm) and it was followed by T_3 (3.90 cm), T_7 (3.87 cm) and T_6 (3.47 cm). Minimum fruit diameter was noticed in T_2 (White transparent polythene). In the fourteenth day of experiment, T_4 (Black polythene) recorded with utmost fruit diameter (3.83 cm) which was followed by T_3 (3.60 cm), T_1 (2.87 cm) and T_5 (2.70 cm). Whereas, T_2 (White transparent polythene) resulted minimum fruit diameter (2.20 cm) in comparison of all other treatments. During the twenty first day of experiment, treatment T_3 (Black polythene) found with greater fruit diameter (3.20 cm) and it was followed by T_4 (3.00 cm), T_2 (2.30 cm) and T_6 (2.13 cm). The lesser fruit diameter (2.13 cm) was noticed in T_6 (Tissue paper). Treatment T_1, T_5 and T_7 were unable to produce fruit diameter. These results are supported with the findings of Miano *et al*. (2016) in cucumber who had recorded maximum fruit diameter when packaged in polyethylene bags, Pratap *et al*. (2017) in sapota who observed maximum fruit diameter with the use of cling film and Prasad *et al*. (2015) in banana who had reported maximum fruit diameter was obtained when tissue paper was used.

Physiological weight :

The effect of different packaging materials on physiological weight loss of tomato stored at ambient temperature. Data about physiological weight are depicted in Table 2. In the day one of experiment, there was no observation recorded in any treatment. During the seventh day of experiment, treatment T_4 (Black polythene) resulted minimum physiological weight loss (5.56%) and it was followed by T_3 (6.77%), T_5 (7.30%) and T_2 (11.57%). Maximum physiological weight loss was noticed in T_1 (Control). In the fourteenth day of experiment, T_4 (Black polythene) recorded with lesser physiological weight loss (11.08%) which was followed by T_3 (12.43%), T_2 (22.87%) and T_1 (27.78%). Whereas, T_5 (News paper) resulted greater physiological weight loss (2.20%) in comparison of all other treatments. During the twenty first day of experiment, treatment T_4 (Black polythene) found lowest physiological weight loss (25.47 %) followed by T_3 (27.80 %), T_1 (43.85 %) and T_6 (52.32 %). The highest physiological weight loss was noticed in T_6 (Tissue paper) while, treatment T_2, T_5 and T_7 were unable to produce physiological weight loss. Present findings get support from the work done by Jawandha *et al*. (2014) in lemon recorded minimum physiological weight loss with film sealed fruits.

Fruit colour :

The effect of different packaging materials on fruit colour of tomato stored at ambient temperature is presented in the Table 3. In the day one of experiment, maximum fruit colour (58.00%) was observed with T_4 (Black polythene) which was followed by T_5 (49.00%), T_7 (57.00%) and T_6 (49.67%). while the minimum fruit colour (49.00%) was reported in T_5 (News paper). During the seventh day of experiment, treatment T_4 (Black polythene) resulted utmost fruit colour (70.33%) and it was followed by T_7 (69.00%), T_3 (68.00%) and T_1 (67.00%). Lowest fruit colour was noticed in T_5 (News paper). In the fourteenth day of experiment, T_4 (Black polythene) recorded with highest fruit colour (58.00%) which was followed by T_3 (81.00%), T_7 (80.00%) and T_1 (77.00%). Whereas, T_5 (News paper) resulted lowest fruit colour (71.33%) in comparison of all other treatments. During the twenty first day of experiment,

Table 2 : Response of physical parameters of tomato against various kinds of packaging materials

Treatments	Fruit diameter (cm)				Physiological weight loss (%)			
	Day 1	Day 7	Day 14	Day 21	Day 1	Day 7	Day 14	Day 21
Control	3.60	3.43	2.87	0.00	0.00	18.96	27.78	43.85
White transparent polythene	4.20	2.60	2.20	2.30	0.00	11.57	22.87	0.00
Yellow polythene	4.40	3.90	3.60	3.20	0.00	6.77	12.43	27.80
Black polythene	4.27	4.17	3.83	3.00	0.00	5.56	11.08	25.47
News paper	3.50	3.23	2.70	0.00	0.00	7.30	34.48	0.00
Tissue paper	3.67	3.47	2.40	2.13	0.00	16.28	31.16	52.32
Paddy straw	3.90	3.87	2.63	0.00	0.00	15.72	33.42	0.00
S.E. ±	0.07	0.08	0.08	0.06	0.00	0.57	0.67	0.60
C. D. (P=0.01)	0.30	0.34	0.33	0.27	0.00	2.38	2.83	2.53

