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Post Harvest handling of fresh strawberry

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Abstract
Strawberry, although nonclimacteric, is one of the most perishable fruit. During ripening, various physiological, morphological, and compositional changes transform inedible strawberry fruit into a highly cherished fruit. Loss of chlorophyll, gain of anthocyanin, increase in sugars, ascorbic acid and pectin, and reduction in acidity, phenolic and cellulose occur during the ripening stage. Also, fruit softening due to disassembly of cell wall mainly due to dissolution of middle lamellae occurs during this phase. Finally, fruits are harvested at fully ripened stage for its markedly favorable organoleptic features. However, these desirable fruit characters are accompanied by high respiration and tissue softening rate, water loss and susceptibility to physical damage and, hence, fungus infestations, particularly Botrytis rot and Rhizopus rot. Therefore, it is of utmost importance to develop and strictly adhere to strawberry-specific postharvest management procedures to ensure fruit quality and quantity for longer period. This paper deals with all information regarding handling of strawberry including Harvesting, Precooling, Grading, Packaging and storage in brief to curb Post harvest losses.

Keywords: Straw berry, Non climacteric, Fruit, Quality, Post- Harvest Management

Introduction
Strawberry is one of the most adorable fruit crop often characterized by its unique organoleptic properties and nutraceutical importance. Fresh slices of strawberry fruit are rich source of flavonoids, fibers, vitamins, potassium, and diverse array of phenolic acids such as hydroxycinnamic and hydroxybenzoic acids (Deeba *et al.,* 2013) [1]. Strawberry, although nonclimacteric, is one of the most perishable fruit. During ripening, various physiological, morphological, and compositional changes transform inedible strawberry fruit into a highly cherished fruit. Loss of chlorophyll, gain of anthocyanin, increase in sugars, ascorbic acid and pectin, and reduction in acidity, phenolic and cellulose occur during the ripening stage. Also, fruit softening due to disassembly of cell wall mainly due to dissolution of middle lamellae occurs during this phase. Finally, fruits are harvested at fully ripened stage for its markedly favorable organoleptic features. However, these desirable fruit characters are accompanied by high respiration and tissue softening rate, water loss and susceptibility to physical damage and, hence, fungus infestations, particularly Botrytis rot and Rhizopus rot. Therefore, it is of utmost importance to develop and strictly adhere to strawberry-specific postharvest management procedures to ensure fruit quality and quantity for longer period. The postharvest practices are aimed at slowing the respiration rate and water loss, maintaining fruit firmness and minimizing the growth of pathogens. Strawberry fruits have a narrow marketable window of 7–10 days if special care is taken. The objective of this article is to compile and comprehensively describe the general code of practices which should be adopted during harvest and postharvest operations of strawberry to reduce the losses and consequently resolving the quality management issues.

Nutritional Value and Health Benefits
Strawberry contains high content of anthocyanins, flavonols (myricetin and quercetin derivatives), flavanols (catechin, epicatechin, proanthocyanidin B1 and B2), dihydrochalcones (phloridzin) [1, 2]. Fisetin (7,3′,4′-flavon-3-ol) is another novel flavonol biosynthesized in the strawberry fruit through branchy and intricate phenyl-propanoid pathway. Fisetin plays major role for improving antioxidant activity and anticancer ability by blocking PI3K/AKT/mTOR pathway [3]. The fleshy fruit of strawberry contains significant quantity of hydrolysable tannins (ellagitannins and gallotannins). The estimated content of

Ellagitannin ranges 8–23 mg per 100 g fresh weight of strawberry fruit. After ingestion of ellagitannins, they reach in stomach, followed by small intestine and finally in colon where they are catalyzed into urolithins by gut bacteria (Buendia *et al.*, 2010) [2].

Harvesting

Harvesting of straw berry should be carried out preferably during the cooler period of the day (morning harvesting when the fruits are firm and temperature is low) and when fruits are fully ripe and still attached to the plant when transported to a near-by market.

For distant and export market harvest should be done when fruit has developed 75% colouration.

Practice of harvesting under ripe fruits should be avoided at any cost.

Farmers should wait at least thirty to thirty five days after fruit set to judge the visible signs of maturity (Development of full red colour. Farmers should cautiously pick the fruits by pinching the stem at least 1cm above the calyx without pressing the fleshy portion.

Harvesting of too large and over ripe fruits should be avoided.

Precooling: Precooling should be immediately done where in fruits are cooled immediately by forced air cooling or refrigerated at a temperature of 3 ^{0}C.

Farmers should maintain the relative humidity of not less than 85% to prevent any water loss. This can be accomplished by placing water containers in the rooms where cooling is accomplished.

Grading

Grading of fruits should be followed based on size and colour. Diseased damaged and blemished fruits should be separated. This Helps in Fetches higher prices for the growers and Improves packaging and handling and brings an over all improvement in the marketing system.

Packaging

Use poly propylene packages with different perforation sizes should be preffered. Corrugated fiber board boxes with ventilation holes can also be used for packing fresh straw berries. This Helps in Prevents mechanical damage to the fruit during transportation and allows the circulation of air within the fruit. Maintains ideal gaseous concentration close to modified atmospheric packaging system. Prevents quality deterioration of Fresh Straw berry fruit.

3. Conclusion

Strawberry is a highly perishable fruit and subjected to several postharvest losses after harvest. There are several stages which are responsible for quick losses such as improper harvesting methods, developmental stage, improper picking time, sorting and packaging, transportation postharvest treatments, and storage conditions and as well as untrained labor. However, numerous pre- and postharvest studies were conducted to develop strategies for extension of strawberry shelf life such as harvesting methods, heat treatments, UV-C irradiations, coating, and essential oil applications. Furthermore, there is need a to study these technologies on commercial scale to increase the net income. There is a need to develop ecofriendly alternative technologies to enhance the shelf life of strawberries.

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