

Sustainability through Post-Harvest Management of Produce and Need for Rural Industrialization in India

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Abstract: The paradigm shift from a primarily agricultural economy to an industrial work house has set up an atmosphere for a need of high productivity in the Indian villages. Fruits and vegetables are highly perishable in nature that results in rapid spoilage and deterioration in quality. However, proper post harvest management can reduce this spoilage. The cost of reducing spoilage is much lesser than the production on additional land. A good post harvest management reduces spoilage by preserving seasonal surplus and cull fruits and vegetables, which often lie rotting on the roadside. Processing and value addition increases food availability, generates cattle feed by converting factory waste thus reduces garbage accumulation. Growers get remunerative price of their produce and consumers buy it at reasonable price. Many indigenous fruits and vegetables, which are not generally marketed, as fresh can be processed into value added products for export. These products are in demand in national and international market due to its medicinal and therapeutic properties. Fresh as well as processed fruits and vegetables is rich source of vital nutrients like vitamins, minerals, fibers etc. It gives nutritional security forever growing population and protects their health. Resultantly, the concepts of food parks, food processing plants, etc. have gained significance in the recent past, whereby, governments have taken keen initiative to promote proper post harvest management of produce.

The paper entails to discuss as to how, the post harvest management can reduce losses after harvest and increase food availability thereby providing food and nutritional securities. More so, it seeks to discuss how the proper post harvest care can add value and provide benefit to the producers and consumers. Further, it seeks to explain how efficient post harvest operation can generate employment and bring rural industrialization. Highlighting the role of post harvest technology for better economy of the country, through export earning, is also what this paper seeks to present to the readers.

As also, the motive of the present paper is to demonstrate how appropriate post harvest management and processing can utilise unmarketable produce and processing waste for gainful purpose, thereby, reducing the pollution and city garbage.

Keywords: Accessibility, Export Earning, Management of Produce, Processing and Value Addition, Post-Harvest, Rural Industrialisation, Sustainability.

Importance of Post Harvest Management

India is a vast country and a wide range of variety of fruits and vegetables are cultivated in different regions. There has been a phenomenal rise in production of fruits and vegetables in our country since Independence. As per the data for 2000-2001, the production of fruit is about 45.37 million metric tonnes and vegetable about 93.92 million metric tonnes available in India and going to be doubled by 2011 and is considered to be the second largest producer next to china in the world. Unfortunately, unlike other horticulture rich countries, average Indians do not get the basic daily requirement of fruits and vegetables and our Human Development Index is very low. This is because a considerable amount of this valuable produce is lost due to improper post harvest management. High moisture content, living nature and presence of readily utilizable nutrients make fruits and vegetables highly perishable commodities.

Spoilage mainly occurs due to microbial attack, auto-oxidation and insect pest attack. According to a study, at least 25 to 30 percent of the production of fruits and vegetables in the country is lost due to wastage and value

destruction. The wastage cost was estimated to be Rs. 67,500 crores each year. Even if 1% of this could be saved by converting them into value added products, there will be a saving of Rs. 67.5 crores annually. Further, the cost of reducing spoilage is much lesser than the production of the same quantity and quality produce. Post harvest management of horticultural produce is therefore the need of the hour in order to feed ever-growing population of the world in general and India in particular. The most important advantage of post harvest management and processing is the reduction of post harvest losses of fruits and vegetables.

