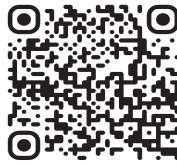


Krishi : Production, Processing and Marketing

BOOK-2



383KRISHIB2



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A Word with You

Dear learners!

Welcome to the Senior Secondary Course 'Krishi: Production, Processing, and Marketing'.

As you know, agriculture is the backbone of our food supply, providing the essentials that we consume daily. However, the growing human population poses significant challenges, with food production needing to increase by 60% by 2050. This task is challenging, given the limitations of land, water, and other critical resources. Additionally, Climate change and global warming have emerged as urgent challenges, profoundly affecting agriculture and livelihoods opportunities worldwide.

India, as an agrarian nation, relies heavily on farming, with a substantial portion of its population engaged in agriculture. Yet, traditional farming practices often yield low productivity and limited returns. The adverse effects of climate change-such as heat waves, flash floods, droughts, and cyclones-further aggravate these challenges. To meet the growing food demand amidst changing dietary preferences and climatic uncertainties, there is an urgent need to re-imagine and reform agricultural practices. A holistic and sustainable approach to farming is essential for addressing food insecurity and ensuring resilience against climate-related challenges.

Agricultural science, a multidisciplinary branch of biology, integrates principles from natural, economic, and social sciences to enhance food production. This course is thoughtfully designed to familiarize you with modern, scientific, climate-smart and sustainable agricultural practices. By the end of this course, you will gain a comprehensive understanding of the journey of food from the farmer's field to our plate.

The senior secondary course 'Krishi: Production, Processing, and Marketing', developed by the National Institute of Open Schooling (NIOS), delves into all dimensions of agriculture. It traces the evolution of agriculture from its origins to the present day, explores promising technologies for crop production, highlights post-harvest management and food processing techniques, and enables you with the knowledge to make informed market decisions for maximizing profitability. This course has been structured into six modules comprising of twenty-five lessons, and one practical manual. The self learning materials (SLMs) of this course have three books (Book 1: Module 1 to 3, Book 2: Module 4 to 6, Laboratory Manual). The syllabus has been bifurcated for Tutor Marked Assignments (TMA) and Public Examination (PE). Please note that questions in public examination will come from the lessons which are earmarked as PE.

We hope you will enjoy reading this self learning material which guide you as 'Teacher in Print'. For any queries feel free to contact us and share your views and comments regarding this book in the mail - aoagri@nios.ac.in.

Wish you all the best in your journey with this course.

Happy learning!

Course Coordinator

Krishi: Production, Processing and Marketing

How to use the Study Material

Congratulation! You have accepted the challenge to be a self-learner. NIOS is with you at every step and has developed the material with the help of a team of experts, keeping you in mind. A format supporting independent learning has been followed. If you follow the instructions given, then you will be able to get the best out of this material. The relevant icons used in the material will guide you. These icons have been explained below for your convenience.



Title: will give a clear indication of the contents within. Do read it.



Introduction: This will introduce you to the lesson linking it to the previous one.



Objectives: These are statements that explain what you are expected to learn from the lesson. The objectives will also help you to check what you have learnt after you have gone through the lesson. Do read them.



Notes: Each page carries empty space in the side margins, for you to write important points or make notes.



Intext Questions: Very short answer self check questions are asked after every section, the answers to which are given at the end of the lesson. These will help you to check your progress. Do solve them. Successful completion will allow you to decide whether to proceed further or go back and learn again.



What You Have Learnt: This is the summary of the main points of the lesson. It will help in recapitulation and revision. You are welcome to add your own points to it also.



Terminal Exercises: These are long and short questions that provide an opportunity to practice for a clear understanding of the whole topic.



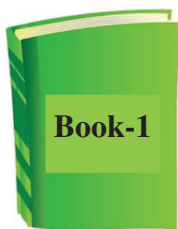
Do You Know: This box provides additional information. The text in boxes is important and must be given attention. It is not meant for evaluation, but only to improve your general knowledge.

Answers : These will help you to know how correctly you have answered the questions.

Activities: Certain activities have been suggested for better understanding of the concept.

