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Influence of Wax Coating and Virosil Agro on Storage Behaviour of Tomato

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ABSTRACT

Tomato fruits of cv. Punjab Chhuhara were treated with an edible wax coating, Stayfresh and eco-friendly chemical, Virosil Agro, separately and in combination at different concentration and fruits were stored in corrugated fibre board boxes at room temperature. Results indicated that the combined effect of Stayfresh and Virosil Agro had an additive effect in reducing the physiological loss of weight, delaying the ripening, maintaining quality and increasing the marketability for longer period. The efficacy of combined effect of high concentration of Stayfresh (i.e., Stayfresh : water in 1:2 ratio) and low concentration of Virosil Agro (0.25%) (T_6) was more pronounced than other treatments. However, T_7 i.e., Virosil Agro 0.50% + Stayfresh : water in 1:4 ratio and T_4 i.e., Stayfresh : water in 1:2 ratio also exhibited better results.

Key words : Edible coating, Stayfresh, Storage behaviour, Tomato, Virosil Agro.

In India next to potato, tomato (*Solanum lycopersicum* L.) is the most important vegetable crop. The fruits are highly perishable and seasonal commodity. The magnitude of post harvest losses in fresh fruit is estimated to be 20-50% in developing countries . To maintain quality of the tomato it should be kept in fresh condition. An average weight loss of 4.1% results in shriveled appearance of tomato which makes the tissue tough or mushy, loss of crispness, palatability and eventually unmarketable (Hrusekha, 1977). Now-a-days, range of formulation of edible coating have been developed to increase shelf-life of fruits and vegetables by post harvest treatments. Stayfresh is a commercial fungicidal wax emulsion edible coating meant for application in fresh produce to minimize the loss by preventing moisture loss, decay loss and reducing the respiration loss (Sashikala *et al*., 2002). Virosil Agro is a universally applicable disinfectant containing 48% hydrogen peroxide and 0.05% (H_2O_2) Silver ion (Ag+) as a stabilizing agent (Fallik *et al*., 1994 and Yair Aharoni *et al*., 1994). Thus in the present investigation, the influence of Stayfresh coating and biologically safe Virosil Agro chemical on storage behavior of tomato was studied.

MATERIAL AND METHODS

Tomato fruits to cultivar Punjab Chhuhara was harvested at breaker stage and thirty fruits per treatment were selected, washed and treated for 10 minutes with the following treatment combination viz., T_1 – Control (Water), T_2 – Virosil Agro 0.25%; T_3 – Virosil Agro 0.50%, T_4 – Stay fresh : water in 1:2 ratio; T_5 – Stayfresh : water in 1:4 ratio; T_6 – Virosil Agro 0.25% + Stayfresh : water in 1:2 ratio and T_7 – Virosil Agro 0.50% + Stayfresh : water in 1:4 ratio. The fruits were then removed from solution, dried in air and placed in corrugated fibre board boxes of 20 x 13 x 8 cm size with 5% ventilation and stored at room temperature (Temp. : 13 to 21^{o}C RH : 72-80%). Each treatment was replicated thrice in completely randomized design. Observation of physiological loss in weight (PLW %), ripening (%), marketability (%), fruit firmness (kg/cm^2), TSS to acid ratio was recorded at different days interval.

RESULTS AND DISCUSSION

Lowest Physiological loss of weight was recorded lowest in T_6 (Virosil Agro 0.25% + Stayfresh : water in 1:2 ratio) throughout the period of storage and it was only 5.65% on 25th day compared to 15.83% in control (Table 1). After 25th day of stprage control fruits no longer had market belity However even after 35 day of storage also PLW of T_6 was much lower (9.06%) than T_7 (Virosil Agro 0.50% + Stayfresh : water in 1:4 ratio), T_5 (Stayfresh : water in 1:4 ratio) and T_4 (Stayfresh

Table 1. Influence of post-harvest treatments on physiological loss of weight (PLW) of tomato during storage.

Treatments	PLW (%) Number of days in storage						
	5	10	15	20	25	30	35
T_1	3.25 (1038)	6.45 (14.70)	9.37 (17.80)	12.76 (20.92)	15.83 (23.43)	16.33 (23.84)	
T_2	2.98 (9.94)	5.15 (13.12)	7.53 (15.93)	10.62 (19.02)	13.41 (21.48)	14.92 (22.72)	
T_3	2.45 (9.01)	4.63 (12.42)	7.53 (15.93)	9.83 (18.27)	12.66 (20.84)	10.86 (19.23)	12.72
T_4	0.92 (5.37)	2.67 (9.41)	4.19 (11.80)	6.34 (14.58)	8.46 (16.90)	13.30 (21.39)	16.48
T_5	1.78 (7.67)	3.08 (10.10)	5.81 (13.94)	8.41 (16.85)	11.11 (19.47)	7.84 (16.26)	9.06
T_6	0.52 (4.15)	1.66 (7.34)	2.85 (9.72)	4.18 (11.78)	5.65 (13.73)	12.15 (20.40)	14.87
T_7	0.89 (5.40)	2.63 (9.32)	4.91 (12.80)	7.43 (15.81)	9.43 (17.89)	0.2305 0.7103	
S.Em ±	0.3473	0.3535	0.3813	0.3636	0.3902		
C.D. at 5%	1.0537	1.0723	1.1566	1.1030	1.1836		

T_1 = Control (water); T_2 – Virosil Agro 0.25%; T_3 – Virosil Agro 0.50%; T_4 – Stayfresh : Water = 1:2; T_5 – Stayfresh : Water = 1:4: T_6 = Virsoil Agro (0.25%) + Stayfresh : Water (1:2); T_7 – Virosil Agro (0.50%) + Stayfresh : water (1 :4).
Angular transformation values are given in parenthesis.

