

POSTHARVEST EVALUATION OF TOMATO CULTIVARS FOR AGRI-BUSINESS

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ABSTRACT

An experiment was conducted during September to November 2004 at Horticulture Research Division, Khumaltar to evaluate the fruits of 15 tomato cultivars for their post-harvest shelf life and consumer acceptability. Among the cultivars maximum shelf life of 35 days was exhibited by N-162 under ambient condition ($20 \pm 6^{\circ}$ C and 75 ± 5 % RH). Significantly higher (0.91 percent) titrable acidity was found in Rampur Sano. The maximum TSS (5.62° Brix) was found in cultivar Yashwant followed by Pusa Ruby (5.25° Brix). Based on size, shape, colour, taste and freshness, N-162 had the highest degree of consumer acceptability followed by cultivars Bisesh and Santripati.

INTRODUCTION

Tomato fruits are highly perishable and cannot be stored for longer duration. Farmers are losing a bulk of the produce each season every year (Saini, 1996). In Nepal, postharvest loss in fresh tomato during marketing has been recorded as high as 17.85 percent (Devkota and Ghale, 1992). During the main season there is surplus tomato in the market and the price is low. This is the major problem of tomato growers as well as entrepreneurs. The cultivars grown in our context have large variation in quality and storability. Variation in quality attributes has been documented by different workers. A high degree of variation in tomato fruits has been in total soluble solid (3.1 to 5.6%), ascorbic acid (11.21 to 53.29 mg/100 ml juice) and acidity (0.33 to 1.07) (Sharma *et al.*, 1996).

Postharvest evaluation of different tomato cultivars grown in Nepal is essential for the establishment of their quality attributes, which influence their market price. The market value of a commodity is certainly increased due to its quality and uniformity. Commercial scale tomato production requires quality standards for its diverse utilization. This study has been designed to address this problem.

MATERIALS AND METHODS

This study was conducted during September to November 2004 at Horticulture Research Division, Khumaltar, Lalitpur under completely randomized design to examine the consumer acceptability and post-harvest shelf life of tomato fruits. Fifteen tomato cultivars consisting of 2 kg uniform fruits of each were kept on open trays. Each treatment was replicated twice and stored at an ambient condition. Ten fruits from each unit were numbered to determine the physiological weight loss by weighing in electronic balance in alternate days up to 10 days and percentage weight loss was determined by following formula:

$$\text{Weight loss (\%)} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

The Total Soluble Solid (TSS) ($^{\circ}$ Brix) was determined by a hand refractometer (Model: Erma Japan) in red ripe stage of fruits. Titrable acidity (TA) was determined by titration method at red ripe stage. It was calculated by using following formula:

$$\text{Titration Acidity (\%)} = \frac{N_B \times V_B \times \text{milliequivalent wt. of citric acid} \times 100 \times \text{d. f.}}{\text{Volume of sample}}$$

N_B = Normality of base

V_B = Volume of the base

d. f. = Dilution factor

An evaluation panel measured consumers' acceptability on the basis of size, shape, color, taste and freshness of the fruits by using a 1-9 Hedonic scale (Thompson, 1996) in which 1 inferior and 9 superior. Shelf life was determined up to consumer acceptability.

RESULTS AND DISCUSSIONS

Physiological Weight Loss

Cumulative physiological weight loss of tomato fruits at 2 days interval has been presented in Table 1. The mean cumulative physiological weight loss after 2, 4, 6, 8 and 10 days of storage was 0.70, 1.55, 2.50, 3.13 and 3.68 percent respectively. The percent weight loss was highest during 4 to 6 days (0.95%) and lowest during 8 to 10 days.

Table 1. Cumulative physiological weight loss (%) of different cultivars of tomato at ambient condition ($20 \pm 6^{\circ}$ C and 75 ± 5 % RH).

