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Post-harvest loss assessment of custard apple (*Annona squamosa* L.) in Andhra Pradesh: A case study

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Abstract

The study to elicit information on post-harvest losses in custard apple at different stages of fruit handling was carried out in Anantapuramu and Chittoor districts of Andhra Pradesh during 2015-16. The data was collected from growers, wholesalers/mandi merchants, transporters and retailers through personal interview by using a pre-structured questionnaire. The aggregate post-harvest loss of 29.98 per cent fruits was recorded in custard apple from farm level to retailer's level. The mean post-harvest fruit loss of 7.65 per cent, 8.87 per cent and 13.46 per cent was observed at farm level, wholesale/mandi level including transit and retailer's level, respectively. The major share of fruit loss occurred at retailers level (44.89 per cent) followed by wholesale/mandi level (29.59 per cent).

Keywords: Custard apple, post-harvest losses

Introduction

India with the adoption of Green revolution achieved self-sufficiency in food grain production and also surged impressively in fruit and vegetable production too making the country known as 'fruit and vegetable basket' of the world. India, the second largest producer of fruits and vegetables in the world, has registered a growth in area under horticulture of about 3.8% per annum and production by 7.6% per annum over the last decade (Pathak and Mathukia, 2018) [4].

There are about 30 to 40 fruit crops under cultivation in India. Among dryland fruit crops, grown, Custard apple known as sitaphal or sugar apple is frenzied in many states of the country due to increased demand for its delicious fruit. Custard apple is mostly cultivated in states of Chhattisgarh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Bihar, Orissa, Assam and Tamil Nadu. Though the crop is mostly seen in forest areas of majority states, regular orcharding is increasing at a faster rate. The area and production of custard apple increased significantly from 18,500 ha and 1.27 lakh tonnes during 2011-12 to 48,500 ha and 4.05 lakh tonnes during 2017-18 in India (Ministry of Agriculture & Farmers Welfare, Government of India, 2018) [2].

The fruits of custard apple are very delicious but at the same time delicate and highly perishable. Being climacteric in nature, the fruits after harvest ripen quickly and become excessively soft within 2-3 days after harvest under ambient conditions and become unfit for consumption. A study on post-harvest management of custard apple in Gujarat indicated 13-25% loss at different stages of fruits handling (Jethva *et al.* 2014) [1].

In Andhra Pradesh (A.P), custard apple is grown in an area of 2,026 ha with an annual production of 13,058 metric tonnes. Though the regular orcharding is less in A.P, considerable quantity of fruits will come from forest and agency areas. The post-harvest losses of custard apple are of normal phenomenon rather than exception in A.P also. The losses occur at various stages of fruit harvesting, transport and marketing. The post-harvest losses not only reduce the per capita availability of fruits but also result in increase in per unit cost of production and marketing. This affects the monetary returns of both producers and consumers.

Keeping the above facts in view, the study was conducted with an objective to estimate the post-harvest losses at different stages of handling (harvest, packing, transport and marketing) of custard apple fruits in A.P.

Methodology: The multi-stage purposive random sampling technique (Sreenivasa Murthy *et al.* 2009 and Sudharshan *et al.* 2013) [5, 6] was used for the selection of study area and sampling units and for estimation of post-harvest losses in custard apple at farm level, wholesale and retail markets. Anantapuramu and Chittoor districts were selected as they are the major producers of custard apple in A.P. For selection of villages and mandals in each district, the major custard apple growing areas, assembly markets/wholesale markets and retail markets in the production and consumption centres were identified. The data related to quantity of fruits harvested, sold and marketed at different stages of handling were collected through personal interview by using a pre-structured questionnaire. The sampling structure for estimation of post-harvest loss (PHL) in custard apple is presented in Table-1.

