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Assessment of post-harvest losses in banana under Jalgaon condition, in Maharashtra

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Abstract
Post harvest losses of fresh produce is a major challenge in the post harvest sector. Banana fruits are the most perishable agricultural produces facing a tremendous loss from harvest to consumption. The present investigation was undertaken to assess post harvest losses (at farm level, transport level, wholesale market level, storage and ripening level and retail level) in Jalgaon district of Maharashtra with 100 farmers since 2018 to 2019. The four banana growing tahsils selected for survey were Raver, Muktainagar, Yawal and Chopda. The variety grown was Grand Nain.
The results revealed that, the overall post-harvest losses in banana comprised of (6.81%) loss at field level, (3.90%) loss during transport. The minimum (1.56%) post harvest losses in banana were recorded during assembly market/wholesale market. The losses to were recorded during storage and ripening was (3.40%). The highest loss (14.12%) was observed at retailer level. The major problems of the post-harvest losses of banana fruits were due to faulty handling, lack of packaging techniques, transport facilities, lack of cold storage facilities. The results have emphasized that efforts should be made to adopt scientific method of handling improved packaging techniques, cushioning material & cold storage facilities at the retail level for minimizing the post harvest losses in Banana.

Keywords: Banana, assessment, post-harvest loss

Introduction
Banana is a very important fruit not only in India but all over the world. India is known as fruit and in the vegetable basket of the world. The present production estimate of 30.2 MT from an area of 8.47 lakh hectares, keeping India first place in terms of production since last three decades. The crop has transformed from its status as a backyard crop to a high value crop in the last 25 years (Annual Report of ICAR-NRCB 2018-19). It is the second largest producer of overall fruits and vegetables production in the world, after China. The main causes are physiological (wilting, shriveling and chilling injury, etc.), pathological (decay due to fungi and bacteria) and physical (mechanical injury). These causes, in most instances can be interrelated, that is, mechanical injury can lead to post-harvest decay in many cases (FAO, 1989; Madrid, 2011). The post- harvest losses not only reduce the availability of fruits but also result in increase in per unit cost of production & marketing. This affects lot the producers (reduction in share in consumer's price) & consumers (reduced availability & higher prices). Thus, the overall objective of the present study was to assess the post-harvest losses in banana fruit at different stages of handling & to develop strategies to reduce these losses. The total estimated loss during post harvest handling of banana in Assam was about 22% (Anonymous, 2005) [1], whereas, in Kerala State 17.82% and 21.33% were recorded in Thrissur and Palakkad, respectively, in Nendran variety of banana. Overall post harvest loss of banana in Kerala state was 19.57%. In Andhra Pradesh 23.67% and 25.54% were recorded in East Godavari and West Godavari districts respectively in 'KC Keli' and 'Grand Naine' variety of banana was recorded. Overall post harvest loss of banana in Andhra Pradesh was 31.94%. In Tamil Nadu state 10.83% and 11.93% in Theni and Erode districts, respectively in 'Grand Naine' variety was reported, while it was 17.39% and 6.41% in Tiruchirapalli and Tuticorin districts, respectively in 'Poovan' variety. Overall post harvest loss of banana in Tamil Nadu state was 11.64 % (ICAR-AICRP on Fruits –Annual Report 2018-19).
Generally, the primary factors causing postharvest loss in fruits can be categorized in to mechanical, physiological, pathological or environmental factors (Kader and Rolle, 2004) [5].

The losses are favored by secondary factors resulting mainly from inadequate technology applications and quality control. A high postharvest loss caused by inadequate and inefficient postharvest handling practices, is reported to be one of the major problems limiting the expansion of banana production in Africa (Olorunda, 2000) [4]. Similarly, lack of postharvest and marketing infrastructures such as packaging, cold storage, pre-package and distribution, postharvest treatment and washing facilities together with production constraints are reported problems leading to low productivity and considerable postharvest loss of banana in Ethiopia (Gabre-Mariam, 1999) [6].

Processing and product development through value addition is the best alternative to reduce the post harvest losses. To improve the marketing system, it is essential to create awareness among the growers, farm workers and managers, traders and exporters about the extent of post harvest losses. Considering all these facts, the study was undertaken to assess the post harvest losses of banana, during different stages of marketing channel in banana.

