Indian J. Hort. 70(4), December 2013: 606-609

Short communication

Effect of packaging, gibberellic acid and potassium permanganate on chemical characteristic of fruits in tomato cv. Sel-7

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ABSTRACT

An experiment was carried out to assess effective treatment combination of polyethylene packaging, gibberellic acid and potassium permanganate on retention of fruit quality in tomato cv. Sel-7 during winter season (2010-2011). The maximum TSS content of 3.40 percent was recorded under $P_2G_1K_1$. However, on 20thday the maximum pH 4.62 and minimum (3.94) was recorded under $P_2G_1K_0$ and $P_1G_2K_1$ treatments, respectively. The maximum acidity was retained under $P_2G_1K_1$ (0.23%) and minimum under $P_1G_0K_0$ (0.10%) treatments. On 20th day of storage, maximum ascorbic acid content (21.04 mg/100 g) was recorded under $P_1G_1K_1$, which was superior over other treatments. It was revealed that the tomato fruits of cv. Sel-7 treated with 25 ppm GA_3 and kept under perforated polyethylene bags (60 gauge) having 0.5 percent $KMnO_4$ impregnated blotting paper sheets proved to be the most appropriate treatment combination for storage upto 20 days.

Key words: Polyethylene, gibberellic acid, potassium permanganate, quality, storage.

Tomato (*Lycopersicon esculentum* Mill.) is one of the most important vegetables in the world ranking second after potato. Tomato being soft skinned, is subjected to various postharvest diseases and physiological changes upto consumption. During the recent years, some techniques have been developed to retain the postharvest quality of fruits and vegetables for a longer period. Among these, use of polythene packagings in combination with gibberellic acid and potassium permanganate has been found to be quite effective. Polyethylene provides modified atmosphere and consequently reduces decaying, softening and loss of solids. Furthermore, polyethylene packaging increases the shelf-life of commodity both under refrigerated and normal conditions. Amongst various chemicals, the use of potassium permanganate as ethylene absorbent has been found to be useful in increasing the shelf-life of different fruits and vegetables. Besides, gibberellic acid is known to reduce the respiration rate and can be used effectively to improve the postharvest shelf-life. Several scientists postulated that the postharvest application of gibberellic acid prolonged the shelf-life of fruits and vegetables (Khader *et al*., 4; El-Zeftawi *et al*., 3).

The investigation on the post-harvest life of tomato cv. Sel.-7 (syn. Hisar Arun) was conducted during the winter season (2010-2011) in the P.G. Laboratory, Department of Horticulture, Institute of Agril. Sciences, BHU, Varanasi. Uniform, fresh and fully red ripe tomato fruits of were harvested from Vegetable Research Farm, during the winter season (October to January). Selected fruits were thoroughly washed with tap water and air-dried. Prior to application of treatments, fruits were analyzed for their physico-chemical analysis. Polyethylene bags of 60 gauge were used for the purpose of packaging in non-perforated and perforated forms, three concentrations of GA_3 (0, 25 and 50 ppm) and two concentrations of $KMnO_4$ (0 and 0.5%) and their combinations were used. The experiment was laid out in Completely Randomized Design with three replications of 13 treatment combinations (Table 1). Eighteen fruits were used per treatment and observations were recorded at 4 days interval during the storage period of 20 days.

The different parameters analysed include total soluble solids, pulp acidity (pH), pulp acidity and ascorbic acid using standard procedures at different intervals. Data pertaining to total soluble solids (TSS), active acidity (pH), titratable acidity and ascorbic acid content during storage of tomato are presented in Tables 2 to 5. The effect of interaction among packaging, GA_3 and $KMnO_4$ was found to be significant upto 16th day of storage. On the last day (20th day) the maximum TSS content of 3.40 percent was recorded under $P_2G_1K_1$ and the minimum of 2.50 percent under $P_2G_2K_0$ treatments, but the difference was non-significant. The combined effect of P x G x K was found to have significant effect during storage period except on 20th day of storage. These findings are also in accordance to those reported by Sharma and Dashora (7), and Shehla (8) in tomato.

The data contained in Table 3 revealed that the interaction effect of packaging, GA_3 and $KMnO_4$ was found to be significant during entire period of

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Table 1. Treatment combinations of packaging, gibberellic acid and potassium permanganate.