Table 1: Sampling structure for estimation of PHL in Custard apple in A.P

Level	Study area	Village/Mandal	Sample size
Farm level	Anantapuramu district	Kutagulla	Five farmers from each village
		Neerukuntla palli	
		katarupalli	
	Chittoor district	Pathapalli	
		Burakayalakota	
		Nimmanapalli	
		Vempalli	
		Vantimetta	
Wholesale market/Mandi	Anantapuramu district	Kadiri	Five wholesalers from each mandal
		Kalyandurgam	
		Rayadurgam	
		Anantapuramu	
	Chittoor distrct	Madanapalli	
		B. Kotthakota	
Retail market	Anantapuramu district	Kadiri	Five retailers from each mandal
		Kutagulla	
		Anantapuramu Rural	
		Gandlapenta	
		Mudigubba	
	Chittoor district	Madanapalli	
		B Kotthakota	
		Angallu	
		Burakayalakota	
		Madanapalli	

Techniques for data analysis

The different functionaries involved in marketing of custard apple *viz.*, producers, wholesalers and retailers were identified to examine the post-harvest losses at farm level, transportation, wholesalers/mandi level and retailer's level. The simple averages and percentages were used to calculate the post-harvest losses at different stages of fruit handling.

Results and Discussion

Harvesting, packing and transportation

The details of harvesting, packing and transportation of custard apple fruits at farm level, wholesale markets/mandis and retail markets were collected and presented in Table-2.

Table 2: Harvesting, packing and transportation practices followed in custard apple in A.P

Method of harvesting	Sorting & Grading	Packing	Transportation
Manual - hand picking	Manual	Plastic crates, used cement bags, rice bags, bamboo baskets, CFB's with annona leaves and papers as cushioning material	Mini trucks, tempo vans, auto-rickshaws and tractors

Harvesting and packing of fresh fruits of custard apple has great significance in reducing the wastage, as fruit picking and packing techniques play a major role in providing protection from mechanical damage, undesirable physiological changes and pathological deterioration during transportation and marketing. The fruits of custard apple were harvested manually by hand picking. Plastic crates, cement bags, rice bags, bamboo baskets, CFB's with annona leaves and papers as cushioning material were used for packing the sorted and graded fruits. Mini trucks, tempo vans, auto-rickshaws and tractors were the means of transport of fruits from field to different markets.

Post-harvest loss assessment

At farm level

In Anantapuramu district, the survey conducted at farm level indicated that out of 885 kg custard apple fruits harvested, 820.2 kg were the salable fruits by recording a fruit loss of 19.8 kg (2.24%) due to improper harvesting methods (Table-3). About 15.6 kg (1.76%) fruits damaged due to defective packing resulting in pressing and bruising of fruits during transport. Spoilage due to disease, pest and fruit cracking resulted in 29.4 kg fruit loss (3.32%). Total quantity of 64.8 kg (7.32%) fruit loss was recorded at farm level.

Table 3: PHL of custard apple fruits at farm level (as perceived by farmers and by observation) in Anantapuramu district of A.P

S. No.	Particulars	Quantity handled (kg)	Quantity lost (kg)	Per cent loss
1.	Qty. of fruits harvested	885.0	19.8	2.24
2.	Damage due to poor packing, press and transport	865.2	15.6	1.76
3.	Spoilage due to disease/pest/fruit cracking	849.6	29.4	3.32
4.	Salable fruits	820.2	--	--
5.	Total discarded fruits	--	64.8	7.32

The loss of 73.8 kg fruits (7.97%) was recorded with 23.2 kg (2.5%) fruit loss at harvesting stage, 17.6 kg (1.9%) loss due to poor packing, pressing and transportation and 33.0 kg (3.57%) loss due to disease/pest/fruit cracking out of 925.0 kg fruit handled at farm level in Chittoor district (Table-4).

Table 4: PHL of custard apple fruits at farm level (as perceived by farmers & by observation in Chittoor district of A.P

S. No.	Particulars	Quantity handled (kg)	Quantity lost (kg)	Percentage
1.	Qty. of fruits harvested	925.0	23.2	2.50
2.	Damaged due to poor packing, press and transport	901.8	17.6	1.90
3.	Spoilage due to disease/pest/fruit cracking	884.2	33.0	3.57
4.	Salable fruits	851.2	--	--
5.	Total discarded fruits	--	73.8	7.97

At wholesale market/mandi level including transportation

Several factors contributed for post-harvest loss of custard apple fresh produce at wholesale market/mandi level. After harvesting, majority of the farmers transported the fruits to different markets by means of tractors and tempos. Fruits got damaged or bruised due to improper packing, loading and transportation. The loss occurred during the transportation and at wholesale market/mandi level were estimated and the data is presented in Table-5.