Glossary: It provides definition/meaning of words or phrases that may be unfamiliar to the learner, or that have a specialized or technical meaning.

Suggested Readings: Here additional resources are mentioned for extended learning and more comprehensive understanding of the topic.



COURSE OVERVIEW

1. SCOPE AND IMPORTANCE OF AGRICULTURE

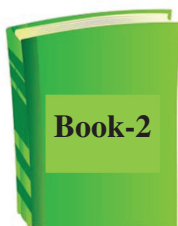
1. Evolution and development of agriculture
2. Importance of agriculture in indian economy
3. Characteristics of indian agriculture
4. New developments in agriculture

2. CROP PRODUCTION PRACTICES

5. Soil Health and Plant Nutrition
6. Crops, cropping system and crop establishment
7. Nutrient, water and weed management
8. Plant protection and harvesting
9. Fundamentals of horticulture and fruit production
10. Vegetable crops
11. Flower crops

3. POST-HARVEST MANAGEMENT

12. Need and importance of post harvest management
13. Processes in postharvest management system
14. Storage and warehousing



4. FOOD PROCESSING AND VALUE ADDITION

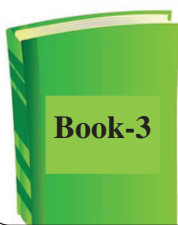
15. Food processing sector: opportunities and challenges
16. Food groups and nutritional importance
17. Types and methods of food processing
18. Value added food products
19. Food safety and quality control

5. AGRICULTURAL ECONOMICS, MARKETING AND POLICY

20. Basics of agricultural economics
21. Agricultural marketing and policy
22. Agricultural finance and credit in india

6. ENTERPRISES IN AGRICULTURE

23. Entrepreneurship: nature, types and levels
24. Importance of self-help groups in agriculture and village economy
25. Career opportunities in agriculture sector



LABORATORY MANUAL

National Institute of Open Schooling

Bifurcation of Syllabus

Krishi : Production, Processing and Marketing at Senior Secondary Level (383)

Total no. of lessons - 25

Modules (No. & Name)	TMA (40%) (No. of lessons - 10)	Public Examination (60%) (No. of lessons - 15)
		Objective question - 50% and Subjective question 50%
1. Scope and importance of agriculture	L-1: Evolution and development of agriculture L-2: Importance of agriculture in Indian economy	L-3: Characteristics of Indian agriculture L-4: New developments in agriculture
2. Crop production practices	L-10: Vegetable crops L-11: Flower crops	L-5: Soil health and plant nutrition L-6: Crops, cropping system and crop establishment L-7: Nutrient, water and weed management L-8: Plant protection and harvesting L-9: Fundamentals of horticulture and fruit production
3. Post harvest management	L-12: Need and importance of post-harvest management	L-13: Processes in postharvest management system L-14: Storage & warehousing
4. Food processing and value addition	L-15: Food processing sector: opportunities and challenges L-19: Food safety and quality control	L-16: Food groups and nutritional importance L-17: Types and methods of food processing L-18: Value added food products
5. Agricultural economics, marketing and policy	L-22: Agricultural finance and credit in India	L-20: Basics of agricultural economics L-21: Agricultural marketing and policy
6. Enterprises in agriculture	L-24: Importance of self-help groups in agriculture and village economy L-25: Career opportunities in the agriculture sector	L-23: Entrepreneurship: nature, types and levels

Note: The syllabus has been bifurcated into two sections-

(i) Lessons for the Tutor Marked Assignment (TMA)

(ii) Lessons for public examination question paper

The details of the different sections are on the next page.

