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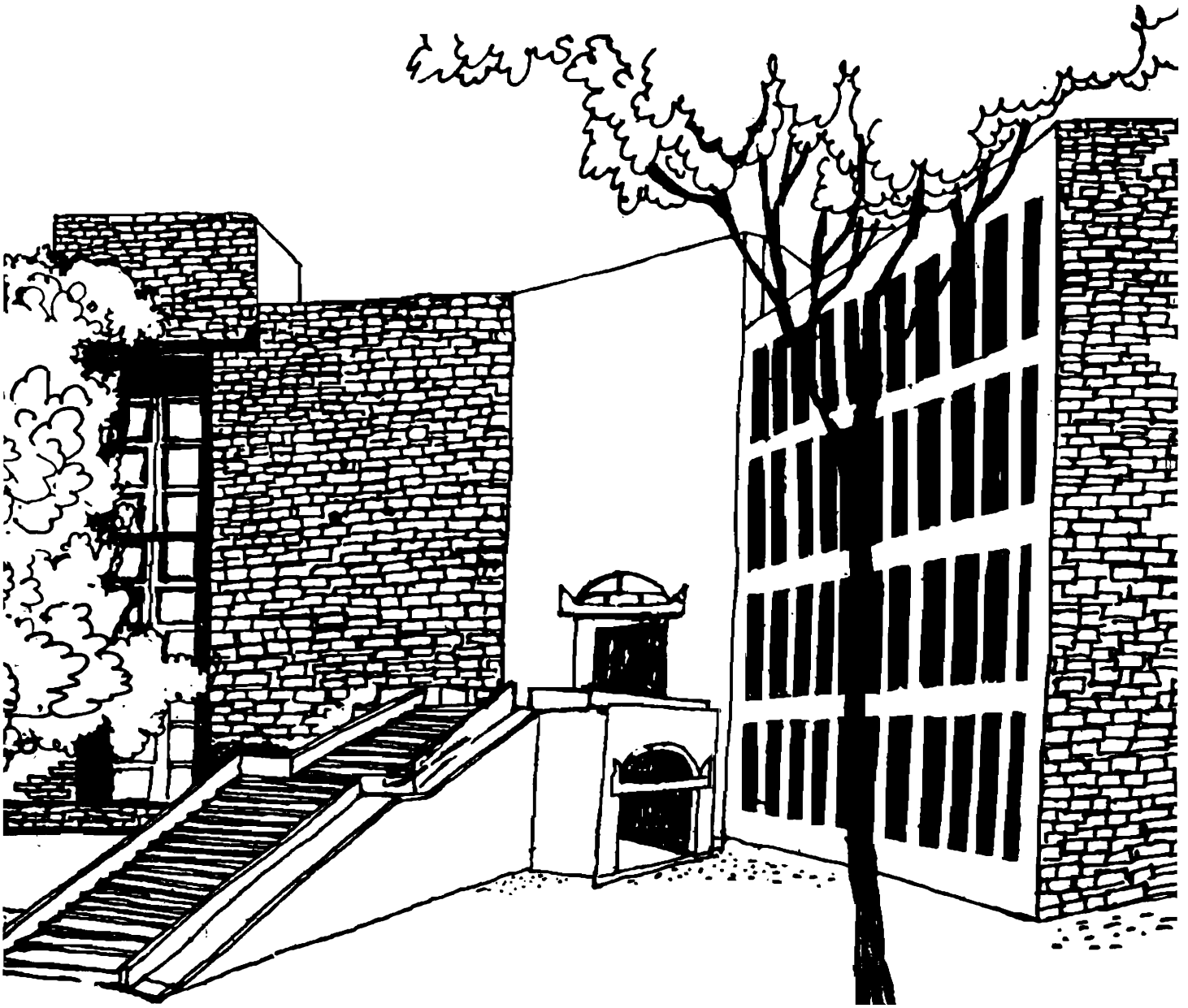

QUALITY ASPECTS OF TOMATO ARRIVING FOR AUCTION AT APMC AHMEDABAD

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Quality Aspects of Tomato arriving for Auction at APMC Ahmedabad

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Abstract

Tomatoes transported from long distances were procured from Sardar Patel Market, Ahmedabad. Fruits were inspected visually for mechanical damage. Experiments were conducted to study the effect of storage on weight loss, firmness and toughness. Injuries and losses due to mechanical causes were found related to transport distance. Proportion of produce rendered unusable could be as high as 17 per cent, even when transport distance was no more than 300 km.

