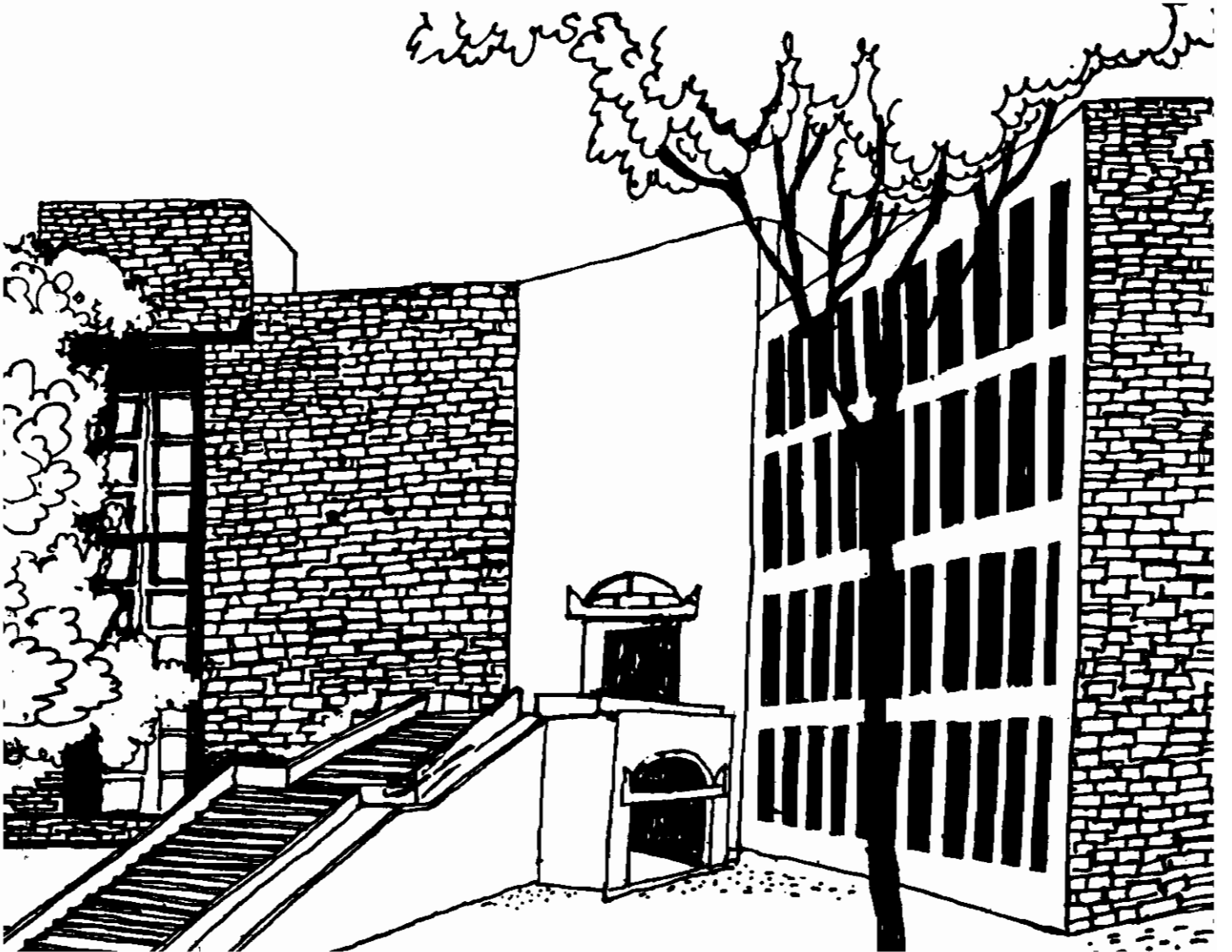




Working Paper



FIELD TRIAL OF VASTRAPUR CARTONS

By

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Field Trial of Vastrapur Cartons

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Abstract

We present in this paper the results of road transport trial of newly developed tomato packaging named **Vastrapur Carton**. Farm fresh tomatoes were taken from Khanderaopura village to Rajkot a distance of 250 km. Two trials were made. In one trial, entire truck was loaded with Vastrapur Carton only. This was done to determine the effect of physical location of cartons in the carrier on damage to produce and to package. The result revealed that the damage to produce was more on the lower tiers than the upper, more near the axle than away from it, more on the left side (towards the shoulder of the road) than the middle and rightward. In second trial, one - half of truck was loaded with conventional 'Peti' and other half with Vastrapur Carton. Overall damage to produce in 'Peti' was found to be higher (4.6%) than that in Vastrapur Cartons (2.8%). This difference is like to increase with increase in transport distance.

