

## Marketing and post-harvest loss assessment in sapota

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### ABSTRACT

A study was undertaken in the Kolar district of Karnataka to assess the losses in post harvest handling and marketing of sapota. The analysis of data collected at the field level, market level, procurement centre of HOPCOMS and at the retail level indicated post harvest loss (PHL) of 15.98% in the wholesale marketing channel (WSM) and about 14.07 per cent in the HOPCOMS channel. Marketing system for sapota was found to be inefficient as the efficiency index was found to be less than 1. However, between WSM and HOPCOMS, the latter was found to be more efficient in terms of lower marketing cost, higher price realization by farmers and lower margin of the intermediaries. Use of mechanical harvester, pre harvest management of fruits against fruit borer and opening of procurement centres of HOPCOMS in the producing region are suggested in order to reduce the PHL and also to improve the efficiency of the marketing system.

**Key words:** Efficiency, marketing, post harvest loss, sapota

### INTRODUCTION

Sapota is an important fruit crop accounting for about 2% each of area and production of fruits in the country (Anon, 2004). The production at national level has been increasing at a compound rate of 6.14% annually. Karnataka is one of the major sapota growing states with an area of 21,274 ha. and a production of 2,26,512 (Anon, 2005) accounting for about 25% each of area and production of sapota in India. Like in other fruits, production of sapota is also subject to losses at different stages of post harvest handling. Not much information is available on the marketing and post harvest handling or assessment of post harvest loss (PHL) in this fruit crop. Very few studies, mainly under experimental conditions have reported the PHL in sapota (Jagtap and Katrodia, 1998). Hence, a study was taken up to examine the marketing practices and to assess PHL in sapota with the following specific objectives: i) to examine the existing marketing practices for sapota, ii) to assess post harvest losses and to identify causal factors at different stages of handling in different marketing channels and iii) to suggest strategies to reduce PHL and to improve the marketing system in sapota.

### MATERIAL AND METHODS

#### Selection of the study area

Multistage random sampling was used to select the study area and the sample respondents were selected

randomly. In the first stage, Kolar district was selected, as, it is the major sapota growing area of the state accounting for about 15% each of area and production in Karnataka (Anon, 2005). In the second stage, Bangarpet, Malur and Kolar taluks were selected as these are the major sapota growing taluks of the district. A total of 21 respondents/farmers' fields were randomly selected from among 5 villages. Depending upon the marketing channels followed, Bangalore wholesale market and the horticultural producers' cooperative marketing and processing society Ltd. (HOPCOMS) were selected for examining the marketing practices and to assess PHL at the market level. Private retail outlets and HOPCOMS retail outlets in Bangalore city were selected for assessing retail level losses in sapota. Details of sampling are given in Table 1.

#### Estimation of PHL

Keeping in view the stakeholders involved in post harvest handling operations, three stages, viz, field level, market level and retail level were identified for PHL assessment. Losses at the field level were estimated in 21 sample lots drawn from the harvesting fields at the time of harvest. At the field level, normally, no grading is done but fruits damaged due to mechanical injury, borer attack and bird attack are sorted out and discarded. This category of discarded fruits was treated as loss at the field level. At the

market level, samples were drawn from the wholesale market at Agricultural Produce Market committee (APMC), Singena Agrahara and from the procurement centre of HOPCOMS, Bangalore. The loss was assessed at the time of auctioning in the wholesale market and at the time of purchase at HOPCOMS procurement centre. At the market level, very small and immature fruits, and fruits damaged due to crushing/bruising during transit, are discarded. These discarded fruits were considered to be loss at the market level. The retail level losses were assessed from the sample lots of private and HOPCOMS outlets. At the retail level, overripe and rotten fruits are discarded and the quantity of such fruits was taken as loss at the retail level. Simple averages and percentages were used as analytical tools.

### Estimation of marketing efficiency

Efficiency of the marketing system is normally analysed using the standard formula of Acharya and Agarwal (2001). This formula was later modified by Sreenivasa Murthy *et al.* (2004) by including PHL as an item of cost. The modified formula used in our study is given below:

$$ME = \frac{NP_F}{MC + MM + PHL}$$

where ME = Marketing efficiency index

$NP_F$  = Farmer's net price

$NP_F = GP_F - \{C_F + (L_F \times GP_F)\}$  or

$NP_F = \{GP_F\} - \{C_F\} - \{L_F \times GP_F\}$

where  $NP_F$  is the net price received by the farmer (Rs/kg)

$GP_F$  is the gross price received by the farmer (Rs/kg)