Introduction

On an average about 135 tons of fresh tomatoes are sold through APMC Market in Ahmedabad each day. Depending on the season, these could have come from within the State, or neighbouring Rajasthan and Maharashtra or even more distant Karnataka and Punjab. Produce coming from out of state arrives in trucks, packed in lugs, usually containing 20 kg each. Lugs are rectangular boxes made of wood from discarded tea crates. Fabrication is crude. layer of newspaper is used as lining. Top of the lug is also covered with paper and secured with about half a dozen wood sticks nailed across the top face. Lugs are stacked in six to seven high columns for transport. Loading and unloading is manual.

Aim of this study was to examine the quality of tomato arriving for sale in APMC market at Ahmedabad. Aspects studied include visually observable defects. It also includes firmness and toughness measured on arrival and after storage in home like atmosphere. Loss of water in storage has also been determined.

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Material and Method

Tomatoes were purchased directly from traders of Sardar Patel Market, Ahmedabad, once in October and second time in December 1996. Each sample was divided in two groups, those from upper half of the lug and those from the lower half. Each fruit was inspected for defects listed below. Definitions are as per Mohsenin (1970).

Bruising	Damage to plant tissue/fruit by external forces causing physical change in texture and/or eventual chemical alteration of colour, flavour and texture but does not break the skin
Distortion	A change in shape of an intact fruit or vegetable which is not characteristic for the variety
Crack	A cleavage without complete separation of the parts
Cut	Penetration or division by the sharp edge of an object
Puncture	A small hole or wound on the surface of the fruit made by a pointed object or stem of other fruits
Skinbreak	Crack limited to the skin

After visual inspection by authors, each fruit was put in to one of the following categories.

Perfect (P)	No visual defects
Acceptable (A)	Mild bruised and/or distorted less than 10 per cent surface area. Also slight and cleanly healed injuries like crack, cut, puncture etc. are tolerated
Not likely to be Acceptable (NA)	Severely bruised/distorted and/or subjected to skin breaks, cracks, cuts, punctures, etc. can be sold at reduced price
Rejects (R)	Fruits subjected to injuries and infection and not fit for consumption.

October sample consisted of one lug weighing 20 kg. This sample was subjected to only visual inspection. December sample consisted of two lugs. In addition to visual examination, these were also studied for their keeping quality under ambient conditions. Storage experiments were

done at Agricultural Product Process Engineering Department, Gujarat Agricultural University, Anand where the samples were taken to by car from Ahmedabad. Distance between Ahmedabad and Anand is 90 km along National Highway # 8. Crates were taken to Anand carefully in a car from Ahmedabad. All the fruits were numbered, and weighed individually on the day of arrival. Ten fruits were randomly selected from each group, and their weights were recorded at regular intervals, for 21 days by which time weight loss exceeded 10 per cent and experiment discontinued.

Quasi-static compression tests were conducted with the help of Instron Universal Testing Machine (Model 1000-Instron) equipped with 5000 N compression load cell, an integrator and a chart recorder. The speed of the crosshead was 100 mm/min, the load range was 0 to 50 N and chart magnification was one. Individual fruit was loaded between two parallel plates of the machine. The crosshead was lowered till it just touched the surface of the tomato. Then the recorder was set at a convenient starting point. Subsequently, the crosshead was moved down with a predetermined speed forcing the flat plate kept on the fruit to apply pressure on the specimen. At the same time, the force applied and corresponding deformation were recorded. The point where fruit rupture occurred was designated as the 'bio-yield point' on the force deformation curve. Tests were conducted on fresh and stored tomatoes. Five replications were made for each test. From the force-deformation curve, firmness and toughness were determined.

Results and Discussion

Uniformity

Figure 1 shows the uniformity of tomatoes in a crate, via the frequency distribution of weight of fruits. Growers usually sort the fruit in two sizes at the time of filling the crates. Nevertheless, large coefficient of variation (33%) suggests that sorting is not tight.

Damages

Results of inspection are summarised in **Figure 2.** It is evident from the proportion of rejects that longer the transport distance, greater the loss. This is in conformity with the findings of Singh *et al* (1991, 1992a) who studied the effect of vibrations during actual transportation; and Singh *et al* (1992b) who used a simulator (vibration table) to do the same. Longer the exposure to vibration, lower the firmness and more rapid the decay in storage. In simulated vibration test

tomato at the bottom were totally deformed and flattened. In the present study, the proportion of rejects is nearly equal in the upper and lower half.