Vastrapur Cartons

Detailed specifications of newly developed cartons are given in **Table-1**. These are of 20 and 15 kg capacity, known as '*Vastrapur-20*' and '*Vastrapur-15*'. **Figure-1** shows a photograph of Vastrapur-20. The 15-kg carton is similar, only smaller in volume. These were first tested in laboratory [1]. These cartons are designed for road travels of 500 to 1000 km. This is the usual distance from growing areas of Gujarat to various markets where the produce is sold - Ahmedabad, Baroda, Rajkot. These cartons were developed as an alternative to the currently used wood carton locally called 'Peti'.

Wood Peti

Three different sizes of wood peti are seen in Gujarat, which is the dominant mode of packaging tomato in present. The most common has outer dimension of 420 x 300 x 280 mm, and holds about 20 kg tomatoes. These are made of waste wood from timber processors, usually of neem, mango, deodar, nilgiri, etc. **Figure-2** shows a photograph of wood peti. Peti making is a household industry. Everything is done by hand with simple tools. A gap of about 5 mm is left between the slats for aeration. It has a coarse finish. A large variation was observed in dimension, tare weight, firmness of joints and consequently the mechanical strength. Price of the peti ranges between Rs.8-15 per piece. Weight of empty peti varies from 2.3 to 2.6 kg. Petis were also tested in laboratory [2]. Petis used in trial were those that the growers had purchased from their vendors.

Trial Procedure

Packed cartons were loaded on the truck with longer wall along the road (**Figure-3**) as per usual practice. Cartons were stacked in columns of four and were labeled to indicate their location in the carrier. A truck load of cartons is viewed as a three dimensional array. Each carton was marked, $C(i, j, k)$, where $i = 1$ to 7, $j = 1$ to 8 and $k = 1$ to 4. On arrival at Rajkot, cartons that were to be observed in accordance with prior plan, were separated for observation. Observations on damage to carton included failures, ruptures and bulges. Observations on damage to produce included fruit burst and skin discontinuities only. Cartons were handed over to growers who filled them as per their practice. They were instructed to sort out tomato with skin discontinuities. Usually also they do so.

Transit Information

Month	March
Origin	Khanderaopura Village
Destination	Rajkot
Travel distance	250 km

Starting time	2000 hours
Arrival	0100 hour
Pay load	Five tons
Vehicle	TATA 407. Multi - leaf (8nos) front and rear suspension without damper, wooden plank chassis mounted on two steel 'T' beams.
Road conditions	A stretch of 10 km from Khanderaopura to State Highway is Panchayat road, single lane 4.5 m wide. Rest of the distance is a State Highway 7.5 m wide.

Travel speed was 60-80 km/hr. There was a journey break after 75-100 km, for half an hour.

Trials

It is obvious that damage will differ with location of the carton in the carrier. No reports are available in literature about such variation. Therefore one trial was done to observe damage with respect to location in the carrier. Truck was therefore loaded only with one type of carton - Vastrapur 20. Entire load consisted of 250 cartons of which 104 cartons were marked for observation

Aim of the second trial was to compare the performance of Vastrapur Cartons with Peti. Truck was loaded one-half with Petis and other-half with Vastrapur Cartons as shown in **Figure 4**. As seen, front-left quarter of truck and rear right quarter were loaded with Vastrapur Cartons. The front-right and rear left were loaded with Petis. The configuration removes the effect of location.