treatment T_4 (Black polythene) noticed with greatest fruit colour (94.00 %) and it was followed by T_3 (92.33%), T_2 (87.00 %) and T_6 (82.00 %). The lesser fruit colour (82.00 %) was noticed in T_6 (Tissue paper) while, treatment T_1, T_5 and T_7 were unable to produce fruit colour. These results are in accordance with Sanchis *et al.* (2015) in pomegranate and Zaharah and Singh (2013) in mango they reported highest colour with the use of modified atmosphere packaging.

Fruit shrinkage :

Data showed that different packaging materials had significant effect on fruit shrinkage of tomato during storage is presented in the Table 3. In the day one of experiment, there was no observation recorded in any treatment. During the seventh day of experiment, treatment T_4 (Black polythene) resulted lowest fruit shrinkage (0.19%) and it was followed by T_3 (0.37%), T_5 (0.49%) and T_7 (0.64%). Maximum fruit shrinkage was noticed in T_1 (Control). In the fourteenth day of experiment, T_4 (Black polythene) found with lesser fruit shrinkage (1.30%) which was followed by T_3 (1.61%), T_6 (1.79%) and T_2 (1.84%). Whereas, T_1 (Control) resulted greatest fruit shrinkage (2.11%) in comparison of all other treatments. During the twenty first day of experiment, treatment T_4 (Black polythene) noticed minimum fruit shrinkage (3.01 %) followed by T_3 (3.14 %), T_6 (4.65 %) and T_1 (4.69 %). The utmost fruit shrinkage (4.69 %) was noticed in T_1 (White transparent polythene) while, treatment T_2, T_5 and T_7 were unable to produce fruit shrinkage. These results are supported by the findings of Singh (2017) in kinnow reported that minimum shrinkage per cent was obtained with the use of high density polyethylene.

Fruit decay :

Data depicted in Tables 4, showed that different packaging materials had significant effect on fruit decay of tomato during storage. In the day one of experiment, there was no observation noticed in any treatment. During the seventh day of experiment, treatment T_4 (Black polythene) resulted minimum fruit decay (0.25%) and it

Table 3 : Response of physical parameters of tomato against various kinds of packaging materials

Treatments	Fruit colour (%)				Fruit shrinkage (%)			
	Day 1	Day 7	Day 14	Day 21	Day 1	Day 7	Day 14	Day 21
Control	56.00	67.00	77.00	0.00	0.00	0.98	2.11	4.69
White transparent Polythene	53.33	63.00	74.67	87.00	0.00	0.79	1.84	0.00
Yellow Polythene	57.00	68.00	81.00	92.33	0.00	0.37	1.61	3.14
Black Polythene	58.00	70.33	82.33	94.00	0.00	0.19	1.30	3.01
News Paper	49.00	59.00	71.33	0.00	0.00	0.49	1.90	0.00
Tissue Paper	49.67	61.00	73.00	82.00	0.00	0.89	1.79	4.65
Paddy Straw	57.00	69.00	80.00	0.00	0.00	0.64	2.09	0.00
S.E.±	0.68	0.63	0.65	0.50	0.00	0.12	0.12	0.24
C.D. (P=0.01)	2.86	2.65	2.76	2.12	0.00	0.49	0.52	1.02

Table 4 : Response of physical parameters of tomato against various kinds of packaging materials