It must, however, be stated that in our study no attempt was made to ensure that produce filled in the crates was of uniform grade to start with. It was as sent by the grower.

Weight Loss

Esteban *et al* (1989) in their review reported that weight loss from 3 to 6% might cause dehydration, wilting or wrinkling in certain fruits leading to a pronounced reduction of their commercial quality. In the present study, it was observed that weight loss will exceed 5 per cent after about a week. It must be kept in view that this was the case in December, when ambient temperatures are about 25 to 30°C in Anand. In comparison, temperature in summer months will be 40 to 45°C.

Table 2 shows the storage duration and weight loss data. The two were found to be linearly related as given below.

(a)	Perfect tomatoes - top layer	W =	0.3028 + 0.5949 d
(b)	Tomatoes acceptable - top layer	W =	0.3031 + 0.6043 d
(c)	Tomatoes not likely to be accepted - top layer	W =	0.7236 + 0.6234 d
(d)	Perfect tomatoes - bottom layer	W =	0.3028 + 0.5949 d
(e)	Tomatoes acceptable - bottom layer	W =	0.1982 + 0.5548 d
(f)	Tomatoes not likely to be accepted - bottom layer	W =	0.1498 + 0.6602 d

W Weight loss (%)
d Storage period (days)

Firmness and Toughness

The toughness varied from 286 to 470 N.mm. No particular trend was observed for toughness with respect to storage duration. However, it was observed, in general, the toughness

values of the top layer tomatoes are higher compared to that of bottom layer tomatoes which indicates that the tomatoes in the top layer received less battering during transit that those in large parts. By eighth day, the firmness in the perfect tomatoes decreased by about 11 per cent. Experiment was discontinued after eighth day as the weight loss was more than 5 per cent by that time.

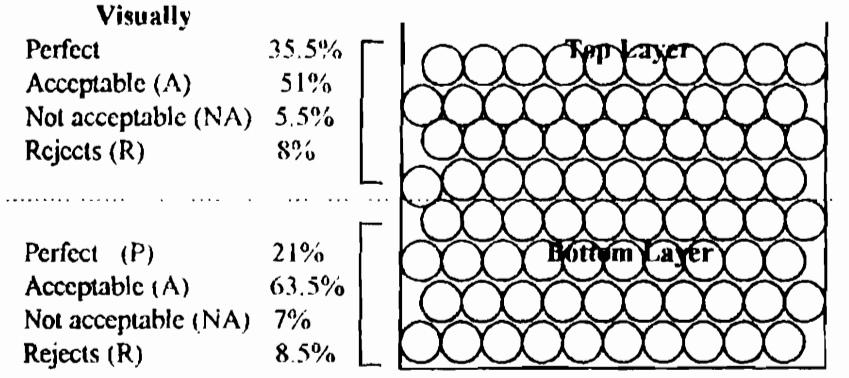
Conclusions

Tomatoes packed in lugs and transported by truck incur significant mechanical damage. Injuries and losses due to mechanical causes are directly related to transport distances.

Acknowledgement

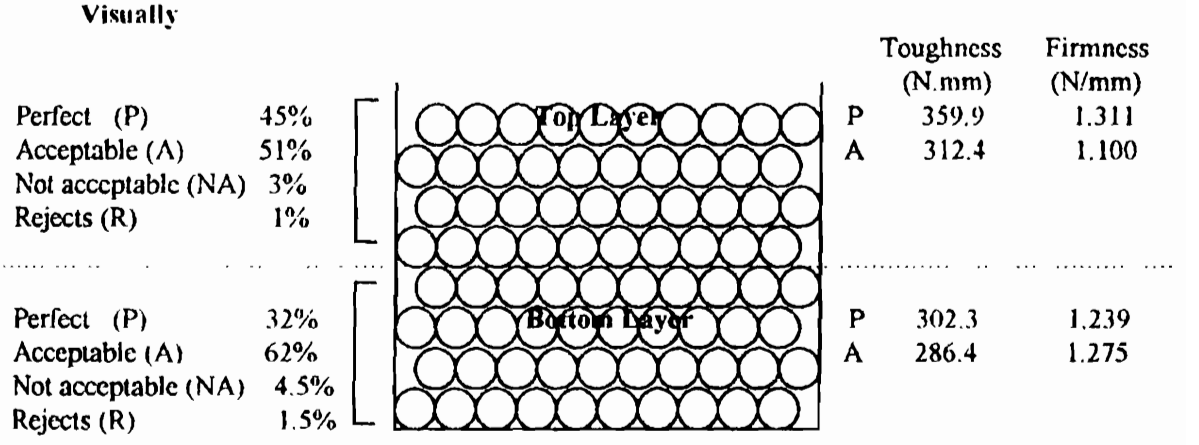
The authors are thankful to Professor and Head and staff of Department of Dairy Technology, Dairy Science College, Gujarat Agricultural University, Anand for providing the facilities and assisting in conducting the tests on Instron Universal Testing Machine.