Methodology (Details of Research Project)

Field level estimation of post-harvest loss (PHL), in banana cv. Grand Naine was done by using multi-stage stratified random sampling approach. In Maharashtra, the Jalgaon district was selected because of the maximum contribution of banana cultivation to the total state production. For this study four banana growing tahsils namely Raver, Muktainagar, Yawal, Chopada of Jalgaon district were randomly selected; these accounted for more than 70 per cent of banana growing area in the district from each Taluka, 5 villages, from each village select at random 5 orchards, from each orchard at random10 bunches/orchard at the time of harvest to estimate post-harvest loss. 5 wholesalers and 5 retailers were selected from each of the market.

Table: Sampling Structure of estimation of post-harvest losses in the study area

Level	Study Area	Tehsil	Sample size
Farm level	Jalgaon district	Raver, Muktainagar, Yawal, Chopada	Five villages were randomly selected from each tahsil
Transport level			Five orchards were randomly selected from each village
Wholesale/ assembly market level			Ten samples from each orchard were selected
Storage and ripening level			Five wholesalers from each of the market
Retail level			Five retailers from each of the market

Results & Discussion

A. Post-harvest Losses at Farm Level

The farmers were not found to sort the harvested banana in the field. However, some of the bananas were discarded at the field which was considered as loss at the field level. It was observed that, at farm level post-harvest loss of 6.81per cent (16 Kg) was worked out due to the various reasons at the farm including mechanical damage due to improper harvesting and handling method, absence of sorting-grading and packaging practices. It indicated that out of 234.80 Kg banana fruits 16 kg fruits were found unfit for consumption. These fruits were neither marketed nor consumed in any form during sorting, grading & packing at the farm level.

The major losses were damage and dropping of fruits during harvesting, handling, loading of bunches, refusal of twin fingers, immature fruits, spoilage as well as pre-harvest ripening of fruit, which made the banana fruits unsuitable for long distance transportation and gave the undesired quality attributes like colour, flavour and taste. Generally, farmers sold the bananas when there was good demand in the market so as to get higher economic returns, i.e., during early season or during the scarcity of banana in the market. Therefore, the farmers harvested banana at early stage without considering full and even maturity in the bunch. So, immature fruits mainly contributed to increase in the losses at the field level.

Table 1: Post-harvest Losses in banana at Farm Level

Particulars	Quantity (Kg)	Percentage (%)
Total quantity of banana sample drawn (kg)/(sample size of 100 hands)	234.80	100
Salable fruits	218.80	93.19
Weight of damaged/rejected fruits, dehanding during harvesting and sorting- grading (Due to decay, Bruise/cut injury)	10.40	4.42
Pre-mature ripening / immature ripening etc.	2.39	2.39
Total discarded fruits (kg)	16.00	6.81

B. Post-harvest losses at transport

The losses at traders level included the losses occurred during transportation, unloading and handling. It is evident from the investigation that during transit the PHL was higher when fruits were sold to long distance market than medium and short distance market. In case of damage due to the poor packing, dumping and kacha roads during transportation up to market was recorded 3.50 per cent in Raver market as compared to 4.30 per cent in Burhanpur market. By considering the data elicited from two market average losses during transportation was recorded 3.90 per cent.

Table 2: Post-harvest losses in banana during transport

Particulars	Quantity (Kg)	Percentage (%)
Total quantity of banana produce on arrival	218.80	93.19
Saleble produce	209.64	89.28
Weight of banana loss due to the poor packing, dumping during transportation, unloading and pre-mature ripening (cause by uncontrolled temperature conditions)	9.16	3.90
Total discarded fruits (kg)	9.16	3.90

C. Post-Harvest Losses at Wholesale Marketing Level

Post harvest losses were more when fruits reaching the wholesale market are off loaded and weighed before entering it to the ripening rooms. It was possible to observe during the assessment that labor handling during unloading was also very rough. In this study the loss during wholesale market level was estimated at two spatially distributed markets viz. Raver & Jalgaon market. The most of the wholesaler prefer storage house/ godowns to collect the farm produce until they get adequate produce to load trucks or wagons in case of rail transport. It is found that during investigation of wholesale market level, the PHL was 1.56 per cent (g) when fruits were stored at godowns/ storage house due to unproper handling and uncontrolled storage conditions.

