



A review of Post Harvest Management and value addition of horticultural crops: A source of income generation for the farmers of Easter Utter Pradesh

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Abstract

India harvested 223.089 million tonnes of horticultural produce from 20.876 million hectares of land in the 11th five year plan. The major crops contributing to it are fruits and vegetables (approx 204 million tonnes from 14.314 million hectares area). Horticulture sector contributing 30 percent to the India's agricultural GDP from 8.5 percent of cropped area. As the waste utilization technology are adopting in developed countries and the scales of economies of these technologies does follow in Indian conditions due to various factors. Therefore, there is a need for development of cost effective technologies for the production of value added products. Post harvest management of fruits and vegetables provides ample opportunities for value addition besides providing wealth from waste. Its effective utilization helps in reducing the cost of production of crops besides optimum utilization of biomass. A several process technologies used to utilize fruit and vegetables such as drying & dehydration, freezing, fermentation, extraction, etc., are some treatment examples that can be useful to recycling and upgrading waste of fruit and vegetable market.

Keywords: Horticulture, Post Harvest management, Post Harvest losses, Value Addition, Biomass, etc.

Introduction

The horticultural crops has the huge potential for development of wastelands through planned strategies, need comparatively less water than food crops, provide higher employment opportunity and environment-friendly. On the basis of nutritional security, fruits and vegetables have high potential of value addition that gives high foreign exchange earnings and is an important item of commerce as they have gained enormous market potential. Horticultural crops in Indian agricultural economy shared a significant role as it contributes 30% to the GDP from 11.73 % of its arable land area. Indian fruits and vegetable sector is the largest in the world next to China in terms of production with estimated food processing industry size of US\$ 70 billion as in 2012, India had the production of 257 million tons of food grain (rice, wheat, coarse grains and pulses), 75 million tons of fruits and 149 million tones of vegetables. India has very high post harvest losses of fruits and vegetables which reached to 30 to 40 per cent and only 2.2 % of the total production are under processing as compared to the other countries like USA and China which are far ahead than India in reducing the wastage and enhancing the value addition and shelf life of the farm products. Different organizations in India have been trying to find solution for serious issue related to post-

harvest but the progress and achievements, did not reflect to visible success as expected. So, in this study, our motive is to address and to discuss the important ramified issues in post-harvest management of fruits and vegetables in India with focusing on the value addition of most of the produce. According to the many literature review, India has well established postharvest institutions supported by government, public and private sector. There are many remarkable technologies distributed successfully and reached to the farmers in few places. The rules of national/international non-governmental organizations ranged and concentrated on specific areas.

About 10-15% of fresh fruits and vegetables shrivel and stale with lowering their market value and consumer acceptability. Being a rich source of carbohydrates, minerals, vitamins and dietary fibers, these commodities constitute an important part of our daily diet. The dietary fibers have several direct and indirect advantages. Not only this, fruits and vegetables provide a variety in taste, interest and aesthetic appeal. Their significance in human life is being recognized increasingly in Western societies with the objective of minimizing the occurrence of the diseases related with an affluent life style. Their lesser recognized benefits relate to their role in kidney functions, prevention of cancer and cardiac disorders through contribution of ascorbic acid, β -carotene and non-starch polysaccharides besides the biochemical constituents like phenols, flavonoids and alkaloids. A considerable amount of fruits and vegetables produced in India is lost due to improper post-harvest operations as a result there is a considerable gap between the gross production and net availability. Furthermore, only a small fraction of fruits and vegetables are utilized for processing (less than 1%) and exported (Fruits – 0.5% and Vegetables – 1.7%) compared to other countries.

Losses occur after harvesting is known as post harvest losses. It starts first from the field, after harvest, in grading and packing areas, in storage, during transportation and in the wholesale and retail markets. Several losses occur because of poor facilities, lack of know-how, poor management, market dysfunction or simply the carelessness of farmers.