Increase Food Availability

It is well known fact that fruits and vegetables are perishable in nature due to its high moisture content, high rate of physiological activity viz. respiration and ripening, microbial attack, rapid bio-chemical changes such as enzyme activity, softening of the texture and many other biotic and abiotic factors. Harvesting season of almost all fruits and vegetables is very narrow lasting only for 1-2 months. During this short period, availability of that particular fruits and vegetables is abundant but at the end of harvesting season, products availability decreases rapidly and may be completely out of market within 1-2 months. Here, therefore comes the role of Post harvest management of horticultural commodities like proper handling, packaging and storage at safe low temperature, maintenance of cool chain during transportation and marketing, pre and post harvest treatments in order to increase self - life and reduce the overall spoilage etc. These practices make fruits and vegetable available throughout the year. Many modern technologies such as refrigerated storage and transportation, Controlled and Modified storage, irradiation, processing into value added products are some of the ways to extend the availability of fruits and vegetables beyond the end of the harvesting season. In this way, the food already produced can be saved for consumption by applying the techniques of post harvest management and indirectly increase food availability. Attention to the concept of post-harvest food loss reduction as a significant means to increase food availability was drawn by the World Food Conference held in Rome in 1974. The seventh session of the U.N. General Assembly in 1975 passed a resolution calling for a 50 percent reduction of post harvest losses by 1985. In the FAO, after consultation with its Governing Body food loss prevention became a priority area and an Action Programme became operational in early 1978. The Food Loss Prevention Programme of FAO till recently focussed mainly on the durable food grains, because of the prominence in daily diet. Only in May 1980, an Expert Consultation on Food Loss Prevention in Perishable Crops mainly covering fruit and vegetables was held in Rome.

Nutritional Security

Fruits and vegetables constitute an important part of human's food. Even though they are generally not considered as a staple food yet they help in intake of cereal foods by making them more palatable in nature. Fruit and Vegetables in general, except for a few, are not considered to be the primary source of carbohydrate, protein and fat. However, some of them with storage 9 Importance of Post Harvest Management roots and tubers are rich in carbohydrate, particularly starch, in amounts comparable to the cereal crops, and the leguminous vegetables supply as much as 14 per cent protein, dry seeds supplying still more. The lipid content in most vegetables is less than 0.1 per cent. Most fruit, vegetables and root crops are rich in minerals, carotene (Pro-vitamin A) and vitamin C. Besides, there are some trace elements required by the body like copper, manganese and zinc, which act as coenzymes. These are found in appreciable quantity in fruit and vegetables. The amount of nutrient can vary with fruit and vegetables, cultural practices, stage of maturity, post-harvest handling and storage conditions. Once they are harvested, their composition goes on changing as a result of physiological and biochemical activities, which are natural processes. Fruits and vegetables are the rich source of vitamins, minerals, and trace elements, deficiency of which leads many diseases such as scurvy, beriberi, night blindness etc. In addition, most of the fruits and vegetables are also loaded with antioxidants and fibers. Antioxidant neutralizes free radicals produced in the body that is found a possible cause of cancer and also prevents faster aging. At the same time fiber controls many cardiovascular diseases and movement of foods in the digestive system. Several vitamins and minerals that are scarce in cereals and animal products are present in abundance in fruits and vegetables. Beside this, fruits and vegetables also supply carbohydrates and protein and fulfill the essential nutrients in human diet. Therefore, human health is protected if fruits and vegetables or their processed products are consumed regularly. Fruits and vegetables are therefore considered as protective foods. Further, several vitamins, minerals and phyto-hormones found in fruits and vegetables have now assumed the status of functional food. These substances are capable of providing additional physiological benefit, such as prevention or delaying onset of chronic diseases, as well as meeting nutritional requirements. Keeping in view the nutritional quality of fruits and vegetables, post harvest management of these perishable commodities is the only solution for nutritional security to ever growing population of the country.