Results

Damage to Produce:

Figure 5 (a), (b), (c) and (d) give the results of the first trial. **Figure-6** shows the variation in damage from front to rear. Tomato in the front row of chassis sustained the greatest damage (4.7%). Magnitude of damage reduced steadily up to the central row of chassis; after which it again began to increase. At the rear most row it was 4.3% which is

almost the same as the front row. Variation from front to rear is influenced by the closeness of the axles. It is high near the axles.

Figure-7 shows the variation in extent of damage from the floor to top tier. Damage is greater on the floor (5.3%), declines steadily upward (1.4%). This is due to the fact that disturbance induced by road discontinuities diminishes as one moves upwards. It is highest on the floor.

Figure-8 shows the variation in extent of damage from left to right. Damage is greater to the cartons on the left side of chassis (4.2%). Thereafter damage declines and remains the same towards center and right side of chassis (3.4%). Right side is towards the center of road, which is usually smoother. Left is usually not so even. Besides, when vehicle is being overtaken, it tends to go towards the curb side, which is even more uneven. This may be the reason for greater damage on the left side.

Damage to Carton:

Observations on the first trial shows that the bottom cartons were physically bulged on longer side and enclosures pressed inside. No other damage was found in the cartons. Upper most cartons were found undamaged.

Comparative Trial

Data on damage from the second trial is summarised in **Table-2**. In general damage to produce is lesser in Vastrapur Cartons than the Petis. As expected, damage is more in bottom tier and reduces progressively in upper tiers. Overall, damage to produce was lesser (2.8%) in Vastrapur Cartons compared to Petis (4.6%).

Summary

Field trial was conducted twice. Each trial consisted of road journey of 250 km from Khanderaopura to Rajkot. In one trial, the entire truckload consisted of tomato packed in Vastrapur Carton of 20-kg capacity. The aim of this trial was to observe the effect of location on the damage. It showed that extent of damage is more in front than in rear, more near the axle than away from it; more on the left (curb) side than the middle and rightwards. Damage is more on the carton placed on chassis floor than those on upper tier are.

Based on the insights gained from this trial, the placement of cartons in the second trial was done appropriately so as to study comparative damage in Vastrapur Cartons and in Petis. In this trial, the entire truck was loaded one-half with wood cartons and other-half with Vastrapur Cartons. The overall damage in wood cartons was found to be higher (4.6%) than the Vastrapur Cartons (2.8%).

Reference

1. Sharan Girja, Dave Umang, Srivastava S.M., and P. Sreenivas (1999). performance of vastrapur carton in laboratory. *Packaging India*, 39:44, June - July 1999.
2. Sharan Girja, Srivastava S.M., and Monika Khandelwal (1999). Mechanical properties of wood carton used for long distance transport of tomatoes. *Packaging India*, 31:5, December 1998-January 1999.

Table-1		
Specification of Vastrapur Cartons		
<i>Specifications</i>	<i>Vastrapur - 20</i>	<i>Vastrapur -15</i>
1. Material of Construction	CFB, 5 ply	CFB, 5 ply
2. Internal Dimensions (mm)	430 x 205 x 390	363 x 192 x 373
3. Style of Box	RSC 0201	RSC 0201
4. Direction of Flutes	Vertical	Vertical
5. Type of Flutes	B/C	B/C
6. Grammage of Plies (g/m.sq) (Outer to Inner)	150 all	150 all
7. Bursting Strength (kg. cm sq)	11± 1	11± 1
8. Compressive Strength (Kg/mm)	42	35
9. Cobb Value (30 minutes) g/m sq	140 gsm	140 gsm
10. Type of Adhesive	Starch based	Starch based
11. No of Pieces per Box	1	1
12. Joints	Glued	Glued
13. No of Ventilation Holes	8	8
14. Diameter and Position of Holes	24.5 mm (long walls)	24.5 mm (long walls)

Table-2		
Damage to Tomato		
(Journey : Khanderaopura-Rajkot, 250 km)		
Tier	Damage (%)	
	Peti	Vastrapur Carton
1	6.9	6.0
2	5.6	4.1
3	4.1	1.3
4	2.1	0
Overall	4.6	2.8