The estimation of post-harvest loss is essential to make available more food from the existing level of production. The production of fruits and vegetables in the country is lost due to wastage and value destruction. The wastage cost is estimated to be Rs.23, 000 crores each year. According to Swaminathan Committee (1980) reported that the post-harvest handling accounts for 20-30% of the losses at different stages of storage, grading, packing, transport and finally marketing as a fresh produce or in the processed form. According to Chadha (2009) India loses about 35-45% of the harvested fruits and vegetables during handling, storage, transportation etc. leading to the loss of Rs. 40,000 crores per year. Estimated loss of fruit are high in Papaya 40%, Grapes 27%, Banana 20-28%, Citrus 20-95%, Avocado 43% and Apple 14% and loss of Vegetables such as Onion 25-40% ,Garlic 08-22% ,Potato 30-40%, Tomato 5-47%, Cabbage & cauliflower 7.08-25.0%, ChiIli 4-35%, Radish 3-5% and Carrot 5-9%.

Post harvest losses

Fruits and vegetables has high moisture content, tender texture and high perishability. If not handled properly, a high value nutritious product can deteriorate and rot in a matter of days or hours. Horticultural crops also generate a considerable cash income for growers as compared to the cereals and pulses. The natural process of respiration involves the breakdown of food reserves and the aging of these organs. Mechanical Owing to their tender texture and high moisture content, fresh fruits and vegetables are very susceptible to mechanical injury. Poor handling, unsuitable containers, improper packaging and transportation can easily cause bruising, cutting, breaking, impact wounding and other forms of injury. Physiological deterioration Fruits and vegetable cells are still alive after harvest and continue their physiological activity. Physiological disorders may occur due to mineral deficiency, low or high temperature injury or undesirable atmospheric conditions, such as high humidity, physiological deterioration can also occur spontaneously by enzymatic action leading to over-ripeness and senescence, a simple aging phenomenon. The losses of vegetables are a serious matter of concern for India's agricultural sector (Chadha, 1995). The highly perishable commodities of vegetables are lost after harvest due to insufficient methods of harvest, decay, over-ripening, mechanical injury, weight loss, trimming and sprouting. So that, these aspects are to be looked critically to see if any improvement in the present state of vegetable industry, especially in the context of processing and marketing are to be accomplished. Lack of market demand Poor planning and market information may lead to over production of certain fruits or vegetable, which cannot be sold in time. This situation occurs most frequently in areas where transportation and storage facilities are inadequate. These losses can be due to inadequate preservation methods at home, methods of cooking and preparation such as peeling, consumption styles etc. Post-harvest losses of horticultural crops affect both the nutritious status of the population and economy of the country. Nutrition Fruits and vegetables are rich source of vitamins and minerals essential for human nutrition. These are wasted in transit from harvest to consumer represent a loss in the quantity of a valuable food. This is important not only in quantitative terms, but also from the point of view of quality nutrition. Economy Careless harvesting and rough handling of perishable bruise and scar the skin, thus reducing quality and market price. Such damaged produce also fails to attract the international buyers, and bring the exporting country less profit and bad name. This ultimately results in huge economic losses to the country. "The degradation in both quantity and quality of a food production from harvest to consumption. Quality losses include those that affect the nutrient/caloric composition, the acceptability, and the edibility of a given product". It is very common generally in developed countries (Kader, 2002). Quantity losses refer to those that result in the loss of the amount of a product. Loss of quantity is more common in developing countries (Kitinoja and Gorny, 2010).

For improving the situation, it is essential to create awareness among growers, farm workers, manager's traders and exporters about the extent of losses being incurred and their economic consequences. These groups of people involved in the fruit industry also need to learn the basic principles of fruit handling and storage. Today, consumers are becoming increasingly conscious of the health and nutritional aspects of their food basket. The tendency is to avoid chemicals and synthetic foods and preference for nutrition through natural resources. The underutilized fruits like aonla, bael, jamun, karonda, passion fruit, phalsa, pomegranate, pumpkin, tamarind, wood apple etc. are the main sources of livelihood for the poor and play an important role in overcoming the problem of

malnutrition (Gajanana et al., 2010). They are in general accepted as being rich in vitamins, minerals and dietary fibre and therefore, are an essential ingredient.