: water in 1:2 ratio) while fruits of other treatments T_3 (Virosil Agro 0.50%), T_2 (Virosil Agro 0.25%) and T_1 (Control) was not available beyond 25 or 30 days. Marketability of T_4 (Virosil Agro 0.25%), T_5 (Stayfresh : water in 1:4 ratio), T_6 (Virosil Agro 0.25% + Stayfresh : water in 1.2 ratio) and T_7 (Virosil Agro 0.50% + Stayfresh : water in 1:4 ratio) was 83.33%, 63.33%, 86.67% and 80.00% respectively on 35th days of storage (Table 2).

Post-harvest treatment delayed ripening upto 20 days and thereafter ripening in all the treatments were 100% (fully ripe). Throughout the period of storage ripening was less in T_6 (Table 3). Fruit firmness decreased gradually during storage and it remained significantly high in T_5 particularly during early period of storage followed by T_6 particularly during later period of storage compared to other treatments (Table 4).

TSS to acid ratio increased rapidly in control (T_1) fruits during storage (Table 5). On 25th day the TSS to acid ratio of control fruits was 13.74 which was significantly higher than the treated fruits. Low TSS to acid ratio was recorded in T_6 (7.35) and T_4 (7.74). On 35th day, TSS to acid ratio was very low in T_6 i.e. 8.43 followed by 10.23 in T_7, 11.12 in T_4 and 11.51 in T_5.

Results of the experiment indicated that T_6 (Virosil Agro at 0.25% + Stayfresh : water in 1 : 2 ratio) reduced the physiological loss of weight during storage remarkably. Beside T_6, T_7 (Virosil Agro at 0.50% + Stayfresh in 1 : 4 ratio) and T_4 (Stayfresh : water in 1:2 ratio) also reduced the physiological loss of weight significantly. Stayfresh treatments dry up on the fruit surface to produce a membrane which is differentially permeable to gases. Permeability can change with different thickness of coating in different fruits and because of this, it must be stressed that the recommended concentrations of Stayfresh dispersions should be used (Sashikala *et al*., 2002). It works by restricting

Table 2. Marketability (%) of different postharvest treated tomato fruits during storage.

Treatments	Marketability (%) Number of days in storage				
	15	20	25	30	35
T_1	76.67	66.67	53.33		
	(61.22	(54.78)	(46.92		
T_2	96.67	93.33	73.33	56.67	
	(83.85)	(77.71)	(59.21)	(48.93)	
T_3	100.00	96.67	86.67	70.00	
	(90.00)	(83.85)	(72.29)	(57.00)	
T_4	100.00	100.00	96.67	93.33	83.33
	(90.00)	(83.95)	(77.71)	(66.14)	(66.14)
T_5	96.67	86.67	76.67	70.00	63.33
	(83.85)	(68.85)	(61.92)	(57.29)	(52.86)
T_6	100.00	100.00	90.00	86.67	86.67
	(90.00)	(90.00)	(75.00)	(72.29)	(72.29)
T_7	100.00	96.67	90.00	86.67	80.00
	(90.00)	(83.85)	(71.56)	(68.85)	(63.93)
S.Em ±	4.5070	4.2200	5.8072	5.6288	4.9629
C.D. at 5%	13.6718	12.8012	17.6162	17.3456	15.6374

T_1 = Control (water); T_2 – Virosil Agro 0.25%; T_3 – Virosil Agro 0.50%; T_4 – Stayfresh : Water = 1:2; T_5 – Stayfresh : Water = 1:4: T_6 = Virsoil Agro (0.25%) + Stayfresh : Water (1:2); T_7 – Virosil Agro (0.50%) + Stayfresh : water (1 :4).
Angular transformation values are given in parenthesis.