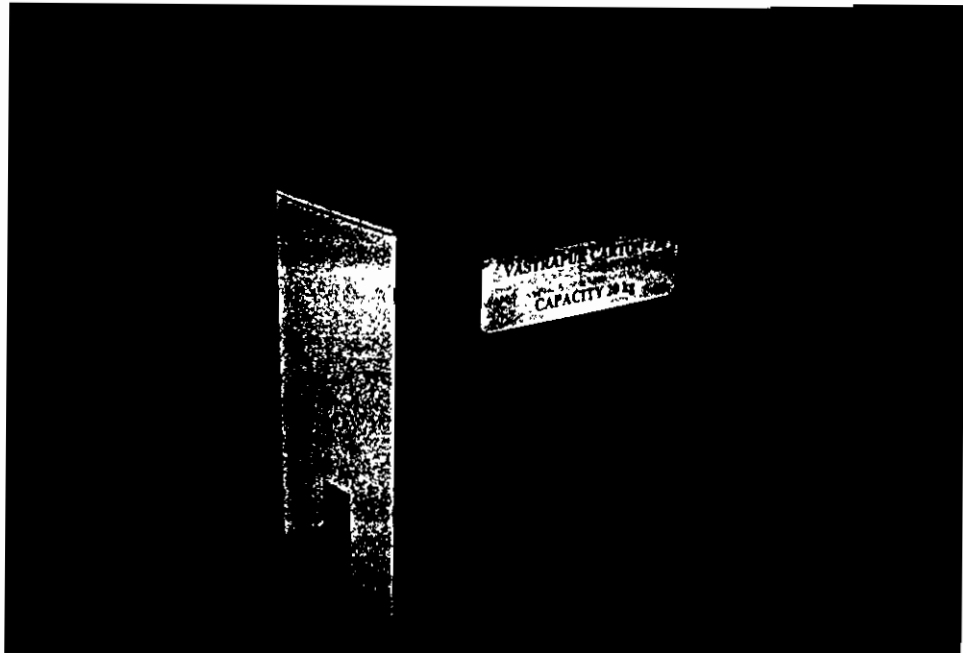


Figure-1: Photograph of Vastrapur Carton-20

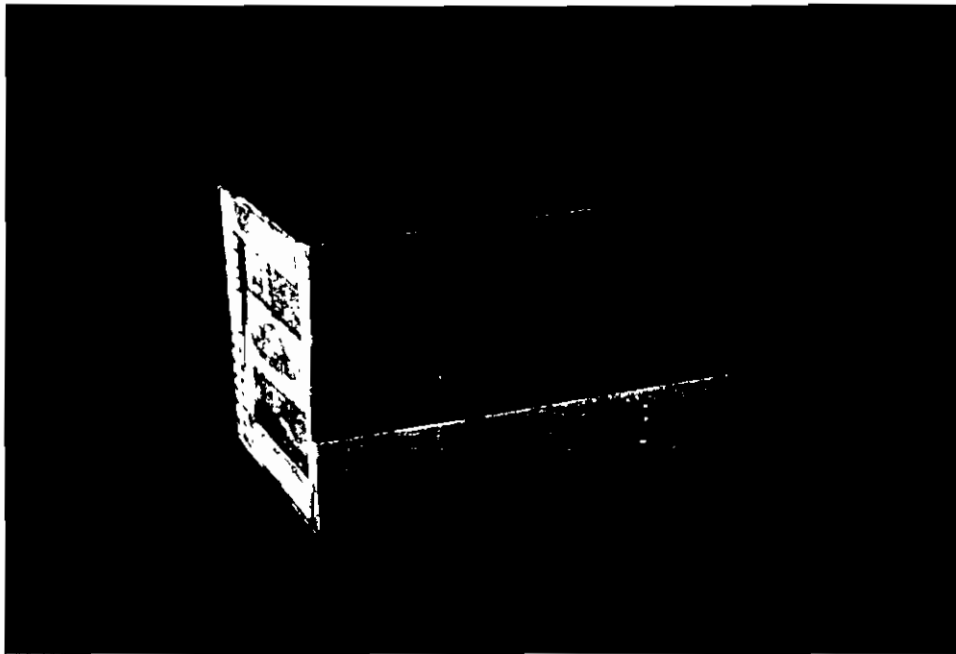


Figure-2: Photograph of Traditional Wood Peti 20-kg

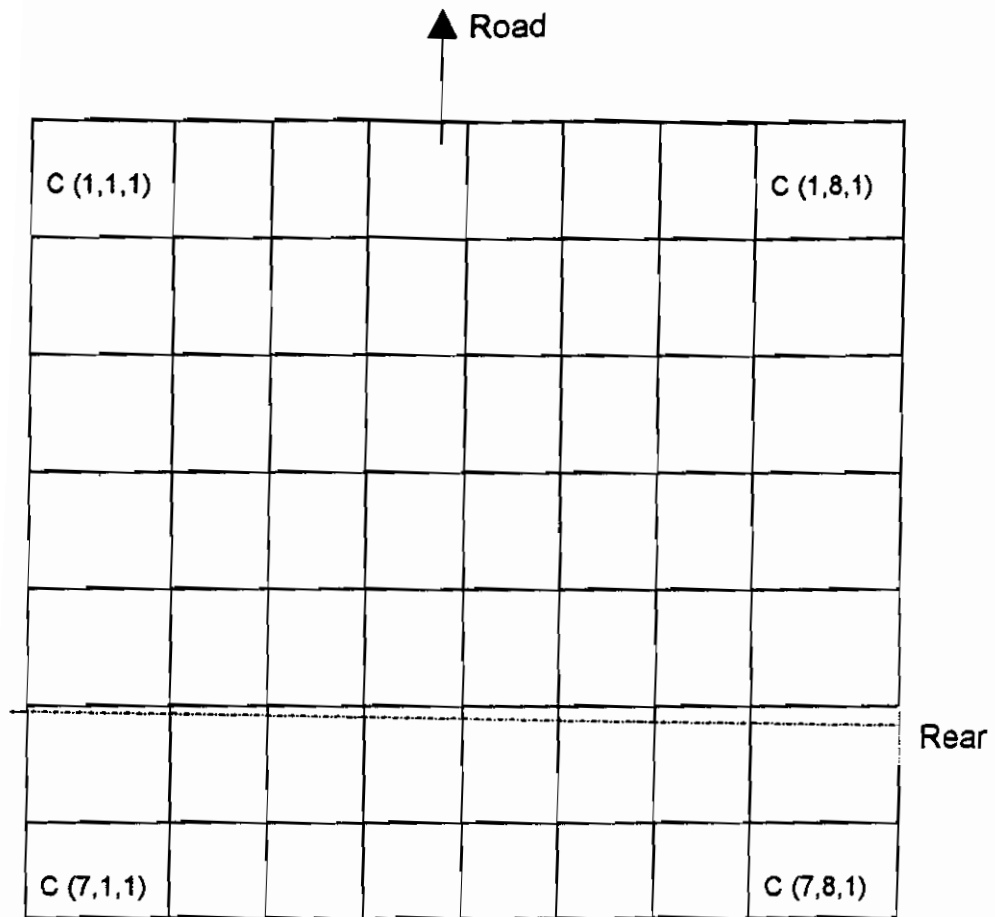


Figure-3: Plan View of Cartons on Truck

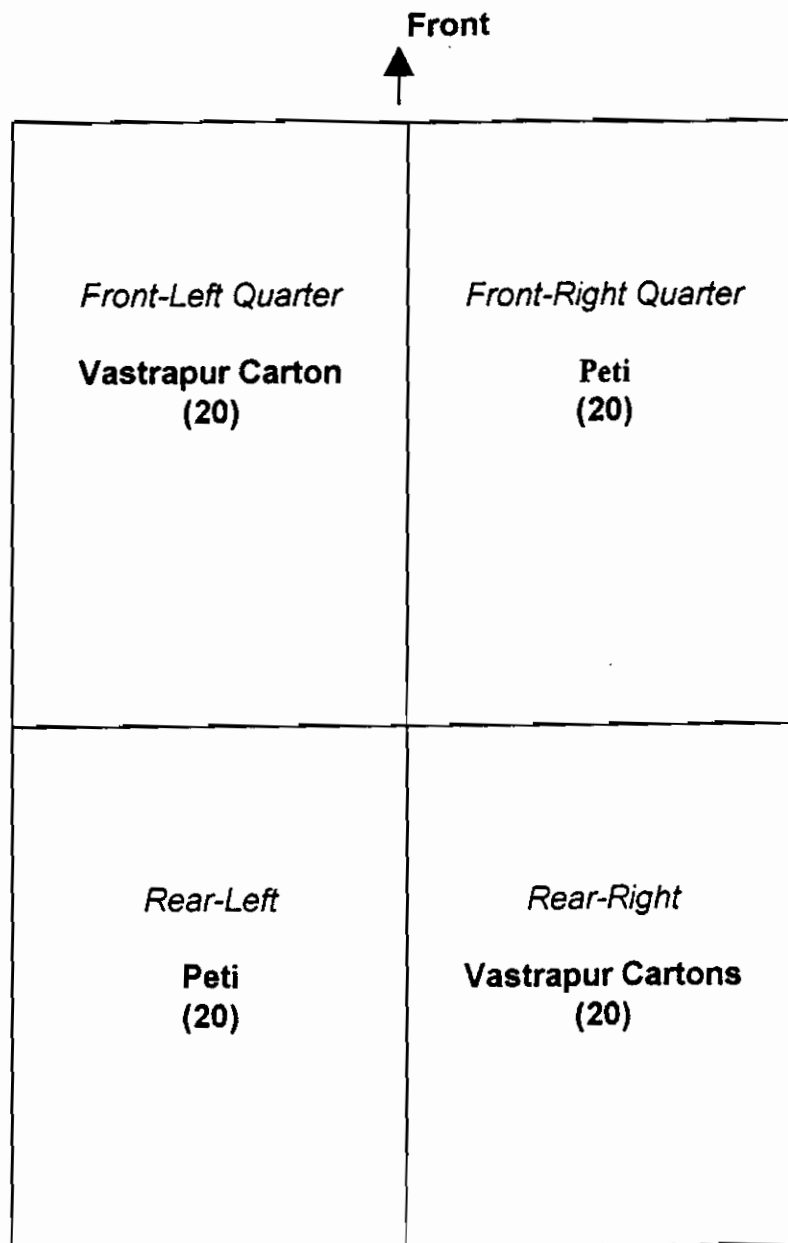


Figure-4: Placement of Vastrapur and Petis for Comparative Study

		FRONT								
		1	2	3	4	5	6	7	8	
L E F T	1	6%				5.5%			6%	R I G H T