Cultivars	Days after storage				
	2	4	6	8	10
Gaurabh	0.86	1.58	3.34	4.04	4.76
Raja	0.50	1.59	1.93	2.38	2.66
N-162	0.20	0.81	1.54	1.88	2.39
Pusa Ruby	1.08	1.84	2.93	3.68	4.47
C-315	0.75	1.35	2.45	3.07	3.55
Santripti	1.01	1.92	2.43	2.84	3.22
BWT-3	0.90	1.48	2.36	2.94	3.15
NS-6441	0.69	0.94	2.14	2.43	2.83
Bisesh	0.54	0.90	1.97	2.72	3.25
Yashwant	0.54	1.41	2.53	3.37	3.80
BWT-2	0.51	1.17	1.95	2.22	2.83
Rakshita	0.28	0.60	1.24	1.79	2.10
Naveen 2000	0.41	0.67	1.18	1.61	2.13
Surkhet sano	0.83	2.84	3.81	4.75	5.20
Rampur sano	1.41	4.12	5.97	7.21	8.91
Mean	0.70	1.55	2.50	3.13	3.68
F-value	ns	*	*	*	**
LSD-value	-	1.738	2.099	2.337	2.001

A great variation in weight loss was noticed in different cultivars. After 2 days of storage, highest weight loss was exhibited by Rampur Sano (1.41%) followed by Pusa Ruby (1.08%). Variations in weight loss among other cultivars were statistically non-significant, however, lowest weight loss was noticed in N-162 (0.20%). After 10 days of storage, the highest cumulative physiological weight loss was 8.91% in Rampur Sano followed by 5.20% in Surkhet Sano.

In tomato, physiological weight loss is mainly due to transpiration and respiration. There is a greater loss by evaporation from produce with a high surface area to unit volume ratio. Higher weight loss in smaller fruits is mainly due to higher surface area (Wills *et al.*, 1996).

Total Soluble Solids

The maximum TSS (5.62^o Brix) was found in Yashwant, which was significantly different than others. The significantly lower TSS (4^o Brix) was noticed in BWT-2 at ripe stage (Table 2). High value of total soluble solids is desirable for processed product (Opena, 1983). Thus cultivars Yashwant, Pusa ruby, Naveen-2000 and N-162 are more suitable for tomato sauce and ketchup preparations.

Titration Acidity

At red ripe stage, significantly higher (0.91%) TA was found in Rampur Sano followed by Surkhet Sano (0.85%) and NS-6441 (0.76%). Significantly lower TA (0.36%) was found in Pusa Ruby (Table 2). According to Sharma *et al.* (1996) TA of tomatoes depends on the inherent characters of cultivars. Acid value of 0.35 to 0.55% is considered ideal for processing (Gould and Berry, 1972). While citric acid content at 0.35% is desirable for obtaining high quality juice (Tarutani, 1954). Thus, cultivars Pusa Ruby, Gaurabh and C-315 are more suitable for juice preparation.

Table 2. Postharvest quality parameters of different cultivars of tomato harvested at barker stage and ripened at ambient condition

Cultivars	TSS (^o Brix at 25 ^o C)	TA (%)	No. of locules
Gaurabh	4.25	0.48	3.00
Raja	4.27	0.54	2.00
N-162	5.15	0.49	4.00
Pusa Ruby	5.25	0.36	4.50
C-315	4.30	0.48	2.25
Santrupty	4.82	0.60	2.75
BWT-3	4.20	0.67	3.75
NS-6441	4.30	0.76	3.00
Bisesh	4.90	0.64	2.00
Yashwant	5.62	0.50	3.25
BWT-2	4.00	0.58	2.50
Rakshita	4.42	0.53	3.50
Naveen 2000	5.22	0.62	3.00
Surkhet sano	4.42	0.91	2.00
Rampur sano	4.30	0.85	2.00
F-value	**	*	**
LSD-value	0.428	0.116	0.825

Number of Locules and Mesocarp Thickness

The maximum numbers of locules were found in Pusa Ruby followed by N-162 (Table 2). Significantly minimum numbers of locules were in Rampur Sano, Raja, Surkhet Sano and Bisesh. Highest mesocarp thickness (7.28 mm) was in Rakshita followed by Raja (6.52) (Table 3).

Shelf- life

Among fifteen tomato cultivars shorter (11 days) shelf life was exhibited by Rampur Sano followed by Surkhet Sano (12 days) and Gaurabh (17days). Highest shelf life (35 days) was exhibited by N-162 followed by Rakshita (29.50 days) (Table 3).