the oxygen intake through the skin of fresh fruit and carbondioxide output, thus delaying ripening or maturity process by slowing down the respiration without causing anaerobiosis (Drake *et al*., 1987). Stayfresh coating effectively converts each fruit into a self contained modified atmosphere store. As a result of coating movement of CO_2 is relatively unrestricted compared with the passage inward movementof oxygen,with little danger of anaerobic conditions being established inside (Banks, 1985 and Curtis, 1988). Similar to Stayfresh another product, Semperfresh, an improved formulation of earleir sucrose polyesters coating controls weight loss in tomato, and citrus fruits (Curtis, 1988 and Kabir *et al*., 1995). It also improves the general appearance with freshness and delays senescence by reducing ethylene production (Drake *et al*., 1987; and Curtis, 1988). The coating helps to retain chlorophyll pigmentation for longer period (Curtis, 1988). Further high internal CO_2 concentrations delayed response to ethylene and reduced losses in acidity (Kader, 1986). Virosil Agro is a strong oxidant that contains 48% hydrogen peroxide (H_2O_2) and 0.05% silver ion (Ag^+) as a stabilizing agent (Fallik *et al*., 1994 and Yair Aharoni *et al*., 1994). Hydrogen peroxide effectively kills microorganisms because of its capacity to generate reactive and cytotoxic oxygen species which are powerful oxidants (Fridovich, 1981). The reduction in decay and increase in shelf-life by application of Sanosil (Virosil Agro) has also been reported in eggplant and sweet pepper at 0.6% to 0.7% (Fallik *et al*., 1994) and pointed gourd at 0.75% (Naiya and kabir 2006). Sanosil 25 incorporated into wax markedly decreased decay of "Galia" melons during storage and enhanced shelf-life without any phytotoxic effect (Yair Aharoni *et al*., 1994).

The combined effect of Stayfresh and Virosil Agro had an additive effect in reducing the PLW, delay in ripening, lycopene synthesis and maintaining

Table 3. Ripening (%) of different postharvest treated tomato fruits during storage

Treatments	Ripening (%) Number of days in storage				
	5	10	15	20	25
T_1	53.33 (46.91)	72.33 (58.28)	95.00	100.00	100
T_2	50.00 (45.00)	71.67 (57.86)	95.00	100.00	100
T_3	47.67 (43.66)	71.00 (57.45)	91.67	98.33	100
T_4	46.67 (43.09)	66.67 (54.75)	86.67	96.00	100
T_5	50.00 (45.00)	68.33 (55.82)	88.33	98.33	100
T_6	41.67 (40.20)	53.33 (46.91)	76.67	91.67	100
T_7	51.67 (45.95)	66.67 (54.78)	86.67	96.67	100
S.Em ±	0.7284	1.4207	2.5974	1.3157	-
C.D. at 5%	2.2097	4.3097	7.8791	3.9912	-

T_1 = Control (water); T_2 – Virosil Agro 0.25%; T_3 – Virosil Agro 0.50%; T_4 – Stayfresh : Water = 1:2; T_5 – Stayfresh : Water = 1:4: T_6 = Virsoil Agro (0.25%) + Stayfresh : Water (1:2); T_7 – Virosil Agro (0.50%) + Stayfresh : water (1 :4).
Angular transformation values are given in parenthesis.

the quality of fruit for longer period. The efficacy of higher concentration of Stayfresh and low concentration of Virosil Agro is more pronounced compared to control and other treatments.

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Table 4. Changes in fruit firmness during storage of different postharvest treated fruits.

Treatment	Marketability (%) (Number of days in storage)							
	0	5	10	15	20	25	30	35
T_1	5.15	5.06	4.40	2.33	1.57	0.92		
T_2	4.91	4.80	4.59	3.39	2.65	1.71	0.97	
T_3	4.37	4.43	4.27	3.51	2.50	1.57	0.90	
T_4	4.34	4.27	4.08	3.59	3.02	2.22	1.75	1.22
T_5	5.03	4.94	4.54	4.14	2.96	1.75	1.30	0.80
T_6	4.70	4.57	4.47	3.86	3.22	2.27	1.96	1.43
T_7	4.62	4.53	4.03	3.26	2.43	1.80	1.15	0.63
S.Em ±	0.2894	0.2852	0.1992	0.2397	0.1671	0.1395	0.1192	
C.D. at 5%	N.S.	N.S.	N.S.	0.7271	0.5068	0.4231	0.3673	

Table 5. Influence of postharvest treatments on TSS : acid ratio of tomato fruits during storage

Treatment	Marketability (%) (Number of days in storage)							
	0	5	10	15	20	25	30	35
T_1	5.80	5.91	7.86	11.10	11.69	13.74		
T_2	5.56	5.51	7.37	10.14	10.43	11.46	11.35	
T_3	5.12	5.60	7.09	7.94	8.20	9.81	10.34	
T_4	5.52	5.93	6.12	6.45	7.06	7.74	8.95	11.12
T_5	6.14	6.31	6.97	7.43	8.53	8.32	11.17	11.51
T_6	5.40	5.45	5.72	6.38	6.92	7.35	8.08	8.43
T_7	5.19	5.40	5.61	6.02	7.06	7.73	8.42	10.23
S.Em ±	0.3454	0.3809	0.3084	0.5264	0.4270	0.4545	0.4295	
C.D. at 5%	N.S.	N.S.	0.9357	1.5968	1.2954	1.3788	1.3235	

T_1 = Control (water); T_2 – Virosil Agro 0.25%; T_3 – Virosil Agro 0.50%; T_4 – Stayfresh : Water = 1:2; T_5 – Stayfresh : Water = 1:4: T_6 = Virsoil Agro (0.25%) + Stayfresh : Water (1:2); T_7 – Virosil Agro (0.50%) + Stayfresh : water (1 :4).
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