Table 3: Post-harvest losses in banana at Wholesale Marketing Level

Particulars	Quantity (Kg)	Percentage (%)
Total quantity of banana produce on arrival	209.64	89.28
Saleble produce	205.98	87.73
Weight of rejected fruits due to overloading or unproper storage (due to decay, rotting, poor quality of fingers) and loss due to pre-mature ripening/ blackening of fruits	3.66	1.56
Total discarded fruits (kg)	3.66	1.56

D. Post-harvest Loss in Ripening Chamber

It is observed that, the post harvest losses in banana in ripening chamber were 3.40 per cent (4 kg) mainly it is due to physiological loss in weight (PLW), more time exposure to ripening conditions and absence of standard practices during ripening process.

The higher weight loss during the ripening treatments, i.e., smoking and the calcium carbide + H_2O Acetylene gas which hastens ripening. It does not produce large amount of heat due to the high amount of moisture loss from the banana. The peel of bananas remained green even though internal ripening already commenced. Therefore, in such case, the peel colour did not reflect the internal status of banana. After 4 to 5 days under ripening the peel splitting was observed under ethephon + ice treatment method. However, the overall appearance was good indicating good quality of bananas. The lowest loss (4.66%) and excellent appearance of banana was found when ethephon + air-cooled chamber method of ripening was followed (P.R. Davara *et al.* 2009) [2].

Table 4: Post-harvest losses in banana in Ripening Chamber

Particulars	Quantity (Kg)	Percentage (%)
Total quantity of banana produce on arrival	205.98	87.73
Saleble produce	198.00	84.32
Loss in weight due to PLW (physiological loss)	4.00	1.70
Weight of rejected fruits during ripening (due to fungal diseases i.e., decay, crown rot)	2.20	0.94
Loss due to over-mature ripening/ blackening of fruits	1.78	0.76
Total discarded fruits (kg)	7.98	3.40

E. Post-Harvest Loss at Retail Market Level

It is observed that, Post Harvest Losses in banana at retail marketing level were 14.12 per cent (14.92 per cent in Raver & 14.32 per cent in Burhanpur markets respectively). The main cause of loss in both markets was due to drying of skin & over ripening. The discarded banana fruits fetched no economic value to the retailers. These were eaten by stray animals or thrown away by the retailers.

At retail level, fruit rotting was mentioned by majority of the retailers (44%) as the main cause for fruit loss while fruit softening and mechanical damage was noted by 32% and 24% of the retailers, respectively (Figure 3). The high percent score in rotting could be explained by the fact that during handling, fruits are infected with various pathogens which can be established at any time before or after harvest but will cause decay and rot during storage. Banana pathogens gain entry through injuries created during harvesting and injuries related to poor handling and transport. During storage, banana fruit deteriorates through the action of spoilage microorganisms, which become activated due to the changing physiological and biochemical state of the fruit. Fruit softening is mainly because of the increased respiration rate as the ripening proceeds. The ripening associated softening in banana fruit also leads to an increased susceptibility to physical damage and pathogen attack during storage which increases the risk of fruit spoilage at retail market (Turner, 2001) [3].

Table 5: Post-harvest losses in banana at Retail Marketing Level

Particulars	Quantity (Kg)	Percentage
Total quantity of produce purchased for selling at retail level	198.00	84.32
Quantity of produce sold	164.85	70.21
Weight of rejected fruits (Sometimes due to Collar rot, rotting, poor quality of fingers)	13.15	5.60
Loss due to Over-ripening/ blackening of fruits	12.88	5.49
Quantity of produce unsold	7.12	3.03
Total discarded fruits (kg)	33.15	14.12

Summary and Conclusion

The survey studies coupled with the actual observations of post harvest losses in banana at different levels from farm level till it reaches consumers in four tahsils of Jalgaon district revealed that the post harvest losses were minimum i.e.1.56 percent at wholesale marketing level while it was maximum (14.12) percent at retailer level.

It can be concluded from the study that significant amount of postharvest banana loss occurs with the causes varying along the supply chain. Based on the results and observations made

during the survey, it seems that the current postharvest management system of banana both at farm and marketing levels is inadequate. The postharvest management of banana has not been given sufficient attention in the area hence, fruit handlers lack information about postharvest handling practices. It was also observed that there is a knowledge gap between the respondents in their experience of proper fruit handling techniques. Therefore, in order to reduce the levels of postharvest losses in the area, focus should be given to management practices. The loss can be minimized by awareness creation, education and training about the importance of postharvest losses, adopting better management operations, careful handling and packaging to the supply chain actors. Furthermore, testing and implementing improved postharvest handling techniques to reduce fruit spoilage could contribute much to the loss reduction effort.

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