



## Losses in litchi at various stages of supply chain and changes in fruit quality parameters



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### ABSTRACT

During May and June of 2012 and 2013, a study was conducted to assess losses at the farm, wholesale and retail levels in the supply chain of litchi in India. Changes in fruit quality parameters after harvest and the effectiveness of an improved corrugated fibre board (CFB) box versus conventional wooden box packaging to minimize postharvest losses were also studied. Farm-level samples were collected immediately after harvest from farmers' orchards in the Muzaffarpur district of Bihar state. Wholesale market samples were procured from the Delhi market, and retail samples from the Muzaffarpur and Delhi market. Real-time data on losses and quality parameters of fruits were recorded by transporting litchi from Muzaffarpur to Delhi (distance 1000 km) by truck. Studies indicated that the average loss (fruits discarded at sorting) apparent at the farm level during 2012 and 2013 was 30.4% and 25.8%, respectively. The average loss at the wholesale market level in Delhi was 15.8% and 12.4% during 2012 and 2013, respectively. The highest mean loss (up to 20.5%) was observed at the retail level. The mean fruit weight loss during transport to Delhi was 9.42% and 7.07% during 2012 and 2013, respectively. The mean total loss in the supply chain of litchi ranged from 35.3% to 43.8%. The total soluble solids, respiration and ethylene evolution in litchi fruits were found to increase after transport, whereas acidity and colour parameters ( $L^*$ ,  $a^*$  and  $b^*$  values) significantly decreased over time. The predominant pathogen associated with fruit decay was *Alternaria alternata* (Fr.) Keissler. CFB packaging significantly reduced various losses, thus indicating its effectiveness in its current use in non-refrigerated trucks for transport.

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### 1. Introduction

Litchi (*Litchi chinensis* Sonn) is a popular fruit in India due to its distinctive taste, pleasant flavour and appealing pinkish-red colour. These fruits are rich in vitamin C, niacin, riboflavin, thiamine, folate and  $\beta$ -carotene. They also contain minerals such as potassium, phosphorous, calcium, magnesium and copper. These low-calorie fruits contain no saturated fats or cholesterol, but are rich in dietary fibre and polyphenols. The demand for litchi fruits and its products continues to increase in both domestic and overseas markets. Litchi is a highly perishable fruit crop. Considerable losses of litchi fruits are incurred every year during harvesting, sorting, transportation and marketing, as its perishability is caused by great physiological changes after harvest (Momen et al., 1993). These changes include browning of the pericarp due to degradation of anthocyanins, which may be caused by pericarp polyphenol

oxidase and peroxidase activities (Underhill and Critchley, 1995) accelerated by desiccation, mechanical injury and postharvest decay. These quantitative and qualitative losses in litchi fruits from the time of harvest to the final consumption not only reduce the availability of fruits but also increase the per-unit cost of transport and marketing.

India produces about 594,000 metric tonnes of litchi, of which Bihar contributes 45% (NHB, 2015). The Muzaffarpur district is one of the leading producers of litchi in Bihar. The majority of the litchi grown in Bihar is sent to the wholesale market at Delhi, from where it is transported to retailers. The supply chain of distant markets such as Delhi involves farmers–wholesalers–retailers–consumers, but local markets such as Muzaffarpur involve harvest–retailers–consumers or preharvest contractors–consumers. The bulk of litchi fruits are transported to distant markets in non-refrigerated trucks. Although postharvest losses in litchi have been estimated in some reports, they have not been empirically assessed in the supply chain. Information on the extent and cause of losses at various levels of handling would be beneficial in

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