Fruit and vegetable processing

Fruit processing is necessary where it ensures fair returns to the growers to improve their economic condition. It also helps to mitigate the problem of under-employment during off-season in the agricultural sectors. The perishable fruits are available as seasonal surpluses during certain parts of the year in different regions and are wasted in large quantities due to absence of facilities and know-how for proper handling, distribution, marketing and storage. The primary meaning of “postharvest loss” was defined as to measure quantitative and qualitative food loss in the postharvest system (de Lucia and Assennato, 1994). This relates to interconnected steps, which starts from the time of harvest through crop processing, marketing and food preparation, reaches to the consumer to accept or discard the food. Furthermore massive amounts of the perishable fruits produced during a particular season results in a glut in the market and become scarce during other seasons. Food preservation has an important role in the conservation and better utilization of fruits in order to avoid the glut and utilize the surplus during the off-season. It is necessary to employ modern methods to extend storage life for better distribution and also processing techniques to preserve them for utilization in the offseason in both large and small scale (Bhattacharyya and Bhattacharjee, 2007; Jena et al., 2013). An analysis of production, processing, marketing channels and upgrading strategies for fresh and processed fruit with development of niche markets for high-value produce creates new opportunities for developing countries' producers and exporters that can meet the required standards. A value chain perspective is used to identify various routes by which the value of food exports can be increased. Value addition to underutilized fruits by processing them into various products is explained in this paper.

There are many reasons for processing fruits besides the development of a business with a good return on investment for the owners such as to prevent post harvest losses, to eliminate waste, to preserve quality, to preserve the nutritive value of the raw materials, to make seasonal horticultural produce available throughout the year, to put them in convenient form for the user, to safely put the food away for emergencies and to develop new products, to increase the value of the product and also better return to the farmers. So, ultimately it will be beneficial to producer, processors and consumers. Food processing/ preservation, in the broad sense, refer to all the measures taken against any kind of spoilage in food. It is the process of treating and handling food in such a way so as to stop or greatly slow down spoilage to prevent food borne diseases while maintaining nutritional value, texture and organoleptic quality as well as increasing shelf life. Proper packaging and storage of processed/preserved products are also important aspects of agro-processing to retain quality of fresh horticultural produce which could be adversely affected by physical damage, chemical reactions, microbiological changes and attack by insects and rodents. There is great scope for processing and value addition to the underutilized fruits into various products like jam, jelly, preserve, candy, confectionery, pickle, fruit drinks, dried products etc. The medicines, like ayurvedic and unani for treating ailments like common cold, gastric troubles, chronic diarrhoea and dysentery, headache, constipation, enlarged liver, diabetes, bronchitis, jaundice and fever, etc. (Chadha, 2003; Agarwal and Chopra, 2004).

Value addition

Aonla fruit is sour and astringent in taste; hence it is not popular as table fruit. The fruit however has excellent nutritive and therapeutic value thus has great potentiality for processing into value added products. It is a rich source of ascorbic acid and contains about 20 times more vitamin C than citrus fruit (Shankar, 1969). Aonla fruits are highly perishable in nature and hence its storage in atmospheric conditions after harvesting is very limited, which is accompanied by browning of the skin, loss of glossiness and vitamin C content (Kumar and Nath, 1993; Singh et al., 2005). Due to its highly acidic and astringent nature, the fruit in fresh form or as a table fruit is not popular and consequently, it is used in the preparation of various ayurvedic tonics like chayvanprash, triphala, etc. However, aonla fruits are processed into a number of food products like preserve, jam, jelly, candy, toffee, pickle, sauce, squash, juice, RTS beverage, cider, shreds, dried powder, etc (Tandon et al., 2003; Singh et al., 2005; Jain