Employment Generation

Employment generation of Indian Youth is becoming more and more difficult with increasing in population. It has been observed that job opportunities in government sectors are shrinking day by day and private companies closing fresh recruitment. For rural youth, it becomes more and more difficult to get a good or moderate employment in rural areas as a result unemployed rural youth are rushing towards towns and cities to do any sort of work. This type migration of population from rural to urban area is detrimental to the society. In addition, this situation is creating a big problem in metro cities. Therefore it is the need of the hour that these youth start their own ventures that should not only be remunerative and attractive in nature but also easy to operate. Post harvest handling and processing of fruits and vegetables is one such area that can provide great possibility for employment generation. During harvesting season, people can get employment in harvesting, pre-treatments if any, packaging and transportation of fresh produce to towns and cities. The surplus production and cull fruits and vegetables can be converted into pulps and value added products during the season and later it can be used to prepare various tertiary processed products. All these operations require human resources in large quantity. Need and Importance A fruit and vegetable processing factory having a capacity of 10qt/month can engage 4-6 people for the whole year. In addition in order to handle freshly produced fruits and vegetables properly grading and packing stations and quality control laboratory have to be developed to keep the pace of development process. Further, as ancillary industries manufacturing units for food processing machinery, packaging materials both for fresh and processed fruit and vegetable products will also develop side by side and generate employment. Other relevant industries and establishments, such as, retail outlets etc, will also provide additional employment. In our country 90% of fruit and vegetable produced are marketed by the farmers compared to only 20% of cereals/food grains production of India. Employment potential of food processing industries is much higher compared to many other relevant industries. For example per 1,000 crores of investment employment potential in food is 54,000 compared to textiles –48000 and paper –2500. It has been reported that there is a 4 fold indirect employment on investment in food and it provides 60% employment in small towns and rural areas. Our aim is to increase processing from present level of 2% to 10% by 2010 that will involve an investment of Rs.1,40,000 crores generating direct employment 77 lakh and indirect employment 3 crores.

Value Addition

Horticultural produce in general and fruits and vegetables in particular generate a large amount of valuable waste such as inedible plant parts as such for human food that end up as garbage. However, if they are gainfully utilised at the proper time they can produce value added products. Vegetables such as cauliflower, peas, leafy vegetables, etc. can be primarily/minimally processed so that inedible parts are removed before being sent on to the metropolitan city markets. They should be unit packed at packing stations situated at appropriate points in every district. This process will reduce the transportation and handling cost of inedible parts and help the consumer by providing a convenience food. The consumers particularly the working women would be willing to pay higher prices because these ready to use products save lots of time, in kitchen besides labour and space. Similarly, bananas should be transported in hands as is done in other countries. Each packing station should have the facility for processing. Physically damaged fruit and vegetables that are without infection but would be spoiled on storage can be made into durable and value added processed products at this point. Utilization of physically damaged fruits and vegetables into value added processed product could considerably reduce the price of main product as a result more processed food products will come within the reach of common people.

Fruits and vegetables are perishable in nature, it can not be stored for longer period. It has been observed that about 25-30% of total production are not fit for fresh marketing and called culled produce. These produce are undersized, oversized and malformed/deformed and physically damaged fruits and vegetables but microbiologically sound at the time of harvest. The produce of this category either sold at throw away prices or left to spoil as such. Thus a huge quantity of horticultural produce in the form of cull fruits and vegetables occurs every year which otherwise could be utilized, if processed into various value added by products. Fruits and vegetable processing units also generate large amount of valuable waste such as peel, stones and other inedible plant parts that are generally not utilised properly and rejected as such in our country Importance of Post Harvest Management and finally end up as garbage. However, if they are gainfully utilised at the proper time they can become value added products. Some of these waste are rich source of vital constituents like carbohydrates, protein, fat, minerals, edible fibres, etc. and also constituents of commercial use such as pectin, starch, colours/ pigments, essential oils, sugars, vinegar, alcohol, and many compounds useful in food and beverage industries. In addition the waste may be used as cattle feed that is in short supply in our country. These waste processing not only gives value added products but also reduce the price of the primary processed products that are sold at a premium price in our country beyond the means of the common people. In general, it improves the overall economy of the country. Premature fruit drop due vagaries of climate such

dust or hailstorm is also a big problem in India. As a result a substantial quantity of fruits and vegetables are lost before they attend proper maturity stage. These produce can be utilized usefully if processed into value added products such as pulp, pickle, chutney, dried powder etc. During peak harvesting season a good amount of quality fruits and vegetables are available in abundant quantity resulting in market glut and all of these quality produce cannot be marketed in the fresh form. As a result, there is huge spoilage and wastage of fresh fruits and vegetables.