CONTENTS

MODULE	LESSON	PAGE NO.
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	16. Food Groups and Nutritional Importance	19-44
	17. Types and Methods of Food Processing	45-70
	18. Value Added Food Products	71-94
	19. Food Safety and Quality Control	95-122
5. Agricultural Economics, Marketing and Policy		
	20. Basics of Agricultural Economics	123-148
	21. Agricultural Marketing and Policy	149-172
	22. Agricultural Finance and Credit in India	173-194
6. Enterprises in Agriculture		
	23. Entrepreneurship: Nature, Types and Levels	195-214
	24. Importance of Self-help Groups in Agriculture and Village Economy	215-228
	25. Career Opportunities in Agriculture Sector	229-256

MODULE - 4

Food Processing and Value Addition

15. Food Processing Sector: Opportunities and Challenges
16. Food Groups and Nutritional Importance
17. Types and Methods of Food Processing
18. Value Added Food Products
19. Food Safety and Quality Control



FOOD PROCESSING SECTOR: OPPORTUNITIES AND CHALLENGES



Notes

Food is one of the basic requirements for our survival. It provides essential nutrients like proteins, carbohydrates, fats, minerals and vitamins, which are necessary for our growth. Raw food materials like grains, fruits and vegetables, milk and fish are produced through cultivation of field crops, horticulture, animal husbandry and aquaculture, respectively. While some of these can be consumed in their natural (raw) form, most of them require processing to become edible. Thus, food processing transforms raw food items into more acceptable, consumable, durable and commercially viable food products like wheat flour, jam, ketchup, pasteurized milk, frozen fish, etc. Food processing has emerged as one of the priority areas of commercial importance in India. It plays an important role not only in reducing food wastage but also developing value-added products. In this lesson, we shall explore the status, scope, challenges, and opportunities in the food processing sector in our country.



LEARNING OUTCOMES

After studying this lesson, the learner:

- defines food processing and explains its importance;
- describes the current status of the food processing sector in our country;
- lists various sub-sectors of the food processing industry;
- discusses the scope and opportunities available in the food processing sector;
- highlights the challenges and constraints faced by the food processing sector; and

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- outlines various schemes and initiatives by the government to support the food processing industry.

15.1 IMPORTANCE OF FOOD

Let us start with definition of food. We know that food is something we can eat. It is defined as material, usually of plant or animal origin that contains essential body nutrients such as proteins, fats, carbohydrates, vitamins and minerals for nourishment. The related terms are defined as:

Food Science: It is the discipline that deals with the study of physical, chemical, and biological nature of food, the causes of their spoilage, and the principles of food processing. Its important sub disciplines are food chemistry, food microbiology, food processing, food engineering and food safety and quality.

Food Technology: It deals with the application of food science to the selection, preservation, processing, packaging, distribution and use of safe food.

Food Preservation: This involves treatments given to food to prevent spoilage and deterioration while preserving nutritional value. Examples include drying, addition of salt, sugar, etc. The main objective is to prevent the growth of microorganisms and reduce water activity.

Food Processing: It defined as the treatments given to raw food materials to convert them into edible, less perishable and value-added products. Examples are milling, pasteurization, fermentation, etc.

Post-Harvest Management: It includes handling, cleaning, storing, grading and transportation operations undertaken after the harvest of agricultural commodities.

All raw food materials are processed to improve their taste, nutritional value and shelf life. Foods are processed for the following reasons:

- Preservation for later consumption or sale to fetch better prices
- Removal of inedible portions
- Destruction or removal of harmful substances
- Conversion into forms desired by the consumers

Food processing industries help in

- Reducing post-harvest losses and wastes as well as using by-products more efficiently.

- b. Increasing farmers' income by enabling them to obtain better prices and enhancing consumer welfare by increasing the availability of agricultural goods.
- c. Maintaining reasonable prices of food produce even during excess production (glut) situations.

The Food Processing Industry (FPI) provides a strong linkage between the two pillars of the economy i.e., agriculture and industry. Food processing plays a crucial role in increasing shelf life, value addition, employment opportunities, farmer's income, export earnings, and reducing wastage of food and food products. This is evident from the following significant factors:

- a. **Employment generation:** Being a direct linkage between agriculture and manufacturing, it provides wide direct and indirect employment opportunities.
- b. **Increasing farmers' income:** With the increase in demand for agri-based products, the price paid directly to farmers increases, thereby increasing their income.
- c. **Reduction in malnutrition:** Fortification of processed foods with vitamins and minerals helps in reducing the malnutrition in the population.
- d. **Reduction in food wastage:** Proper processing of food reduces wastage, resulting in better price realisation for farmers.
- e. **Boosting trade and earning foreign exchange:** Processed food is an important source of foreign exchange. For example, Indian Basmati rice is in high demand in Middle Eastern countries.
- f. **Control of food inflation:** Food processing increases the shelf life of food products and keeps supply in alignment with demand, thus controlling food inflation.
- g. **Nutrient preservation and spoilage prevention:** Proper processing of food preserves the nutritive quality of food and extends shelf life by preventing spoilage due to action of microbes and other agents.
- h. **Enhancing the food experience:** Processing improves the quality and taste of food, offering more choices in the food basket.
- i. **Enhances consumer choices:** Food processing allows food from other parts of the world to be transported to local markets and vice versa.



Notes

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**INTEXT QUESTIONS 15.1**

1. Name five important nutrients present in food.
2. Define food processing.
3. FPI stands for.....

**ACTIVITY 15.1**

Collect ten processed food products along with their raw materials.

.....

.....

.....

15.2 PRESENT STATUS OF INDIAN FOOD PROCESSING INDUSTRY

We know that our country is the largest producer of milk, pulses, and spices in the world. We rank second in the production of fruits, vegetables, tea, farmed fish, cotton, sugarcane, wheat, rice, and sugar. Similarly, we stand third in egg production. The Indian food processing industry accounts for 32% of the country's total food market, ranking fifth globally in terms of production, consumption, export and expected growth. The sector has been growing at an average annual growth rate of around 11.18 %. It contributes approximately 8.80% and 8.36% to the gross value addition (GVA) in the manufacturing and agriculture sectors, respectively.

Despite having a substantial production base, the level of food processing in India remains low (<10%). Approximately 8% marine products, 35% of milk, and 6% of poultry are processed. Although India is the second largest producer of fruits and vegetables in the world after China, only about 2% of the total produce is processed. This is due to the lack of adequate processing infrastructure and techniques, which poses a significant challenge to the sector.

The food industry is divided into four major segments; (a) Agriculture Production; (b) Manufacturing / Processing; (c) Distribution; and (d) Marketing.

Food processing industry in India can be categorized as follows:

- Cereal/pulse milling
- Milk & milk products
- Meat & meat products
- Fruit & vegetable processing
- Beverages like coffee, tea & cocoa
- Bread, biscuits & other bakery products
- Aerated waters/soft drinks
- Edible oil/fats
- Fish, poultry & egg products
- Beer/alcoholic beverages
- Confectioneries
- Breakfast cereals, malt protein, weaning, extruded food products

The categorization of food processing operations includes primary processing, secondary processing, and tertiary processing. Primary processing (Fig. 15.1) pertains to the transformation of raw agricultural produce, milk, meat, and fish into commodities that are suitable for human consumption. This phase involves a series of activities such as cleaning, grading, sorting, packing, etc.

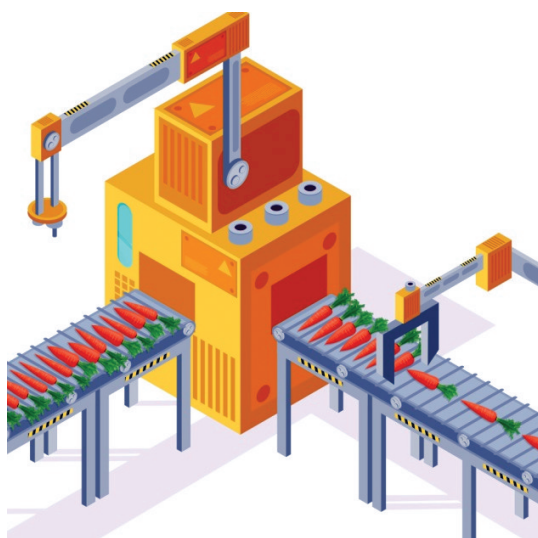


Fig. 15.1: Primary processing of carrots



Notes

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Notes

Secondary (Fig. 15.2) and tertiary processing industries usually involve a higher level of processing, where new or modified food products are manufactured.

