CHAPTER

1

IMPORTANCE OF FRUIT CULTURE AND SETTING UP OF FRUIT BASED INDUSTRY

OBJECTIVES

After studying this chapter, students will be able to:

- Understand the economic and health benefits of fruits
- Understand the problems faced by entrepreneurs for setting up of a fruit based industry
- Know the points to be kept in mind while setting up a fruit processing unit
- Start a fruit based processing unit

INTRODUCTION

You must be eating several fruits, sometimes in bulk, when available at a cheaper rate. Have you ever thought about their cultivation? What benefits can you draw by cultivating fruits? Have you ever thought of fruit based product, which you eat almost daily that where they come from, where are these produced, who produces them? Perhaps not, but it is clear that fruit cultivation is a gentlemen's job. It is an art as well as science, which has several benefits to mankind. In this chapter, you will come to know that fruit culture is highly beneficial to us as fruits not only generate income but they also possess several vitamins, minerals, antioxidants that have several health benefits. In addition, they provide raw material for processing industry, which generates rural employments and helps in increasing our earning manifolds.

Fruit culture: Economic preposition and health benefits

Economic preposition

Cultivation of fruits is considered as one of the most lucrative enterprises, which provides very high net income in comparison to cereal crops. Fruit crops provide a base for several agro-industries, which again becomes a source of good money. Similarly, by producing value added products, a farmer can earn a lot of money. At present, export of fresh fruits and their processed products is a major source of foreign exchange in our country. Moreover, fruit cultivation provides employment to rural, skilled and technical personnel, which becomes the base for survival of a mass population as described briefly hereunder.

Source of employment: Fruit cultivation is a labour intensive preposition, which offers higher employment opportunities to us. Cultivation of fruits can generate employment to the tune of 860 man days as compared to merely 150 man days in cereals. In contrast to cereal crops, which are harvested once in a season, fruit crops are harvested for a longer time period as fruits mature in flushes, which ensures additional employment opportunities. Some fruit crops like grape, banana and pineapple generate much large employment ranging from 1,000 to 2,500 man days per hectare.

Source of raw material for agro-industry: Fruit cultivation is a mother for many auxiliary industries like canning industries and processing industries etc. Several agro-industries, based on fruit products are being established, thereby solving the unemployment problem to some extent. For instance, coir (coconut) industry. Further, owing to change in food habits, there is an increasing demand for factory made jams, jellies, fruit beverages, dehydrated foods, pickles etc., in the domestic market. Fruits like mango, citrus, guava, pineapple, banana, litchi, apple, strawberry etc., provide raw material for their processing into value added products. This not only provides employment to rural and urban population but also becomes a source of foreign exchange .

Export earnings: There is a considerable demand for fresh and processed fruit products in foreign markets e.g. mangoes both fresh and canned, fruit juices, salted cashew and other fresh fruits etc. Mangoes, walnuts, grapes, bananas, pomegranates account for larger portion of fruits exported from the country. These fruits are mainly exported to the countries like Kuwait, Dubai and Saudi Arbia. West Asia, the Far East and West Europe are the main export markets for Indian fruits. Fruit juices, fruit pulp and pickles are mainly imported by the USSR, Yemen, Arab Republic. The other markets for processed fruits are UK, UAE, Saudi Arabia, Kuwait, Germany, USA, Holland and Switzerland. Nearly half of India's processed fruit exports are mango based fruit juice, canned and bottled fruits, of which, mango pulp is mainly exported to countries like Saudi Arabia, The Netherlands, UAE, Yemen Republic etc. Thus, fruit cultivation offers great opportunities for earning foreign currency.


Fruits as a source of export earnings

Health benefits of fruits

Fruits were thought to be an ill man's food about 4 decades back and were being given to a person when he was not feeling well. At that time, more emphasis was put on foods providing energy such as carbohydrates and fats. However, the importance of fruits for human nutrition was known which is obvious from the famous proverb" An apple a day keeps the doctor away". The per capita availability of fruits is about 70 g per day, which is just sufficient for a balanced human diet. Requirement of fruits for different groups is different (children 50 g, men 30 g and women 30 g per day). Hence, to meet the requirements of fruits for our increasing population, the production potential need to be increased besides reducing post harvest losses.