This wastage can be reduced if they are timely processed into different value added products or preserved by different methods during harvesting season. Now it can be used throughout the year and can be transported to distant market. Value added products not only palatable but also nutritious and gives economic gain. Nutritional value of these products can be increased many folds through fortification particularly of protein, vitamins and minerals. Processing serves as an outlet for surplus production and therefore acts as price stabilizer. Fruits are generally consumed as fresh but mostly vegetables are cooked before consumption expecting a few ones like cucumbers, tomatoes etc. Value addition also includes peeling, slicing, cutting into pieces, processing and packaging. All such activities increase value of the products. India has a wide range of indigenous fruits that are underutilized. Most of these fruits are tropical/subtropical in nature and grow even under adverse agro-climatic conditions. A large number of these fruits are known for their therapeutic/medicinal and nutritive value and have excellent flavour and very attractive colour. Some of these fruits are not easy to eat out of hand e.g. baelfruit that has a hard shell, mucilaginous texture and numerous seeds; as a result it is not popular as a dessert fruit. Kokum is not acceptable as a fresh fruit because of its high acidity, only its thick outer rind is used in beverage industry or for culinary purpose in the dried form. Similarly aonla as a fresh fruit is not liked because of its strong astringent taste.

All these fruits have a great potentiality to processing into a value added fruit products of commercial importance. So that the growers get a remunerative price and consumers get the opportunity to enjoy the indigenous fruit products. A shrink-wrapped fruit and vegetable fetches more prices compared to non shrink-wrapped ones because of value addition. It has already been mentioned that less than 2% of production of fruits and vegetables in India goes for processing. As a result, value addition in food sector is low at 7%. The production of fruits and vegetables in our country is now 66% of food grains. It is expected that this figure is likely to be 80% by 2010. With proper infrastructure facility for post harvest handling and processing, value addition will correspondingly go up from 7% to 35 % resulting in increases in GNP.

Need and Importance

Export Earning

It is known that about 84 different fruits and 63 items of vegetables are traded in world market. In addition a large number of fruit and vegetable products are also marketed. India by virtue of its varied agro-climatic conditions has the advantage of producing most these fruits and vegetables and processing them into products that can be traded in the world market. In order to achieve export potential, following fruits have been identified as having good market potential viz. Mango, Grapes, Banana, Lychee, Exotic fruits Chikoo, Ber, Pomegranate, Amongst vegetables the items identified as having good export potential are - Onion, Potato, Green vegetables. The following two categories of vegetables also has great potentiality: a) Traditional - okra, bitter gourd, chili and other seasonal vegetables; b) Non-traditional - asparagus, celery, broccoli, bell pepper, sweet corn and baby corn; green and lima beans. India has vast resources of indigenous fruits and vegetables that have established medicinal and therapeutic values apart having high nutritive value, attractive color and excellent flavor viz. aonla, baelfruit, jamun, kokum, phalsa etc. There is always a demand all over the world for new, nutritious, attractive and delicately flavoured products. Also, the trend today is a return to the natural and a preference for the therapy provided by nature. Consumers today are becoming increasingly conscious of the health and nutritional aspects of their food. The tendency is to avoid chemicals and synthetic foods and choose therapy and nutrition through natural resources. The underutilised fruits of India have an important role to play in satisfying the demand for nutritious, delicately flavoured and attractive natural foods of high therapeutic value.

The development of these fruits can considerably contribute to crop diversification, farm income and the improvement of nutrition and also provide valuable exports and additional employment. Therefore, among these indigenous fruit lies an untapped potentiality for processing into value added products that can attract export market. For example, Bael and Aonla are indigenous fruits having highest riboflavin (Vit. B2) and vitamin C respectively. Increased health consciousness in the masses will boost their consumption in India and in International market. Any Aonla products can be exported as they are rich in vitamin- C. Therefore, export of these indigenous fruits and vegetables and their processed products can earn valuable foreign exchange. Though some fruit products, are being manufactured at present on a small scale, inspite of such favourable possibilities no systematic approach has been

made to utilise the potential of the indigenous fruits on a large scale mainly because of the lack of the requisite amount of raw material. Organised orcharding and systematic collection of raw material is of utmost importance. Kiwi fruit that was practically unknown in the world market a few years back, is now in the forefront of international fruit trade. The New Zealand Kiwi Fruit Marketing Board highlighted the plus points of Kiwi Fruit such as thirst quenching, highly nutritious, rich in Vitamin -C, good for maintaining health, slimming effect etc. to make it popular among the consumers the world over. There is no reason why we cannot achieve similar success. Instead of trying to compete in a market where other countries are already established and far ahead we must break new ground and create markets for our indigenous fruits where no other country can compete with us. Freezing is rated as the best technique available for food preservation since it maintains the natural properties by reducing post harvest changes and microbial deterioration to the barest minimum without any influence on the original qualities.