Treatments	Fruit decay (%)				Specific gravity (g/ml)			
	Day 1	Day 7	Day 14	Day 21	Day 1	Day 7	Day 14	Day 21
Control	0.00	1.97	5.19	6.67	0.93	0. 75	0.55	0.00
White transparent polythene	0.00	1.94	4.98	0.00	0.95	0.89	0.62	0.25
Yellow polythene	0.00	0.62	3.83	6.42	1.07	0.96	0.68	0.43
Black polythene	0.00	0.25	3.71	4.94	1.11	0.99	0.77	0.48
News paper	0.00	1.07	5.04	0.00	0.94	0.96	0.57	0.00
Tissue paper	0.00	1.35	4.79	5.62	0.98	0.87	0.59	0.35
Paddy straw	0.00	1.88	4.22	0.00	1.08	0.85	0.67	0.00
S.E.±	0.00	0.26	0.17	0.27	0.01	0.01	0.03	0.02
C.D. (P=0.01)	0.00	1.08	0.72	1.13	0.36	0.04	0.12	0.07

was followed by T_3 (0.62%), T_5 (1.07%) and T_6 (1.23%). Maximum fruit decay was noticed in T_1 (Control). In the fourteenth day of experiment, T_4 (Black polythene) recorded with lesser fruit decay (3.71%) which was followed by T_3 (3.83%), T_7 (4.22%) and T_6 (4.79%). Whereas, T_1 (Control) resulted utmost fruit decay (5.19%) in comparison of all other treatments. During the twenty first day of experiment, treatment T_4 (Black polythene) reported lowest fruit decay (4.94 %) and it was followed by T_3 (6.42 %), T_6 (5.62 %) and T_1 (6.67 %). The highest fruit decay was noticed in T_1 (Control) while, treatment T_2, T_5 and T_7 were unable to produce fruit decay. This result agrees with the findings of Mane (2013) in mango and Caleb *et al*. (2012) in pomegranate, who had reported lesser fruit decay percent with the use of plastic bags.

Specific gravity :

Data showed that different packaging materials had significant effect on specific gravity of tomato during storage are depicted in Table 4. In the day one of experiment, utmost specific gravity (1.11 g/ml) was observed with T_4 (Black polythene) which was followed by T_7 (1.08 g/ml), T_3 (1.07 g/ml) and T_6 (0.98 g/ml). Minimum specific gravity (0.953 g/ml) was found in T_5 (News paper). During the seventh day of experiment, treatment T_4 (Black polythene) resulted maximum specific gravity (0.99 g/ml) and it was followed by T_1 (0.96 g/ml), T_3 (0.96 g/ml) and T_2 (0.89 g/ml). Minimum specific gravity was noticed in T_5 (News paper) and T_7 (Paddy straw). In the fourteenth day of experiment, T_4 (Black polythene) recorded with highest specific gravity (0.77 g/ml) which was followed by T_3 (0.68 g/ml), T_7 (0.67 g/ml) and T_2 (0.62 g/ml). Whereas, T_5 (News paper) resulted lowest specific gravity (0.55 g/ml) in comparison of all other treatments. During the twenty first day of experiment, treatment T_4 (Black polythene) maximum specific gravity (0.48 g/ml) followed by T_3 (0.43 g/ml), T_6 (0.35 g/ml) and T_2 (0.25 g/ml). The lesser specific gravity was noticed in T_2 (White transparent polythene) while, treatment T_1, T_5 and T_7 were unable to produce specific gravity. These results are in accordance with the results of Singh *et al*. (2003) in guava who had reported highest specific gravity in tissue paper.

Conclusion:

The study concluded that black polyethylene bag is comparatively better packaging material to retain good quality attributes in tomatoes during storage. Moreover, tomatoes wrapped in polyethylene bags have better quality in terms of fruit weight, fruit colour and fruit shrinkage at red ripe stage.

LITERATURE CITED

Anonymous (2017). Statistical Database, Agricultural and Processed Food Products Export Development Authority, New Delhi, India.

Ayhan, Z. (2011). Effect of packaging on the quality and shelf-life of minimally processed/ready to eat foods. *Acad Food J.*, **9** (4): 36-41.

Caleb, O.J., Opara, U.L. and Witthuhn, C.R. (2012). Modified atmosphere packaging of pomegranate fruit and arils; a review. *Food Bioprocess Technology*, **5**: 15-30.

Castro, L.R., Cortez, L.A.B. and Clement, V. (2005). Effect of sorting, refrigeration and packaging on tomato shelf-life. College of Agricultural Engineering, State University of Campinas, Brazil, pp. 1-5.

Garcia, M.A., Ventosa, M., Diazi, R., Falco, S. and Casariego, A. (2014). Effects of Aloe vera coating on postharvest quality of tomato. *Emirates J. Food Agric.*, **69**: 117-126.