Fruits rich in anlioxidants

Chart showing health benefits of some fruits

In general, fruits are good source of vitamins and minerals and hence termed as protective foods. Vitamins and minerals are required in minute amounts and hence known as micronutrients. They help in better utilization of other nutrients such as carbohydrates, fats and proteins by affecting their metabolism and hence in better assimilation in the body.

Reduced intake of fruits in the diets by a large segment of our population due to socio-economic reasons is largely a contributing factor for prevalence of different types of nutritional deficiency diseases. Many of the common fruits found or grown locally could make a major difference in not only supplying vitamins and minerals but also in efficient utilisation of other food constituents. In the absence of adequate supply of vitamins and minerals, utilization of other nutrients particularly proteins is poor.

The most common vitamin deficiency symptoms among our population include night blindness due to carotene/vitamin A deficiency, scurvy due to vitamin C deficiency, beri beri due to thiamin deficiency and

pellagra due to niacin deficiency. In addition, many common symptoms appear like soreness of tongue, cracking at the angles of mouth, redness of eye, burning of feet, anemia etc., due to deficiency of one or the other vitamin in the diet. Goitre is quite prevalent in hilly regions due to deficiency of iodine in the diet.

Vitamin A is needed for the synthesis of a pigment present in the retina called 'rhodopsin' which helps in night vision. Therefore, vitamin A deficiency leads in night blindness. This is the earliest sign of vitamin A deficiency. If not remedied, further deficiency of this vitamin can lead to total blindness. Appearance of a white plaque on the white of the eye called 'Bitot's spot' is also an indication of vitamin A deficiency. Vitamin A deficiency is an important problem particularly in preschool children and yet it can be totally prevented by the inclusion of cheap vitamin A rich fruits such as mango and papaya.

Vitamins are very sensitive to heat and light and get easily destroyed when food is cooked in open vessels for a long time. Vitamins also get destroyed on storage, and hence from the point of view of nutrition, it is best to consume fresh fruits. After cutting, fruits should not be washed as water soluble vitamins are lost.

Fruits contain several minerals such as calcium, iron, zinc etc. Calcium is the major component of bones and teeth. Iron is a part of the red pigment of blood called haemoglobin. Iron deficiency leads to anemia. Vitamin C helps to improve iron absorption. Unlike vitamins, minerals are not easily destroyed by heat and light but they can be washed away if fruits are cut and washed.

Fruits are also rich source of pigments. The chief pigments of fruits are carotenoids, chlorophylls, anthoxanthins and anthocyanins. The carotenoids are a group of yellow, orange and orange red fat soluble pigments widely distributed in nature. These pigments are present in mango, papaya, peach, apricot, tomato, red pepper, carrot, squash etc. The chlorophylls are fat soluble pigments like carotenoids. They are important in photosynthesis, and occur in the plants in the ratio of 3:1 as chlorophyll a and chlorophyll b. Anthoxanthins are flavonoids, which are yellow in colour, and anthocyanins are also flavonoids which consists of red, blue and purple pigments and are water soluble. These pigments are widely distributed in the fruits such as grapes, plum, cherries, berries, *jamun*, *phalsa* etc.

Different types of fruits vary in their contents of vitamins. Some of them are rich in vitamin C (Barbados cherry, *aonla*, guava) while others are rich in vitamin A such as mango, pineapple and papaya. In India, due to different types of climatic zones, a large number of fruits are grown and available in different seasons

Grouping of fruits on the basis of their nutrients is as follows:

Carbohydrate- Raw or ripe banana or mangoes and other sweet fruits.

Fat- Avocado, olives, figs, seeds of muskmelon, watermelon, apricots, almonds etc.