Treatment	Packaging (polyethylene)	Gibberellic acid (ppm)	Potassium-permanganate (%)
$P_0G_0K_0$	Without packaging distilled water treated	0.0	0.0
$P_1G_0K_0$	Non-perforated	0.0	0.0
$P_1G_0K_1$	Non-perforated	0.0	0.5
$P_1G_1K_0$	Non-perforated	25	0.0
$P_1G_1K_1$	Non-perforated	25	0.5
$P_1G_2K_0$	Non-perforated	50	0.0
$P_1G_2K_1$	Non-perforated	50	0.5
$P_2G_0K_0$	Perforated	0.0	0.0
$P_2G_0K_1$	Perforated	0.0	0.5
$P_2G_1K_0$	Perforated	25	0.0
$P_2G_1K_1$	Perforated	25	0.5
$P_2G_2K_0$	Perforated	50	0.0
$P_2G_2K_1$	Perforated	50	0.5

Table 2. Effect of packaging, gibberellic acid and potassium permanganate on total soluble solids (TSS) of tomato cv. Sel.-7.

Treatment	Storage days					
	0	4	8	12	16	20
$P_0G_0K_0$	4.82	4.70	4.04	3.80	3.50	3.30
$P_1G_0K_0$	4.82	4.00	3.43	3.00	3.00	3.06
$P_1G_0K_1$	4.82	3.96	3.50	3.06	2.80	2.90
$P_1G_1K_0$	4.82	4.46	3.06	2.83	2.86	2.96
$P_1G_1K_1$	4.82	4.06	3.50	3.20	3.08	3.00
$P_1G_2K_0$	4.82	4.06	3.00	3.03	2.96	2.86
$P_1G_2K_1$	4.82	4.00	3.96	3.00	2.43	2.96
$P_2G_0K_0$	4.82	4.00	3.46	3.16	2.86	2.80
$P_2G_0K_1$	4.82	4.00	3.50	3.20	2.90	3.00
$P_2G_1K_0$	4.82	4.43	3.50	3.00	2.94	3.10
$P_2G_1K_1$	4.82	4.13	3.58	3.42	3.40	3.40
$P_2G_2K_0$	4.82	4.56	4.00	3.20	3.00	2.50
$P_2G_2K_1$	4.82	4.00	3.00	3.00	2.90	2.82
CD at 5%		0.097	0.081	0.054	0.046	NS
CV%		1.382	1.390	1.033	0.939	1.260

NS = Non-significant

storage. The pH of juice increased under all treatment combinations including absolute control upto 12th day, where maximum pH of 5.98 was recorded in $P_1G_0K_1$, while a minimum of 4.20 under $P_1G_2K_1$ and $P_2G_1K_0$ treatments. However on 20th day, the maximum pH 4.62 and minimum of 3.94 were recorded under $P_2G_1K_0$ and $P_1G_2K_1$ treatments, respectively. The interaction of P x G x K was found to be significant during all the days of storage. The increase in pH under these interactions might be possible due to complimentary effect of all these three factors, *viz*., packaging, GA_3 and $KMnO_4$ (Chamara *et al*., 2; Shehla, 8).

The interaction effect of packaging, GA_3 and $KMnO_4$ on acidity was found to be significant only on 20th day of storage. The acidity of fruits decreased from 0 to 20th day in all treatment combinations including absolute control. However, the maximum acidity was retained under $P_2G_1K_1$ (0.23%) and minimum under $P_1G_0K_0$ (0.10%) treatments on 20th day of storage. The interaction effect of P x G x K was found to be significant on 20th day of

Table 3. Effect of packaging, gibberellic acid and potassium permanganate on active acidity (pH) of tomato cv. Sel.-7.

Treatment	Storage days					
	0	4	8	12	16	20
$P_0G_0K_0$	3.99	4.49	5.20	5.24	4.15	4.20
$P_1G_0K_0$	3.99	4.99	5.40	5.41	3.95	4.00
$P_1G_0K_1$	3.99	5.31	5.52	5.98	4.47	4.50
$P_1G_1K_0$	3.99	5.21	5.26	5.40	4.50	4.61
$P_1G_1K_1$	3.99	5.11	5.60	5.62	3.96	4.33
$P_1G_2K_0$	3.99	4.00	4.39	4.44	4.29	4.25
$P_1G_2K_1$	3.99	3.98	3.99	4.20	3.81	3.94
$P_2G_0K_0$	3.99	3.99	4.01	4.29	4.11	4.21
$P_2G_0K_1$	3.99	4.00	4.70	4.73	4.20	4.25
$P_2G_1K_0$	3.99	4.00	4.12	4.20	3.82	4.62
$P_2G_1K_1$	3.99	4.00	4.39	4.69	3.84	4.29
$P_2G_2K_0$	3.99	4.2	5.01	5.12	3.80	4.08
$P_2G_2K_1$	3.99	4.51	5.30	5.33	4.30	4.55
CD at 5%		0.014	0.017	0.014	0.020	0.013
CV%		0.194	0.212	0.176	0.300	0.186

storage. The maximum retention of acidity was under $P_2G_1K_1$ treatment. These results are in conformity with those observed by Bhatnagar (1) in guava.