Figure 2 (a)
State of Tomato on Arrival
(transported 270 km)



Lug
(45x30x25cm)

Figure 2 (b)
State of Tomato on Arrival
(transported 120 km)



Lug
(50x30x18cm)

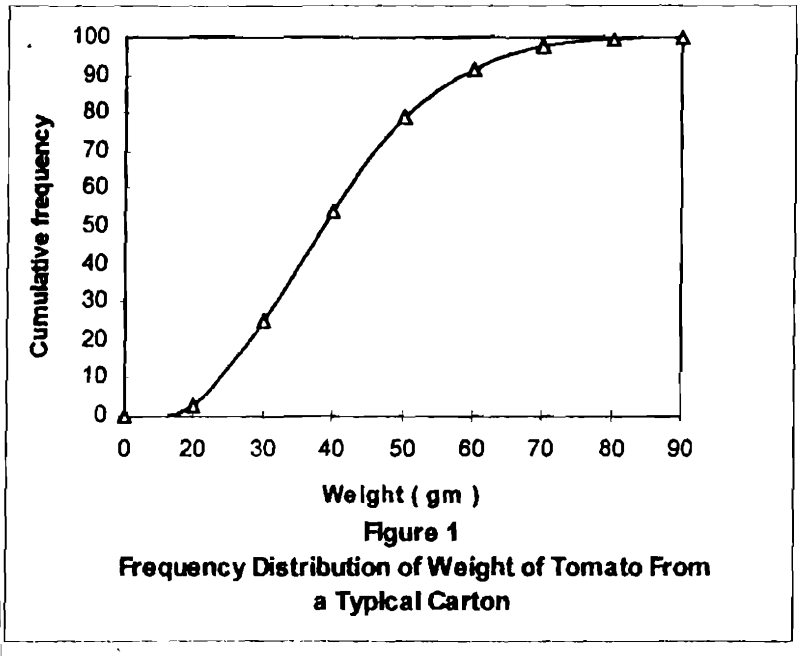


Figure 1
Frequency Distribution of Weight of Tomato From a Typical Carton

Table 1
Weight Loss in Tomatoes Stored
(percentage)

Particulars	Storage Period (days)								
	0	2	4	6	8	10	13	15	20
Top layer perfect	0	1.32	2.91	3.97	5.11	6.47	8.20	9.28	11.87
Top layer acceptable	0	1.36	2.88	4.07	5.25	6.65	8.10	9.42	12.13
Top layer not likely to be accepted	0	1.77	3.95	5.25	5.77	6.66	8.50	10.06	13.18
Bottom layer perfect	0	1 36	2.86	4.02	5.18	6.58	8.22	9.36	12.00
Bottom layer acceptable	0	1.08	2.52	3.58	4.69	5.99	7.57	8.82	10.81
Bottom layer not likely to be accepted	0	1.40	2.89	4.11	5.32	6.93	9.20	9.84	13.15

Table 2
Firmness, Toughness and Storage Duration

Categories	Firmness (N/mm)					Toughness (N.mm)				
	Storage damage (days)					Storage damage (days)				
	0	2	4	6	8	0	2	4	6	8
Top layer (P)	1.311	1.306	1.191	1.138	1.164	359.9	472.9	438.3	377.0	439.1
Top layer (A)	1.100	1.073	1.145	1.153	1.045	312.4	378.9	436.3	470.4	372.8
Bottom layer (P)	1.239	1.303	1.266	1.082	1.098	302.3	339.7	421.1	407.5	376.2
Bottom layer (A)	1.275	1.223	1.211	1.131	1.139	286.4	347.0	390.3	347.7	394.8

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