$C_F$  is the cost incurred by the farmer during marketing (Rs/kg)

$L_F$  is the physical loss of produce at field level (kg)

MC = Marketing cost of the intermediaries

$MC = C_F + C_W + C_R$

where  $C_F$  is the cost of the farmer in marketing (Rs/kg)

$C_W$  is the cost of the wholesaler in marketing (Rs/kg)

$C_R$  is the cost of the retailer in marketing (Rs/kg)

MM = Marketing margin of the intermediaries

$MM = MM_W + MM_R$

where  $MM_W$  is the marketing margin of the wholesaler

$MM_R$  is the marketing margin of the retailer

PHL = Post harvest loss during marketing

$PHL = \{L_F \times GP_F\} + \{L_W \times GP_W\} + \{L_R \times GP_R\}$

where  $L_F$  and  $GP_F$  are same as indicated above

$L_W$  is the physical loss during wholesaling (kg)

$L_R$  is the physical loss during retailing (kg)

$GP_W$  is the gross wholesale price (Rs/kg)

$GP_R$  is the gross retail price (Rs/kg)

## RESULTS AND DISCUSSION

### Marketing channels

There were three important channels used by the farmers in the study area for marketing sapota:

- Producer-Contractor-Distant Market Wholesaler-Retailer - Consumer
- Producer-Commission Agent/Wholesaler-Retailer-Consumer
- Producer-Cooperative Society (HOPCOMS) - Consumer

The above channels could briefly be called 1) Field Sale, 2) Wholesale Marketing (WSM) channel and 3) HOPCOMS channel.

In all, 66.67% of the farmers marketed 66.48% of the total quantity of sapota at the field level itself (Field Sale). About 20% of the farmers marketed 19.23% through wholesale market in Bangalore and 13.33% of the farmers marketed 14.33% of sapota through HOPCOMS.

### Marketing practices

After harvest, fruits damaged due to injury, bird attack or borer attack are discarded, good fruits are packed in gunny bags @ 75 kg /bag and brought to the wholesale market in Tempos (motorized vehicles). Sapota is then auctioned off in the wholesale market through commission agents and it then reaches the retailer. In the case of HOPCOMS, after harvest, sapota is packed in plastic bags @ 35 kg/bag and is brought to the HOPCOMS procurement centre, Bangalore, in Tempos. The produce is purchased by HOPCOMS after careful sorting and discarding very small and immature fruits; ripe, crushed and broken fruits. It is then sent to retail outlets in HOPCOMS' own vehicle where care is taken while loading and unloading the produce.

**Post harvest loss assessment**

PHL assessment and marketing of sapota was confined to Channel II and Channel III only<sup>1</sup>.

Total post harvest loss was observed to be 15.98% consisting of 5.73% at the farmers' field level, 3.15% at the wholesale market level and 7.10% at the retail level in the wholesale marketing channel. In HOPCOMS channel, the PHL was observed to be slightly less at 14.07 per cent consisting of 5.73% at the field level, 3.92% at the procurement centre level and 4.42% at the retail level.

Analysis of data collected from farmers' fields at the time of harvest revealed that PHL in sapota was around 5.73% (Table 2). The main causes of loss were observed to be mechanical (physical) injury (4.15%) due to faulty harvest practices, borer attack (1.35%) and bird attack (0.23%). Manual harvesting of sapota caused injury to fruits as some fruits fell to the ground while picking. Besides mechanical injury, fruit borer also caused damage to the fruits. It may be observed from Table 3 that PHL was 3.15% at the Bangalore wholesale market. The main causes of loss at the market level were observed to be very small fruits (1.35%), bruises (0.82%), broken fruits (0.49%) crushed fruits (0.37%) and overripe fruits (0.12%). At the HOPCOMS procurement centre, PHL was observed to be 3.92 per cent owing to small and immature fruits (1.02%), bruises (1.14%), crushed fruits (0.55%), overripe fruits (0.41%), borer attack (0.32%) and malformed fruits (0.52%). In the case of HOPCOMS, careful initial screening and sorting of fruits was the reason for higher PHL at this level. The harvested fruits are packed in gunny bags and loaded into the Tempos without much cushioning except with leaves. Hence, during transit, fruits are bruised and ripe fruits are crushed and broken. The PHL at the retail level was 7.10% and 4.42%, respectively, in channel II and channel III. Loss at this level was mainly due to overripe and rotten fruits in these outlets. Careful sorting of ripe, borer attacked and malformed fruits at the time of

**Table 1. Sampling details**

| Sl. No. | Stages of handling              | No. of sample lots | Avg. weight of the sample lot (kg) |
|---------|---------------------------------|--------------------|------------------------------------|
| 1       | Field level                     | 21                 | 20.15                              |
| 2       | Market level                    |                    |                                    |
|         | (i) Wholesale market            | 18                 | 73.88                              |
|         | (ii) HOPCOMS procurement centre | 5                  | 30.60                              |
| 3       | Retail level                    |                    |                                    |
|         | (i) Private retail outlets      | 14                 | 15.66                              |
|         | (ii) HOPCOMS outlets            | 5                  | 10.00                              |

procurement by HOPCOMS resulted in less loss during the retailing stage as over ripened and rotting fruits are avoided.