Protein- Seeds of muskmelon, watermelon, apricots, almonds, avocados etc.

Avocado: rich source of fats

Vitamins

Carotene (Vitamin A) : Mango, pineapple, papaya, apricots.

Vitamin C: *Aonla*, citrus fruits like lemons, limes, orange, guava, papaya, strawberries.

Thiamine: *Avocado*, mango, orange.

Riboflavin: *Bael*, avocado, mango, papaya, strawberries.

Niacin: *Avocado*, Blackberry, mango.

Mango: rich source of vitamin A

Minerals

Calcium: *Amla*, guava, Mosambi orange.

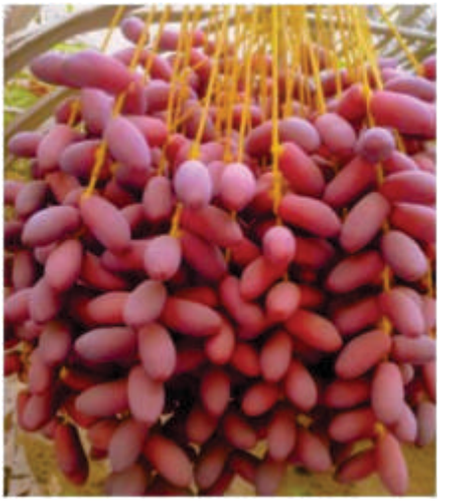
Iron: *Amla*, blackberry, guava, *jamun*, mango, dates, strawberries.

Phosphorus: Avocado, banana, grapes, dates, litchi, Mosambi.


Papaya: rich source of vitamin A

Fruits contain simple sugars such as glucose fructose etc. and also organic acids such as citric acid, malic acid, tartaric acid etc. which gives instant energy to the body. Hence intake of fruit provides a feeling of freshness. Organic acids also increase the availability of some mineral elements by solubilizing them.

As most of the fruits are eaten in the fresh form, some of the digestive enzymes such as proteolytic enzymes (Papain from papaya; bromelin from pineapple; ficin from figs) or starch digestive enzymes (amylase may) help in better digestion of the nutrients in foods and therefore, containing stomach problems. Although in some fruits, for example apple, composition is poor but still they have beneficial effects on human body due to the presence of dietary fibre or flavonoids, which act as antioxidants. Dietary fibres not only help in bowel movement but also help in reducing the absorption of antinutritional factors and in reducing incidence of ulcers. Many fruits such as apple, guava, citrus are rich in pectin, which is a component of dietary fibre.


Dates: rich in P and Ca

In recent years, emphasis is being put on the use of antioxidants for control of cancer and heart diseases. In this regard, fruits play a vital role in providing antioxidants in the form of vitamin C, carotenoid pigments and flavanoids.

Thus, fruits occupy an unique position in human diet. To meet the requirement, the production potential of all the fruits needs to be increased besides reducing post harvest losses.

Health benefits of fruits are due to:

- **Hydrating Effect -** Fruits, eaten raw or consumed as fresh juice, are excellent ways to retain and balance the moisture level in the body. The water absorbed by sick persons in this manner has an added advantage of supplying sugar and minerals at the same time. Patients are frequently advised to take mosambi or grape juice as fructose is readily available to body.

- **Diuretic Effect -** Consumption of fruits lowers the urine density and thereby acceleratea & the elimination of nitrogenous waste and chlorides. Fruits contain a very low level of sodium, they make a valuable contribution to a salt-free diet.

- **Alkalinizing Effect -** The organic acids of the salts in fruits produce alkaline carbonates, when transformed within the organism, which alkalize the fluids. All fruits promote intestinal elimination. This keeps the body free from toxic wastes, which creep into the blood from an overloaded, sluggish intestinal tract.

- **Mineralizing Effect -** Fruits furnish minerals to the body. Dried fruits such as apricots, raisins and dates are rich in calcium and iron. These minerals are essential for strong bones and good blood, respectively.