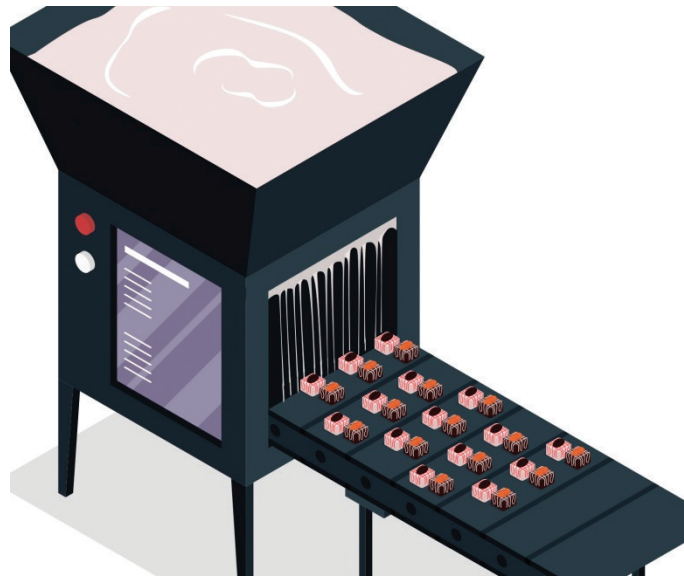


Fig. 15.2: Secondary processing of cakes

Most of the processing operations in India can be classified as primary processing, which results in lower value-addition compared to secondary processing. To boost farmer income and enhance exports, there is a need to improve the value chain in processed food products. Currently, India's agricultural exports primarily consist of raw materials that are processed in other countries, highlighting the potential for India to move up the value chain.

The term 'food processing industries' covers a wide range of relatively modern food processing sectors such as dairy, confectionery, marine products, horticultural and vegetable products, as well as meat and poultry products.

- The cereals sector (wheat, rice, maize, millets) belongs to the first category of processing. Improving efficiency in this sector would lead to higher recovery of desired products and create a number of potentially useful by-products, some of which are not being fully utilized at present.
- The next category is the processing of milk and milk products. This extends the scope of linking the farmers in rural areas to markets, thereby increasing their income.
- The third category relates to processing activities that extend the storage life of seasonal food products such as fruits and vegetables.

To meet the current demand for food materials, the industrial food processing sector has emerged. The food processing sector in the country is mainly handled by the unorganized sector, which contributes approximately 42% of the output. The organized sector accounts for 25% with the remainder coming from small-scale players. The small-scale food processing sector is a significant source of employment.

However, the small-scale food processing sector faces increasing competition from large manufacturers in terms of presentation and marketing. Good packaging is an area of vital importance for small and medium-sized food manufacturers. Food processing has the potential to maintain a safe and continuous food supply for millions of people, including those living in remote and difficult localities. Improvements in processing efficiency, by increasing the yield of unstable products, are one of the important means of reducing food losses and increasing the food supply. The demand for convenience in food preparation at homes, institutions, and restaurants has created a need for food processing industries to provide food ingredients as well as new food forms.



Notes



INTEXT QUESTIONS 15.2

1. Food processing industry in India ranks.....in terms of production, consumption and export.
2. GVA stands for.....
3. Thesector belongs to the first category of processing.

15.3 SCOPE OF FOOD PROCESSING SECTOR

The food processing industries has an enormous potential to boost India's Economy.

- India has a considerable raw material base in the agricultural sector, which provides ample opportunities for the processing sector, which can, in turn create employment. It also has the potential to enhance India's presence in the global export market of food items. Hence increased government intervention and policies are crucial to implement measures that facilitate the growth and development of this industry.
- Estimates suggest that India's current food processing industry is estimated at USD 130 billion and is expected to attract huge domestic and foreign investment.