**Table 2. Post Harvest Loss assessment at field level**

| Sl. No. | Particulars                     | Quantity (kg) | Percentage (%) |
|---------|---------------------------------|---------------|----------------|
| 1       | Total quantity of sample fruits | 422.65        | 100.00         |
| 2       | Quantity of Good fruits         | 398.46        | 94.27          |
| 3       | Damaged fruits                  |               |                |
|         | (i) Mechanical injury           | 17.55         | 4.15           |
|         | (ii) Borer attack               | 5.69          | 1.35           |
|         | (iii) Bird attack               | 0.95          | 0.23           |
|         | Total PHL                       | 24.19         | 5.73           |

It may be observed from Table 4 that field level loss accounted for maximum loss in the HOPCOMS channel (41%), while, in the WSM channel, retail level losses accounted for 44% of the total PHL. Mechanical injury, borer attack at the field level and overripe and rotting fruits were the causal factors in both the channels. This calls for development and use of sapota harvester and pre harvest management of sapota for control of fruit borer at the field level. Further, rotting of fruits was mainly due to secondary infection caused by borer and compression damage during transit. Proper packaging and transportation would reduce this loss.

**Marketing costs and returns in different channels**

It may be noted from Tables 5 and 6 that the producer's share was higher in HOPCOMS channel compared to WSM channel. Further, the farmer could get higher net price (Rs.8.64/kg) in this channel than in WSM

**Table 3. Post Harvest Loss (PHL) at the market level**

| Sl. No | Particulars                     | PHL (kg)            |                    |
|--------|---------------------------------|---------------------|--------------------|
|        |                                 | WS Market           | HOPCOMS            |
| 1      | Total quantity of sample fruits | 1330.00<br>(100.00) | 153.00<br>(100.00) |
| 2      | Good fruits                     | 1228.16<br>(96.85)  | 146.99<br>(96.08)  |
| 3      | Damaged fruits                  |                     |                    |
|        | (i) Small/immature fruits       | 18.00<br>(1.35)     | 1.50<br>(1.02)     |
|        | (ii) Bruised fruits             | 10.87<br>(0.82)     | 1.74<br>(1.14)     |
|        | (iii) Broken fruits             | 6.55<br>(0.49)      | -                  |
|        | (iv) Crushed fruits             | 4.86<br>(0.37)      | 0.85<br>(0.55)     |
|        | (v) Ripe fruits                 | 1.56<br>(0.12)      | 0.63<br>(0.41)     |
|        | (vi) Fruits with borer attack   | -                   | 0.49<br>(0.32)     |
|        | (vii) Malformed fruits          | -                   | 0.80<br>(0.52)     |
|        | Total                           | 41.84<br>(3.15)     | 6.01<br>(3.92)     |

Note: Figures in parentheses are percentages of total

<sup>1</sup>In channel I (Field sale), the movement of the harvested produce could not be traced to its destination due to want of time, resources and non-cooperation of contractor.

**Table 4. Total Post Harvest Loss in Sapota**

| Particulars  | WSM     |                | HOPCOMS |                |
|--------------|---------|----------------|---------|----------------|
|              | PHL (%) | Share in total | PHL (%) | Share in total |
| Field level  | 5.73    | 35.79          | 5.73    | 40.65          |
| Market level | 3.15    | 19.71          | 3.92    | 27.86          |
| Retail level | 7.10    | 44.43          | 4.42    | 31.41          |
| Total        | 15.98   | 100.00         | 14.07   | 100.00         |

channel (Rs.7.08/kg). Marketing cost appears to be the same for both the channels. However, the intermediaries' margin was more than the producer's share in case of WSM channel and was much higher (43.65%) than the margin in the case of HOPCOMS channel (32.86%). Post harvest loss in HOPCOMS channel was slightly less (14.07%) than the WSM channel (15.98%).