	2	5.5%				5%			5%	
	3	5.5%				5%			5%	
	4	5%				4.5%			4%	
	5	5.5%				5%			5%	
	6	6%				5.5%			5%	
	7	6%				5.5%			5%	
		REAR								

↑
Re
Ax

Figure- 5(a): Damage to Produce in Vastrapur Carton-20 (Tier - 1 Bottom Layer)
[Vehicle: TATA 407 Travel Distance 250 km]

		FRONT								
		1	2	3	4	5	6	7	8	
L E F T	1	5.5%				5%			5%	R I G H T
	2	5%				4.5%			4.5%	
	3	5%				4.5%			4%	
	4	4.5%				3.0%			3%	
	5	5%				4%			4.5%	
	6	5.5%				5%			4.5%	
	7	5.5%				5%			4.5%	
		REAR								

R
A

Figure- 5 (b): Damage to Produce in Vastrapur Carton-20 at (Tier -2 First Layer)
[Vehicle: TATA 407 Travel Distance 250 km]

		FRONT										
		1	2	3	4	5	6	7	8			
LEFT	1	5 %				4 %			4.5 %	RIGHT		
	2	4.5 %				3.5 %			4 %			
	3	4 %				2.5 %			2.5 %			
	4	2.5 %				0			0			
	5	4 %				2.5 %		I	3 %			
		6	7	8	REAR							
		4.5 %				4 %			3.5 %	Re		
		4.5 %				4 %			3.5 %	AX		