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- India ranks first in the world in the production of milk, ghee, ginger, bananas, guavas, papayas, and mangoes. Additionally, India ranks second in the world in the production of rice, wheat, and several other vegetables and fruits. Surplus production of cereals, fruits, vegetables, milk, fish, meat, and poultry can be processed and marketed both domestically and internationally, presenting immense opportunities for growth in the sector.
- Due to rapid urbanization, food habits are shifting towards value-added foods.
- India is among the fastest growing economies in the world and has substantial market potential to attract foreign investment in the food processing sector.
- Estimates indicate that around 35% of total food production is wasted due to inadequate facilities for transportation, storage, processing, and marketing. This shows the significant scope for the development of food processing sector.
- In India, the food sector has emerged as a high-growth and high-profit sector due to its potential for value addition, particularly within the food processing industry.
- The food processing industry indirectly employs millions of people in India. The demand for healthy, modern food products is increasing, particularly due to the rising number of working women and nuclear families in urban areas. Thus, the food value chain creates multiple opportunities for investment and employment in storage infrastructure, farming, retail, and quality control.
- The agricultural sector provides employment opportunities for farmers, and self-employment opportunities are available in this sector particularly for women. However, infrastructural facilities like storage and processing centres, transportation networks, and research and innovation for value addition to the product are also crucial.
- The Government of India has launched the SAMPADA scheme to boost the food processing industry in the country. Thus, policymakers have identified food processing as a key sector for encouraging labour movement from agriculture to manufacturing.

**INTEXT QUESTIONS 15.3**

1. What is the primary objective of the SAMPADA scheme launched by the Government of India?
2. The Indian food processing industry accounts for% of the country's total food market.
3. It contributes around and % of Gross Value Added (GVA) in Manufacturing and Agriculture, respectively.
4. Around percentage (%) of total food production is wasted due to lack of processing facilities.

*Notes***15.4 CHALLENGES IN FOOD PROCESSING SECTORS**

The food processing industry accounts for one third of the total food market in India. According to a report by Agricultural and Processed Food Products Export Development Authority (APEDA), the food processing industry accounts for 32% of India's food market. However, the growth of the food processing industry faces several challenges:

- a. Lack of availability of raw materials:** Continuous supply of quality raw materials for the processing industry is a challenge in India because of predominance of small and medium-sized farm holdings. These farmers face challenges to access crop inputs and technical advice.
- b. Lack of infrastructure:** Many small-scale food processing industries suffer from inadequate food storage infrastructure, which affects the storage of raw materials. This limitation makes it difficult to transport food items efficiently.
- c. Lack of adequate connectivity:** Some rural production sites are poorly connected to storage or processing facilities. The goods produced in these areas take a long time to reach the food processing units. There is a need to improve connectivity through roads, railways, rivers and airways in these areas.
- d. Old processes:** The foods are often inspected manually. Upgrading technologies is essential to stay competitive in the global market.
- e. Ignorance and human error:** Many food items are wasted daily due to carelessness in handling during shifting, packaging, storing, and transporting. Efficient measures are needed to reduce such waste.

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- f. **Excess use of fertilizers and pesticides:** Excessive use of fertilizers, pesticides and other chemicals raises concerns about food quality. Such type of processed foods may not be nutritionally balanced and may pose health risks, especially for children, unless fortified.
- g. **Inadequate value addition in processing:** Despite being one of the major producers of agri-commodities, India's level of food processing and value addition remains low, affecting competitiveness and income of farmers.
- h. **Limited ability to control quality and safety:** The food value chain involves many people, making it challenging to enforce food quality and safety standards effectively.
- i. **Low consumer awareness:** Customers are often unaware of nutritional, food safety, and quality issues. It is imperative to address and prioritize these concerns.
- j. **Uncertain climatic conditions:** Adverse weather conditions often cause crop losses for farmers every year, resulting in a limited supply of raw materials for the food processing industry.
- k. **Lack of technology:** Advanced technology adoption in food processing industry is still needed to make it more efficient.
- l. **Food standards:** Every nation has its food standards for consumable food items and thus, the food processing industries must meet national food standards. Adequate laboratories and technical manpower are required to ensure compliance with these standards.
- m. **Perishable commodities:** Perishable items like meat, fish, fruits and vegetables, in particular, have high wastage rates. Minimizing losses in the perishable segment requires significant investment in infrastructure and expansion of processing capacities.
- n. **Marketing of processed food:** It is a major problem faced by food processors, particularly micro and small processors. Limited scale of operations affects their ability to invest in marketing and branding, impacting performance of the sector.
- o. **Coordination:** Several research institutes are currently engaged in research and development activities aimed at improving and developing products, processes, and technologies. Such efforts are crucial to implement a coordinated effort to disseminate research findings to the industry.