- **Laxative Effect -** The fibrous matter in fruits such as cellulose, aids in the smooth passage of the food in the digestive tract and easy bowel action. The sugars and organic acids contained in fruits also increase the laxative effect. Hence, regular use of fruits prevents and cures constipation. One or two fruits a day clean the digestive tract and aids easy bowel action.

- **Antioxidative Effect -** Fruits have been referred in ancient text as the best medicines to prevent aging. These are very strong rejuvsenants, which is believed to be due to natural presence of antioxidant,

vitamin C and E. These are substances that defend our body against the ravages brought on by harmful free radicals. Although antioxidant capacity varies greatly among fruits and vegetables, it is better to consume a variety of commodities rather than limiting consumption to a few with the highest antioxidant capacity.

- **Therapeutic Values -** The active principals present in fruits, leaves, bark and other plant parts of fruit crops have been used since ages in curing different ailments. For example, *aonla* is effective for respiratory complaints. It is used in Ayurveda as a cardiotonic, aphrodisiac, antipyretic, antidiabetic, cerebral and gastrointestinal tonic. A tablespoonful each of fresh gooseberry juice and honey mixed together forms a very valuable medicine for the treatment of several ailments. Likewise, bark of mango, the extracts of *bael* leaves and preserve and banana fruits are used to prevent diarrhea and *jamun* seeds and leaf extract are used to cure diabetes. Another disorder, which is slowly attaining an alarming position with the change in the life style is obesity, particularly in urban areas. Fruit have also find their role in combating this disorder as they are high in nutrition, low in fat and calorie. These attributes are quite effective for long term weight loss.

Establishment of fruit based processing units

Location: The following are some of the basic factors that must be considered in the establishment of a food processing business:

- **Available raw materials -** Primary fruit processing plants are generally located in areas of the production of the individual fruit or vegetable crop. Production applies sufficient yields to attract growers to want to produce a crop that meets specific quality standards. Adequate quantities of right type of horticultural produce from contract farming should be readily available in the locality, as horticultural crops are highly perishable and deteriorate in long distance transport.

- **Handling, storage and transportation facilities -** There should exist proper handling, storage and transport facilities for the safe and easy movement of raw material and finished product.

- **Adequate water supply -** There should be continuous potable water and electricity supply. The water must be potable and low in mineral salts such as calcium, magnesium, sulphur and iron.

- **Clean environment -** The environment should be clean and free from debris, dust and disagreeable odours.

- **Sewage disposal facility -** Wastes from fruit and vegetable processing facilities are high in organic matter, consequently the BOD is high and this must be lowered before discharging into the municipal systems. Proper waste disposal mechanism should be there to prevent environmental pollution.

- For frozen products, cold chain facility should be available.

- **Adequate labour supply -** Ample labour should be available at all times for efficient working of the plant.

- **Adequate markets -** The processing industry should look beyond the borders of its own local area and think globally. It requires good transportation facilities. There should be scope for future orderly expansion of the factory.

Present position, scope and future prospects of fruit processing

At present, we are not able to process even 1% of total fruit produced in our country, whereas, several advanced countries use to process about 70-80% of their produce. The following are the major reasons for low processing of fruits in India:

- Non-availability of modern processing technologies.
- Availability of machinery and equipments at a high cost.
- Lack of information about improved technologies.
- Lack of sufficient capital.
- Lack of information about loaning schemes.
- Excessive burden of work and responsibility.
- Lack of recognition and appreciation in the family.
- High cost and distant place for the availability of raw material.
- Difficulty in getting money from buyer after sale.