The rate of freezing plays a great role on the quality of frozen fruits ¹³ Importance of Post Harvest Management and vegetables; faster freezing rate is required to obtain better quality. Liquid nitrogen is the most common cryogenic substance used in food freezing. Ultra quick freezing rate, minimum dehydration less, freedom from oxidative changes, minimum freezing damage of freeze sensitive products, maximum quality retention of texture, colour and flavour of sensitive fruits and vegetables during freezing and the inert nature of the freezant are the advantages of liquid nitrogen freezing. A systematic establishment of quick freezing industry can boost export trade of our country. Methods have been standardized under laboratory conditions for the manufacture of cryogenically frozen, crack free, peeled ripe mango slices having excellent retention of quality attributes, well comparable with those of fresh mangoes in ready-to-serve form and cent-per-cent edible portion. This will have a great potentiality in export trade. The problems generally facing the export of fresh mangoes, like short storage life, added bulk of stone and peel, hidden disorders like spongy tissue and stone weevil can be successfully overcome by producing the cryogenically frozen mango slices. Hardly there is any fruit that is not cultivated in this country. At present only few established fruits and vegetables are exported. Government has already recognized it as one of the major thrust for augmenting the countries export. Lack of proper post harvest management and infrastructure facilities are the major hurdles for export of horticultural produce. Countries like Indonesia, Malaysia, Thailand etc. are far behind in production of fruits and vegetables compared to India but their exports are many folds higher than our country. It is mainly because of good post harvest management practices, quality maintenance throughout the marketing channel and basic infrastructure for export

Rural Industrialization

Post harvest management and processing of fruits and vegetables is the backbone of the horticulture industry as it takes care of gluts and all possible wastage that occur during handling, storage, distribution and marketing. Most growers are rural people. During peak harvesting season, always there is glut. There is no preservation unit, grading and packinghouse in rural areas. They cannot hold their produce, even for few days due to lack of storage facility and they are unable to preserve their produce. This situation forced them to sale their good quality produce at very low price to middleman. Cull fruits and vegetables are generally goes waste or sold at a throw away price. After harvesting season is over, again rural people become jobless. They generally migrate to cities in search of any sort of job. Setting up of small and cottage level preservation factory at village level not only reduces losses due to glut but also provides jobs for rural people. It can always fetch an additional income to the grower and help in stabilizing the prices and providing economic return. Hence, fruit and vegetable processing industry should be encouraged and developed in rural areas, a way of rural industrialisation

Beneficial to Producers and Consumers

In a country like India, transportation facilities are not so good, rural electrification is also in infancy stage and huge production of horticultural produce occur in different parts of the country particularly in the rural areas and under developed areas. There is always abundance of produce at the production site but scarcity of the same produce at consumption places. Need and Importance Growers at production site sale their produce at the lowest minimum price due to fear of spoilage. However, the consumers purchase the same commodities at a very high price in cities and urban areas due to involvement of middle man. In this way, both producers and consumers suffer and middle man only get advantage. To overcome this situation, growers should be trained properly about post harvest management, storage and processing of fresh Fruits and vegetables. There must be on farm storage facilities viz. pusa zero energy cool chamber for short duration storage. Cottage and small scale level fruit and vegetable processing unit must be encouraged so that cull fruits and Fruits and vegetables can be converted into value added products, properly stored and processed products can be transported to the places of scarcity during their harvesting

season and after the season is over. In this way a glut like situation can be avoided in production areas. Growers will get a good price for their produce and consumer will have to pay a reasonable price only.

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