- p. **GHP & GMP:** Insufficient emphasis is given to food safety measures along the food value chain. Promoting the implementation of Good Hygiene Practice (GHP) and Good Manufacturing Practice (GMP) is necessary to maintain the standards of food quality. There are other areas such as food testing, quality certification and safety issues that require priority attention and improvement.

Challenges Faced at the Consumer Level

- Lack of awareness
- Lack of standardization
- Poor quality in processed foods
- Conventional food and eating habits

Challenges Faced at the Farm Level

- Conventional farming techniques
- Lack of modernized farm equipments
- Heavy reliance on rain-fed farming methods
- Low farm produce yield
- Improper grading and sorting
- Inadequate cold storage facilities
- Inadequate handling and transportation facilities
- Inferior quality of food produce
- High advertising costs

Challenges Faced at the Distribution Level

- Insufficient infrastructural support
- Expensive packaging costs for products
- High cost of modern transportation facilities
- Limited market support
- High expenses for cold chain facilities
- Inadequate modern transportation facilities and high costs



Notes

Food Processing and
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Notes

Challenges Faced by Food Processing Industries

- Financing
- Higher import duties
- Higher cost of raw material and packaging
- Improper transportation and inadequate cold storage facilities
- Lack of availability of refrigerated containers
- Higher advertising costs
- Limited domestic market



INTEXT QUESTIONS 15.4

1. The food processing industry accounts for of the total food market in India.
2. APEDA stands for.....
3. GHP stands for.....
4. GMP stands for.....

15.5 OPPURTUNITIES IN FOOD PROCESSING SECTOR

The Ministry of Food Processing Industries (MOFPI) has launched various schemes to boost the food processing sector. Some of the major initiatives taken by the Government of India to improve the food processing sector in India are as follows:

- a) MOFPI launched the **National Mission on Food Processing** in April 2012, sponsored by the central government. The main aim of this scheme was to establish more food processing industries in India and to monitor and supervise the existing ones.
- b) The **Mega Food Park Scheme** of the Government of India could be game-changing as it directly connects farmers with industries via mega food parks. It aims to promote the development of modern food processing infrastructure in India.



- c) The government is focusing on developing **Agri Export Zones (AEZs)**. Under this scheme, many cities such as Ahmedabad, Anand, Vadodara, etc. have been converted into Agri-export zones. These zones foster healthy competition both abroad and in the domestic market.
- d) Several NGOs are providing connectivity between producers, food processing units, and the market.
- e) The government has introduced several certificate courses related to food processing to increase the skilled manpower.
- f) The government is encouraging start-ups and entrepreneurship in the food processing sector.
- g) The **Food Safety and Standards Authority of India (FSSAI)** is strengthening the food testing infrastructure of India by upgrading 59 existing food testing laboratories and setting up 62 mobile food testing labs.
- h) **Indian Council for Fertilizer and Nutrient Research (ICFNR)** is working on improving research facilities in the fertilizer sector to enhance the quantity and quality of agricultural produce.
- i) **Pradhan Mantri Kisan Sampada Yojana (PMKSY)**: Launched in August 2017, this scheme consolidates various ongoing schemes like mega food parks, integrated cold chains, and food safety and quality assurance infrastructure. It aims to boost agriculture, modernize food processing operations, and reduce agro-wastage.
- j) The Ministry of Food Processing Industries announced the **Human Resource Development (HRD)** scheme in the food processing sector. This scheme is being implemented through State Governments under the National Mission on Food Processing and includes the following components:
 - ❖ Creation of infrastructure facilities for degree/diploma courses in food processing sector
 - ❖ Entrepreneurship Development Programme (EDP)
 - ❖ Food Processing Training Centres (FPTC)
 - ❖ Training at recognised institutions at State/National level