Table 5: PHL of custard apple fruits at wholesale market (Mandi's) in Anantapuramu and Chittoor districts of Andhra Pradesh

S. No.	Particulars	Quantity handled (kg)	Quantity lost (kg)	Percentage
1.	Qty. of fruits handled	3460.00	56.00	1.62
2.	Damage due to poor packing, press and transport	3404.00	188.00	5.43
3.	Spoilage due to disease/pest/rotten	3216.00	63.00	1.82
4.	Salable fruits	3153.00	--	--
5.	Total discarded fruits	--	307.00	8.87

The data presented in Table-5 indicated that the loss of custard apple fruits due to improper handling was 56.0 kg (1.62%), damage due to poor packing, pressing and transport was 188.0 kg (5.43%) and spoilage due to disease /pest/rotten was 63.0 kg (1.82%). The overall fruit loss of 307.0 kg (8.87%) out of 3,460.0 kg handled was recorded at wholesale/mandi level in Anantapuramu and Chittoor districts.

At retail market level

It is evident from the Table-6 and 7 that post-harvest losses of custard apple fruits at retail markets in Anantapuramu and Chittoor districts were 15.19 and 11.72 per cent, respectively. The maximum quantity of fruit loss was occurred due to improper packing which leads to pressing and bruising of fruits and also due to damage during transport in Anantapuramu (14.0 kg = 9.09%) and Chittoor (15.0 kg = 6.82%) districts of A.P.

Table 6: PHL of custard apple at retail market in Anantapuramu district of A.P

S. No.	Particulars	Quantity handled (kg)	Quantity lost (kg)	Percentage
1.	Qty. of fruits harvested	154.00	1.60	1.04
2.	Damage due to poor packing, press, transport	152.40	14.00	9.09
3.	Damage due to disease/pest/fruit cracking	138.40	7.80	5.06
4.	Salable fruits	130.60	--	--
5.	Total discarded fruits	--	23.40	15.19

Table 7: PHL of custard apple at retail market in Chittoor district of A.P

S. No.	Particulars	Quantity handled (kg)	Quantity lost (kg)	Percentage
1.	Qty. of fruits harvested	220.00	2.60	1.18
2.	Damage due to poor packing, press, transport	217.40	15.00	6.82
3.	Damage due to disease/pest/fruit cracking	202.40	8.20	3.72
4.	Salable fruits	194.20	--	--
5.	Total discarded fruits	--	25.80	11.72

Aggregate PHL of Custard apple in A.P

The overall post-harvest loss of 29.98 per cent comprised of 7.65 per cent at farm level, 8.87 per cent during transit and wholesale/mandi level and 13.46 per cent at retailers level was observed in custard apple (Table-8). The study also revealed that the major loss was recorded at the retailers level (44.89 per cent) followed by wholesale/mandi level (29.59 per cent). Sudarshan *et al.* (2013) [7] reported an aggregate post-harvest loss of pomegranate from orchards to consumers ranged from 25.48 per cent in Bangalore market to 38.44 per cent in Mangalore market. Moula Sab *et al.* (2017) [3] reported 34.49 per cent of overall post-harvest losses in mango at different stages from harvesting to consumption.

Table 8: The overall PHL of custard apple fruit in A.P

Particulars	Quantity loss (kg)*	Per cent loss*	Share in total per cent
Farm level	69.30	7.65	25.52
Wholesale market /mandi & transport	307.00	8.87	29.59
Retail market	24.60	13.46	44.89
Total loss		29.98	100.00

*Mean quantity loss of fruits of Anantapuramu and Chittoor district

Summary and conclusions

Estimation of post-harvest losses of fruits is important as it helps in identifying the casual factors at different stages of handling and provides ways and means to reduce the losses. In the present study losses were estimated for custard apple fruits at different stages of handling. The aggregate post-harvest loss of 29.98 per cent was observed in study areas of Anantapuramu and Chittoor, the two major custard apple growing districts of Andhra Pradesh. The maximum post-harvest loss (13.46%) was recorded at retail markets. The impact of post-harvest losses on the availability of custard apple in absolute terms revealed that out of every 100 kg custard apple fruits produced and marketed at wholesale and retailers level, only 70 kg reached the ultimate consumer.

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