Figure- 5 (c): Damage to Produce in Vastrapur Carton-20 (Tier -3 Second Stack)
 [Vehicle: TATA 407 Travel Distance 250 km]

		FRONT										
		1	2	3	4	5	6	7	8			
LEFT	1	5.5 %				5 %			5 %	RIGHT		
	2	5 %				4.5 %			4.5 %			
	3	5 %				4.5 %			4 %			
	4	4.5 %				3.0 %			3 %			
	5	5 %				4 %			4.5 %			
		6	7	8	REAR							
		5.5 %				5 %			4.5 %	R		
		5.5 %				5 %			4.5 %	A		

Figure 5 (d): Damage to Produce in Vastrapur Carton-20 (Tier -4 Top Stack)
 [Vehicle: TATA 407 Travel Distance 250 km]

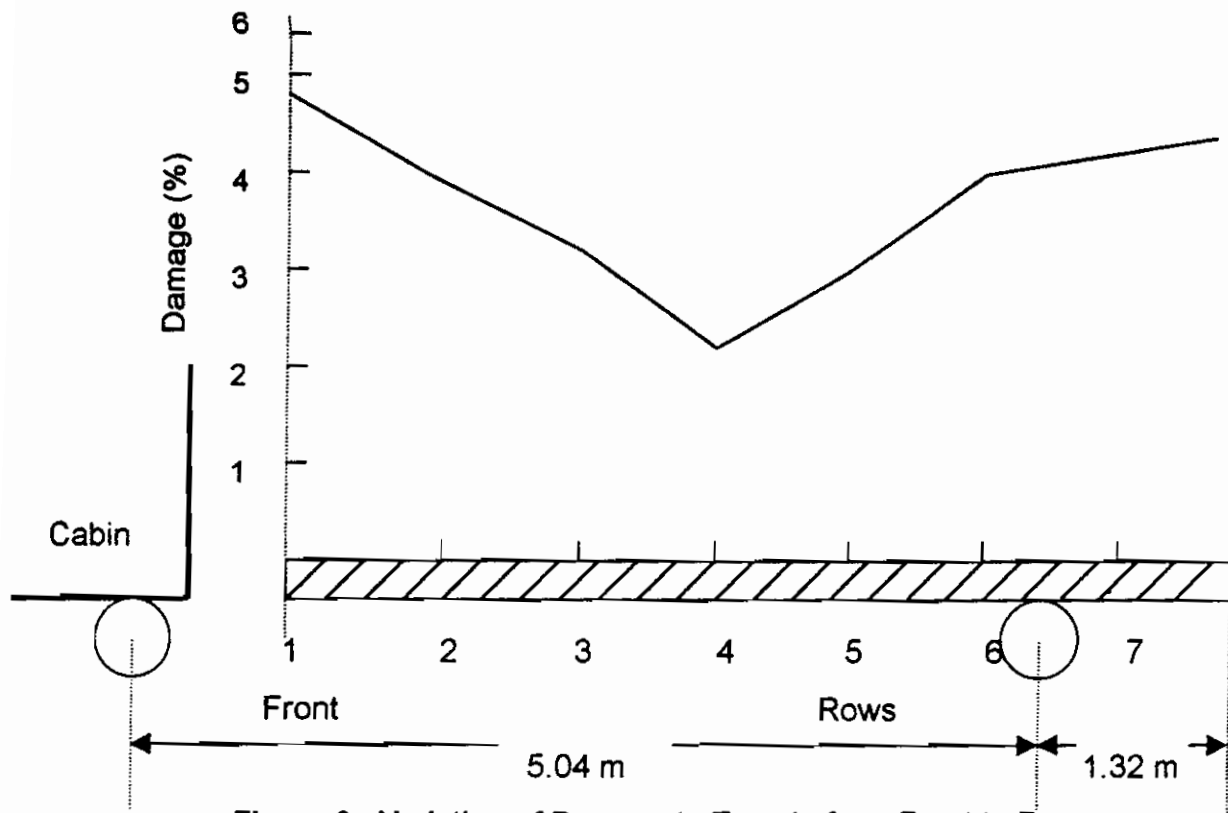


Figure-6: Variation of Damage to Tomato from Front to Rear
[Vehicle : TATA 407 Model; Route : Khanderaopura to Rajkot (250 km); Package : VC – 20 Cartons]