The ascorbic acid content was significantly affected as a result of interaction of packaging, GA_3 and $KMnO_4$ during entire storage period except on 8th day. On 20th day of storage a maximum ascorbic acid content of 21.04 mg/100 g was recorded under $P_1G_1K_1$ which was superior over all other treatments. The combined effect of P_1 x G_1 x K_1 resulted in higher ascorbic acid content (21.04 mg/100 g) as compared to their individual effects. This may be due to the fact that all the three parameters helped in containing the rate of ethylene evolution and accumulation, thereby reducing the rate of respiration and ripening which normally results in dissipation of ascorbic acid during storage. It might be due to slowing down the various processes as also reported by several researchers (Bhatnagar, 1; Kumar *et al*., 5) in guava; Sandooja *et al.* (6) in tomato).

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Table 4. Effect of packaging, gibberellic acid and potassium permanganate on acidity (%) of tomato cv. Sel.-7.

Treatment	Storage days					
	0	4	8	12	16	20
$P_0G_0K_0$	0.32	0.23	0.21	0.19	0.17	0.14
$P_1G_0K_0$	0.32	0.29	0.25	0.25	0.17	0.10
$P_1G_0K_1$	0.32	0.29	0.29	0.27	0.19	0.14
$P_1G_1K_0$	0.32	0.25	0.25	0.21	0.17	0.14
$P_1G_1K_1$	0.32	0.32	0.27	0.23	0.19	0.17
$P_1G_2K_0$	0.32	0.25	0.21	0.19	0.14	0.12
$P_1G_2K_1$	0.32	0.27	0.25	0.21	0.19	0.17
$P_2G_0K_0$	0.32	0.27	0.23	0.21	0.19	0.19
$P_2G_0K_1$	0.32	0.25	0.25	0.21	0.19	0.19
$P_2G_1K_0$	0.32	0.27	0.21	0.19	0.19	0.12
$P_2G_1K_1$	0.32	0.29	0.25	0.25	0.23	0.23
$P_2G_2K_0$	0.32	0.25	0.23	0.21	0.19	0.17
$P_2G_2K_1$	0.32	0.27	0.25	0.25	0.19	0.19
CD at 5%		NS	NS	NS	NS	0.048
CV%		10.514	10.942	12.060	12.249	17.664

NS = Non-significant

Table 5. Effect of packaging, gibberellic acid and potassium permanganate on ascorbic acid content (mg/ 100 g) of tomato cv. Sel.-7.

Treatment	Storage days					
	0	4	8	12	16	20
$P_0G_0K_0$	15.78	16.20	21.04	26.30	16.41	13.15
$P_1G_0K_0$	15.78	16.41	21.91	23.67	21.04	12.27
$P_1G_0K_1$	15.78	21.04	24.54	26.30	21.04	16.41
$P_1G_1K_0$	15.78	21.04	23.67	25.42	15.78	14.90
$P_1G_1K_1$	15.78	22.79	24.54	27.17	23.67	21.04
$P_1G_2K_0$	15.78	21.04	28.93	23.67	16.41	11.39
$P_1G_2K_1$	15.78	24.54	26.30	28.93	14.90	13.15
$P_2G_0K_0$	15.78	21.04	23.67	26.30	14.90	12.27
$P_2G_0K_1$	15.78	23.67	25.42	26.30	21.04	16.20
$P_2G_1K_0$	15.78	26.30	27.17	28.93	16.41	16.20
$P_2G_1K_1$	15.78	28.93	29.80	31.56	23.67	16.41
$P_2G_2K_0$	15.78	21.04	24.54	26.30	21.91	14.02
$P_2G_2K_1$	15.78	23.67	24.54	28.05	23.67	15.78
CD at 5%		1.014	NS	1.224	1.224	1.598
CV%		2.729	4.748	2.718	3.780	6.408

NS = Non-significant

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Received : November, 2012; Revised : July, 2013; Accepted : August, 2013