Higher shelf life in N-162 and Rakshita was associated with thick flesh, lower weight loss, and lesser number of seeds per fruit. Generally, tomato cultivars having thick fleshy fruit with lesser number of seeds have been recommended for commercial production (Bose *et al.*, 1993).

Table 3. Post harvest quality parameters of different cultivars of tomato harvested at breaker stage and ripened at ambient condition

Cultivars	Mesocarp thickness (mm)	Fruit wt. (g)	Shelf-life (Days)
Gaurabh	5.17	66.00	17.00
Raja	6.52	66.09	23.00
N-162	4.29	51.07	35.00
Pusa Ruby	2.99	29.28	21.00
C-315	4.01	74.61	22.00
Santrupti	4.38	59.01	28.00
BWT-3	5.46	54.02	22.00
NS-6441	5.58	61.26	25.50
Bisesh	5.79	55.25	28.00
Yashwant	5.40	71.26	27.50
BWT-2	5.70	76.52	29.50
Rakshita	7.28	88.63	29.50
Naveen 2000	3.64	83.22	29.00
Surkhet Sano	1.29	5.78	11.50
Rampur Sano	0.73	4.94	11.00
F-value	**	**	**
LSD-value	1.191	13.69	3.039

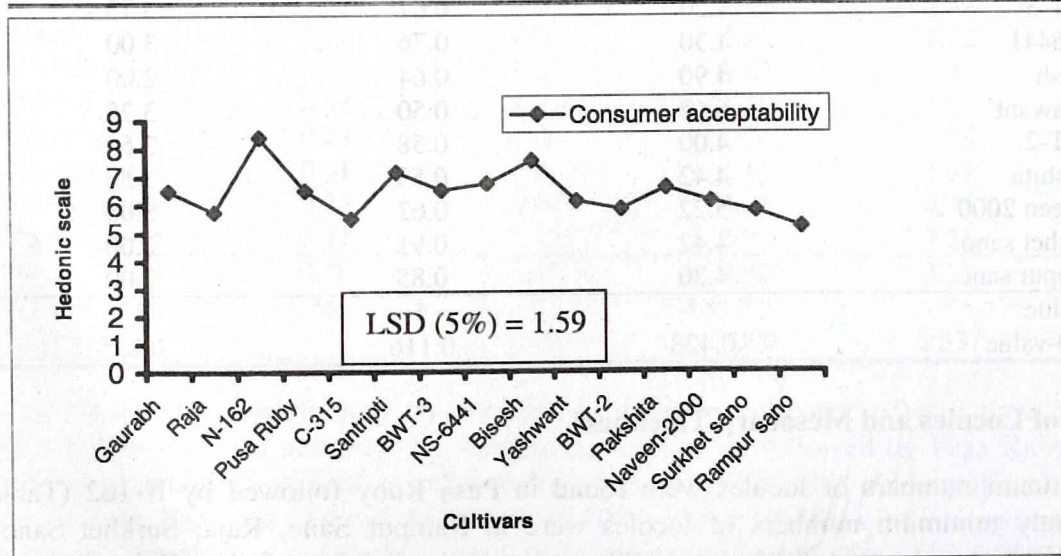


Fig. 1 Effect of tomato cultivars on consumer acceptability.

Consumer Acceptability

Consumer acceptability measured on the basis of fruit size, shape, sourness, colour, and fleshiness by a 1-9 Hedonic scale showed significant varietal differences. It was recorded that N-162 was significantly superior with a relative marking of 8.40, than others except Bisesh (7.57) and Santripati (7.15) (Fig. 1).

CONCLUSION

Tomato is rapidly gaining its importance as essential nutritional vegetable commodity and income generating crop in Nepal. Among the tested cultivars of tomato the maximum shelf life of fruits was found in N-162 followed by BWT-2 and Rakshita. On the basis of consumer acceptability for vegetable purpose, the outstanding qualities were found in N-162 followed by Bisesh and Santripati.

According to the above findings, it can be recommended that

- N-162, Bisesh and Santripati are the most acceptable variety for vegetable purpose.
- N-162 is the most suitable for storage and long distance transport.
- Yashwant, Pusa Ruby and Naveen-2000 are the most suitable cultivars for preparation of tomato sauce and ketchup.
- Rakshita and Naveen -2000 are the most suitable for salad.

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