There is a great scope for processing industry based on fruits as discussed hereunder:

1. Due to perishable nature, about 30-40 of fruits are lost due to improper handling after harvesting. Processing of fruits in times when production is very high or when there is a glut of fruits in market, will reduce these losses to minimum.
2. Sometimes, surplus can't be stored for sale in off season because of inadequate storage facility. With processing, the surplus can be utilized effectively.
3. Fruit based industry will require raw material for which farmers will come forward to grow fruits, which will help in generating employments for rural youth and farm women.
4. With rapid urbanization, there has been significant increase in middle class families, which demand for processed products.
5. In the recent years there has been a change in food habits of the people in Inida. Our children demand for processed products rather than those made at home. Hence, to meet this demand, there is a great scope in expanding this industry in our country.
6. There is a considerable demand for processed fruit products in foreign markets, which can be only bemet after boosting our fruit processing industry.
7. We, in India, are not using much advanced techniques of food processing, whereas, there is a great scope for using several advanced technologies to boost the quality production of such processed products.
8. The rural homemakers who play a considerable role processing at homecale, have not been exposed to modern methods of preservations/processing. We need to disseminate the technology in accordance with the need of locality. Such technologies for rural areas should meet the criteria of low cost, low input, low risk and should be suitable for small scale applications.

Equipments required for setting up of a processing unit

The various types of equipments used in the processing industry are as follows:

1. **Raw material preparation (before processing):** Washing machines, peeling machines, cutting machines, preparation tables, pitting knives, coring knives.
2. **Preparation of pulp / juice extraction:** Continuous simple crusher, horizontal pulper, turbo refiner, continuous extractor, hydraulic press.

3. **Blanching / cooking / concentration / evaporation:** Cooking kettle, steam jacketed pans, continuous water blancher, large stainless steel tank, steam generator, double bottom tank for scalding / blanching.

4. **Pasteurization / deaeration:** De-aerator, pasteurizer, horizontal sterilizer, steam heated processing retort, plate heat exchanger.

5. **Drying / dehydration:** Cabinet dryers, SO_2 generator / chamber, sulphuring box, solar dryer, tunnel dryer, drum dryer, spray dryer, freeze dryer.

6. **Packing machines:** Pouch filler, bottle filling machines, seaming machine, pouch sealing machine, crown corking machine, semi-automatic capping machine.

7. **Canned products:** Can reformer, flanger, double seamer, exhausting tunnel, water sprays, brining/syruping tanks, vacuum gauge, retorts, seam testing machines, salometer, hydrometer.

8. **Quality control equipments:** Refractometer, retorts (autoclaves), hot oven, pH meter, penetrometer, texture analyzer, microscope, incubation oven, analytical balance, working tables, BOD incubator, refrigerator, spectrophotometer/colorimeter, electronic balance, jars vacuum detector, various thermometers, hand refractometer, vortex shaker, colony counter, gas stoves.

9. **Miscellaneous equipments:** Mobile product wagons, storage tank, mixing tank, rotating tank, hot plate, magnetic stirrer, weighing machine, water bath, boilers, exhausts, fans, blowers, illumination and control equipments, waste water treatment equipments, weighing scale, jelmeter, rubber gloves, filter cloth, dusters, aprons, bottles, jars, cans.

EXERCISES/ACTIVITIES

- Go to fruit market. Make a list of fruits and group them on the basis of nutritional composition.
- Take a appointment from a nutritionist. Ask him to list the health benefits of fruits.
- Go to a processing unit. Make a list of positive and negative points of that unit.

CHECK YOUR PROGRESS

1. Describe the health benefits of fruits. Write two fruits rich in Vitamin A, C and minerals such as Ca and Fe.
2. Describe the points which you will keep in mind while setting up a processing unit.
3. Explain why India's could not make a dent in processing of fruits.
4. Write important instrument required for processing of fruits.

WRITE TRUE (T) AND FALSE (F) FOR THE FOLLOWING STATEMENTS

i. Guava is a rich source of B complex group of vitamins

ii. Mango can be helpful in curing night blindness.

iii. Processing units can be set up anywhere in the country.

iv. Our country process about 50-60% of the total fruit we produce.

v. Avocado is a rich source of carbohydrates.

SUGGESTED FURTHER READINGS

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