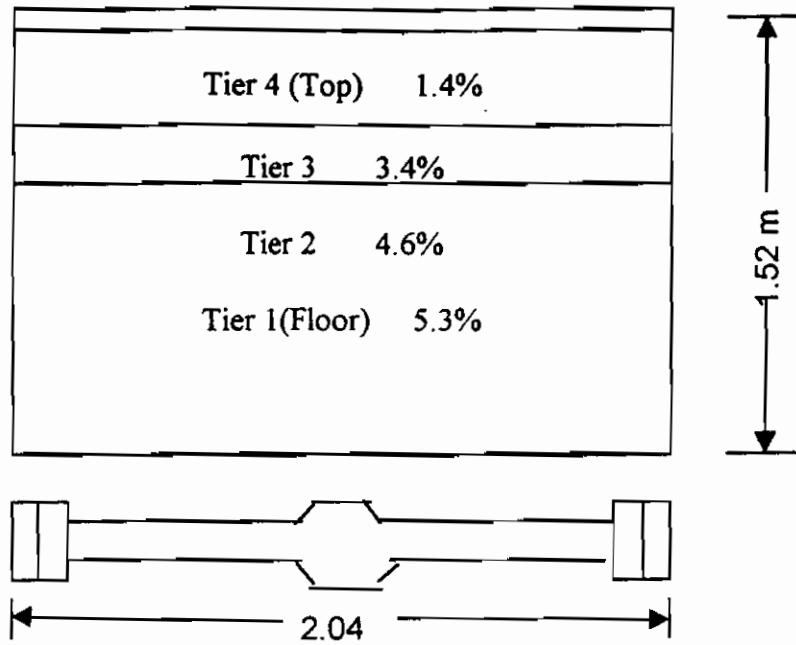


Figure-7: Variation of Damage to Tomato from Bottom to Top
 [Vehicle : TATA 407 Model; Route : Khanderaopura to Rajkot (250 km); Package : VC – 20 Cartons]

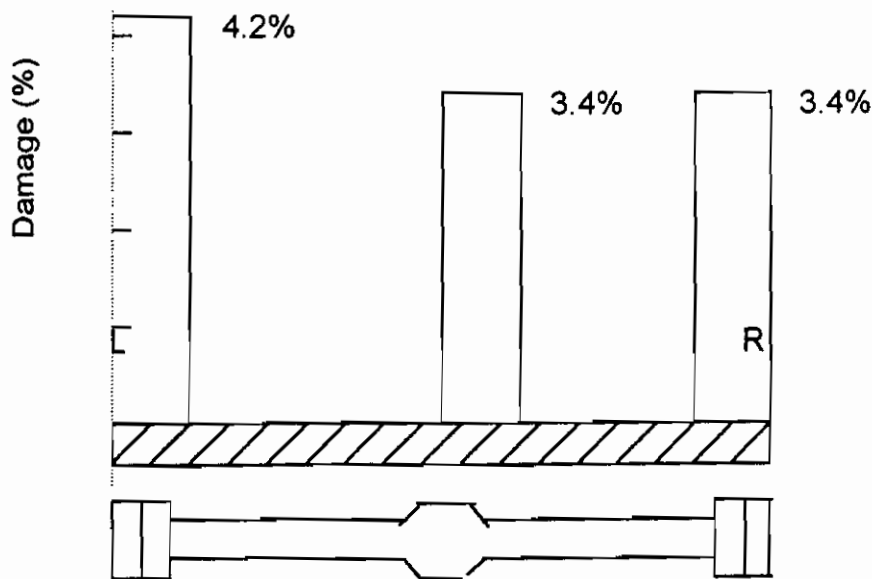


Figure-8: Variation of Damage to Tomato from Left to Right
 [Vehicle : TATA 407 Model; Route : Khanderaopura – Rajkot (250 km); Package : VC – 20 Cartons]

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