et al., 2006; Sagar and Kumar, 2006; Goyal et al., 2008; Bhattacharjee et al., 2011). Pumpkin is grown throughout tropical and subtropical countries. This fruit is mainly consumed as vegetable, though it is used in traditional medicines in countries like in China, India, Brazil, Argentina, Mexico, America, Yugoslavia. In Austria the pumpkin seeds have been used as source of oil (Caili et al., 2007). Both pumpkin flesh as well as seeds is rich in nutritive components (Longe et al., 1983; Lazos, 1986; Asiegbu, 1987; El-Adawy and Taha, 2001; Al-Khalifa, 1996). Pumpkin provides valuable source of carotenoids that have a major role in the nutrition in the form of pro-vitamin A. Despite being rich and cheap source of carotenoids, pumpkin is neglected for utilization in culinary purposes due to some myths and cannot be stored for longer time due to degradation of carotenoids. Consumption of foods containing carotene helps prevent skin diseases, eye disorders and cancer (Bendich, 1989). Pumpkins are cheaper as compared to carrots in cost and are abundantly available in market. Carotene content of some Spanish pumpkin varieties was found to be higher than that of carrots (Wu et al., 1998). Hence, UNO has given lot of importance to pumpkin due to its rich carotene content. Pumpkin due to its larger size (approx 2-8 kg/fruit) has less consumer acceptance as fresh vegetable. Due to surplus production and less consumer demand there is crash in prices during the season causing loss of growers. On the other hand, its scarcity during off-season results in higher market price causing loss to consumers. The ultimate solution to the above said problem is the dehydration of pumpkin and its utilization in various food products. Drying helps in increasing the shelf life, smaller space for storage and lighter weight for transportation. The dehydrated pumpkin will also become the most concentrated source of carotenoids (Akpinar and Bicer, 2004). Drying helps in breaking up cellular structure of pumpkin and emulsify carotenoids, thus increasing their bio-availability (Mathur and Mathur, 2005) Kulkarni (2008) worked on production technology of pumpkin powder, which resulted in a superior quality, carotene and mineral rich, self stable pumpkin powder for various food uses. The technology involves blanching and sulphiting of approximate size of pumpkin pulp cube followed by drying under specified conditions and packaging the powder in light/oxygen barrier type packs. The studies of Pavlova et al. (1996) showed that addition of pumpkin powder to wheat flour at a concentration of 20% had a positive effect on structural and mechanical properties of cracker dough. Finished crackers were characterized by a pleasant flavour, aroma and improved nutritional and biological values.

Bael (*Aegle Marmelos* (Linn), family Rutaceae, is also known as Bale fruit tree, growing wild throughout the deciduous forests of India. This is generally considered as sacred tree by the Hindus, as its leaves are offered to Lord Shiva during worship. The different parts of Bael are used for various therapeutic purposes, such as for treatment of asthma, anaemia, fractures, healing of wounds, swollen joints, high blood pressure, jaundice, diarrhoea healthy mind and brain typhoid troubles during pregnancy (Sharma et al., 2011). The unripe dried fruit is astringent, digestive, stomachic and used to cure diarrhea and dysentery. Sweet drink prepared from the pulp of fruits produce a soothing effect on the patients who have just recovered from bacillary dysentery. The ripe fruit is a good and simple cure for dyspepsia (Parichha, 2004, Chowdhury et al., 2008). Bael fruit products Various process technology for production of value added preserved products from bael fruit is given in Fig. 8 to 12. Fresh bael fruit can be stored for 15 days at 30°C when harvested at full maturity, for 1 week at 30°C when harvested ripe, for 3 months at 9°C. Fruit pulp can be stored for 6 months, when stored in heat-sealed containers. Fruit powder can be stored for a year when packed in 400 gauge polypropylene pouches and stored under dark, cool place, while fruit jam, squash and preserve can be stored for several months (ITDG, 2000). The bael fruit pulp contains many functional and bioactive compounds such as carotenoids, phenolics, alkaloids, coumarins, flavonoids, and terpenoids and has innumerable traditional medicinal uses (Karunanayake et al., 1984; Singh 1986; Nagaraju and Rao, 1990). Thus value added products can be produced by using above process technology to reduce post harvest losses, increase shelf life, value addition and increase the income.

3.0 Conclusion

Most of the minor fruits are enriched with nutritional and medicinal value, and can be grown even in wastelands without much care. Therefore, it is worthwhile to look into the organized cultivation and improvement of minor group of crops like aonla, pumpkin, wood apple, bael etc. so that their utilization can be maximized. There is always demand from consumers for new, delicious, nutritious and attractive food products. To satisfy this demand, there is a constant effort to develop products from diverse sources. The potentiality of processed products from some minor fruits in the country is still untapped. However, efforts have been made by various researchers for the development of

value added products from underutilized fruits as explained above. It reflects the feasibility for the development of some diversified value added products from some of the minor fruit crops grown in India in order to minimize the wastage, to promote these products as export items and to uplift the nutritional and socio-economic status of the vulnerable communities of country.

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