It is interesting to note that the marketing system for sapota does not appear to be efficient as the efficiency index was less than 1.00 in both the channels (Table 6). However, of the two, HOPCOMS channel was better than WSM channel. This may be attributed to the higher price realization by farmers, lower intermediary's margin and better handling of the produce. For farmers, the marketing cost was observed to be Rs.1.88/kg in HOPCOMS channel and Rs.2.24/kg when sold through commission agents. The marketing cost consisted of harvesting and packing (31-37%), transport (25-28%) and deduction towards spoilage in the case of HOPCOMS (33.51%) and commission in the case of sale through commission agent in wholesale market

**Table 5. Price spread in Sapota in different channels**

| Price spread                  | WSM   |        | HOPCOMS |        |
|-------------------------------|-------|--------|---------|--------|
|                               | Rs/kg | %      | Rs/kg   | %      |
| Net price received by farmers | 7.08  | 31.37  | 8.64    | 40.51  |
| Marketing cost of farmers     | 2.24  | 9.92   | 1.88    | 8.81   |
| PHL at field level            | 0.57  | 2.53   | 0.64    | 3.00   |
| Cost of wholesaler            | 0.24  | 1.06   | -       | -      |
| PHL                           | 0.52  | 2.30   | -       | -      |
| Margin of wholesaler          | 5.89  | 26.10  | -       | -      |
| Retailer's cost               | 0.44  | 1.95   | 1.32    | 6.19   |
| PHL                           | 1.63  | 7.22   | 1.84    | 8.63   |
| Retailer's margin             | 3.96  | 17.55  | 7.01    | 32.86  |
| Consumer's price              | 22.57 | 100.00 | 21.33   | 100.00 |

**Table 6: Efficiency of the channels in marketing sapota**

| Sl. No. | Efficiency parameters       | WSM              | HOPCOMS          |
|---------|-----------------------------|------------------|------------------|
| 1       | Producer's share (%)        | 31.37            | 40.51            |
| 2       | Marketing cost (Rs/kg)      | 2.92<br>(5.64)*  | 3.20<br>(5.68)*  |
| 4       | Intermediaries margin (%)   | 43.65            | 32.86            |
| 5       | Post harvest loss (PHL) (%) | 15.98            | 14.07            |
| 3       | Marketing efficiency index  | 0.60<br>(0.46)** | 0.91<br>(0.68)** |

\* indicates marketing cost after inclusion of PHL as an item of cost

\*\* indicates marketing efficiency (ME) after inclusion of PHL as an item of marketing cost

(44.20%). Marketing of sapota through HOPCOMS was found to be efficient both in terms of cost (16% less compared to wholesale market sale) and 13 and 29 per cent higher price realization (Rs.11.16/kg) compared to selling in the wholesale market (Rs.9.89/kg) and field sale (Rs.8.62/kg), respectively. Further, the net returns realized by the farmers were 31 per cent higher in HOPCOMS channel (Rs.36,909/ha) compared to sale of sapota through commission agent in the wholesale market (Rs.28,264/ha).

### Post harvest loss, price spread and efficiency

Post harvest loss accounts for 11 percent of the consumer's price in case of HOPCOMS channel and about 12% in case of WSM channel. As PHL increases cost of marketing, it also has an impact on marketing efficiency. Price spread was observed to be 59.49% which, without the PHL, would have been 50.77% in HOPCOMS channel. In WSM channel the price spread has increased to 68.63% from 61.47% due to inclusion of PHL as an item of cost in the marketing system. If PHL is also included as a cost of marketing, efficiency of the already inefficient marketing system is further reduced by about 33.82% in HOPCOMS channel and by 30.43% in WSM channel. Hence, it may be inferred that inclusion of PHL in the calculation of marketing efficiency will reduce the efficiency. This calls for efforts to reduce loss during post harvest handling of sapota to improve efficiency of the marketing system. Based on the foregoing discussion, it may be concluded that development and use of mechanical harvesters, and, suitable pre-harvest management practices for control of fruit borer at the field level, sorting of damaged/borer attacked fruits at an early stage, would reduce the loss at later stages by avoiding secondary infection. Use of proper packing material with cushioning could reduce loss in transit due to bruises, compression and crushing of fruits. Marketing system for sapota was found to be inefficient due to higher costs and margins of the intermediaries. However, between WSM and HOPCOMS, the latter was observed to be better and hence, procurement centre of HOPCOMS at the production regions may be started. This would reduce transport costs and loss in transit. This would also improve the efficiency of the marketing system by reducing the number of handlings and the associated loss. Efforts need to be made to reduce PHL to increase efficiency index of the marketing system.

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