Jawandha, S.K., Harminder, S., Anita, A. and Jagjit, S. (2014). Effect of modified atmosphere packaging on storage of baramasi lemon (*Citrus limon* L.). *Int. J. Agric. Envion. Biotechn*, **7**: 635-638.

Kumar, J., Sharma, R.K., Singh, R. and Goyal, R.K. (2003). Effect of different types of polythene on shelf-life of summer guava. *Horti Society of Haryana*, **32**: 201-202.

Mane, A.V. (2013). Influence of 1- methylcyclopropene (1-MCP) on postharvest physiology and physicochemical changes in Alphonso mango (*Mangifera indica* L.). A Ph.D. Thesis, University of Agricultural Sciences, Dharwad, Karnataka (India).

Mekonnen, Z.T. (2017). Tomato quality as influenced by different packaging materials and practices. Int Renewable Energy Storage Conference, pp. 14-19.

Miano, T.F., Khaskheli, A.A., Miano, T.F. and Miano, F.N. (2016). Influence of packaging material on physico-chemical and sensory quality of cucumber under ambient and refrigeration temperatures. *Eur. Acad. Res.*, **4**: 4562-4585.

Perez, K., Mercado, J. and Soto-Valdez, H. (2003). Effect of storage temperature on the shelf life of Hass avocado (*Persea americana*). *Intern Food Sci. Technol*, **10**:73-77.

Pramanik, K., Pradhan, J. and Kumar, S.S. (2018). Role of auxin and gibberellins growth, yield and quality of tomato. *The Pharma Innov J*, **7**: 301-305.

Prasad, R., Ram, R.B., Kumar, V. and Rajvanshi, S.K. (2015). Study on effect of different packaging materials on shelf life of banana (*Musa paradisiaca* L.) cv. Harichal under different conditions. *Int J Pure Appl Biosci*, **3**: 132-141.

Pratap, S., Kumar, A., Sujeeta., Vikas., Singh, R., Singh, B. and Singh, H. (2017). Impact of different packaging materials on the shelf life of sapota fruits (*Acharus zapota* L.). *Int J Curr Microbiol App Sci*, **6** (8): 1124-1130

Sammi, S. and Masud, T. (2009). Effect of different packaging systems on storage life and quality of tomato (*Lycopersicon esculentum* var. Rio Grande) during different ripening stages. *Int J Food Safety*, **9**: 37-44.

Sanchis, E., Mateos, M. and Perez-Gago, M.B. (2015). Effect of maturity stage at processing and antioxidant treatments on the physico chemical, sensory and nutritional quality of freshcut 'Rojo Brillante' persimmon. *Postharvest Biol Technol*, **105**: 34-44.

Sibomana, C.I., Opiyo, A.M. and Aguyoh, J.N. (2015). Influence of soil moisture levels and packaging on postharvest qualities of tomato (*Solanum lycopersicum*). *African J Agri Res*, **10**: 1392-1400.

Singh, J., Dwivedi, A.K., Devi, P., Bajeli, J., Tripathi, A. and Maurya, S.K. (2019). Effect of plant growth regulators on growth and yield attributes of tomato (*Solanum lycopersicom* Mill.) *Int J Current Microbio Appli Sci*, **8**: 1635-1641.

Singh, S., Godara, A.K. and Bhatia, S.K. (2003). Effect of different packaging materials on the ethylene evolution rate in guava. *Horti Society of Haryana*, **32**: 203- 205.

Singh, V., Dudi, O.P. and Goyal, R.K. (2017). Effect of different packaging materials on post-harvest quality parameters of pear under zero energy chamber storage condition. *Int J Current Microbio Appli Sci*, **6**: 1167-1177.

Sualeh, A., Daba, A., Kiflu, S. and Mohammed, A. (2016). Effect of storage conditions and packing materials on shelf life of tomato. *Food Sci Quality Manag*, **56**: 60-67.

Wills, R.B.H., McGlasson, W.B., Graham, D. and Joyce, D.C. (2007). Post-harvest: An introduction to the physiology and handling of fruit, vegetables and ornamentals, 5th edition: CABI, pp. 502-508.

Zaharah, S.S. and Singh, Z. (2013). Nitric oxide fumigation delays mango fruit ripening. *Acta Hort*, (ISHS) 992: 543-550.