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- k) **Scheme of cold chain, value addition and preservation infrastructure:** The purpose of this scheme is to provide integrated cold chain and preservation infrastructure facilities, without any break, from the farm gate to the consumer.
- l) **Make in India:** As part of the “Make in India” campaign, the food processing sector was identified as one of the 25 focus areas. Allowing 100% foreign direct investment (FDI) through automatic route into this sector is a significant step in this direction.
- m) **Production Linked Incentive (PLI) Scheme for Food Processing Industry (PLISFPI):** The objective of this scheme is to promote Indian brands of food products, increase employment opportunities for off-farm jobs, and ensure higher income for farmers. The Government announced this scheme in the year 2021 with an outlay of ₹10,900 crore. This aims to create 2.5 lakh jobs by 2026-27, boost exports, and expand food processing capacity to generate processed food output worth ₹33,494 crore.
- n) **Pradhan Mantri Formalization of Micro Food Processing Enterprises Scheme (PMFME scheme):** This scheme aims to build the capacity of entrepreneurs through technical knowledge and skill training; improve existing micro food processing enterprises through technology upgradation; integrate them with organized supply chains by strengthening branding and marketing. It is an All India Centrally Sponsored Scheme with an outlay of ₹ 10,000 crores for 200,000 enterprises over 5 years from 2020-21 to 2024-25. It will adopt a One District One Product (ODOP) approach to get benefit of scale in terms of procurement of inputs, availing common services and marketing of products. There may be multiple clusters for one product in a district.
- o) Government established **National Institute of Food Technology Entrepreneurship and Management (NIFTEM), Kundli in Haryana in 2012.** It is a higher education institute operating under the Ministry of Food Processing Industries and has been granted the Institute of National Importance status in 2021.

**INTEXT QUESTIONS 15.5**

1. MOFPI stands for
2. National Mission on Food Processing scheme was launched in the year

3. AEZs stands for.....
4. Pradhan Mantri Kisan Sampada Yojana was launched in the year
5. PMFME scheme stands for.....
6. PLISFPI stands for.....



WHAT YOU HAVE LEARNT

- Raw food materials undergo a transformation into edible products through various processing techniques that results in value addition. The operations involved in food processing can be broadly categorized into primary processing and secondary processing.
- All the raw food materials are processed to improve their taste, nutritional value and shelf life.
- Indian food processing industry is one of the largest and ranks fifth in terms of production, consumption and export.
- Most processing in India can be classified as primary processing, which has lower value-addition compared to secondary processing.
- India is currently the largest milk producer in the world, contributing 23% of global milk production.
- India ranks second in fruit and vegetable production in the world, after China.
- The Ministry of Food Processing Industries (MOFPI) has launched various schemes to boost the food processing sector.



TERMINAL QUESTIONS

1. Differentiate primary processing from secondary and tertiary processing.
2. What is the importance of food processing?
3. How does FPI act as a strong linkage between the two pillars of the economy?
4. Explain the present status of Indian food processing industry.
5. What are the different categories within the Indian food processing industry?



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Notes

6. Give the present status of cereals and fruits and vegetable processing sectors in India.
7. Discuss the status of milk processing sector in India.
8. Discuss the scope of Indian food processing sector.
9. What are the challenges faced by Indian food processing industry?
10. What are the various opportunities in food processing sector?



ANSWERS TO INTEXT QUESTIONS

15.1

1. Carbohydrates, proteins, fats, vitamins and minerals.
2. Treatment given to food raw materials to convert them into eatable, less perishable and value-added products.
3. Food processing Industry.

15.2

1. Fifth
2. Gross Value Addition
3. Cereals

15.3

1. To boost the food processing industry and encourage labor movement from agriculture to manufacturing
2. 32
3. 8.80, 8.39
4. 35%

15.4

1. One-third
2. Agricultural and Processed Food Products Exports Development Authority
3. Good Hygiene Practices
4. Good Manufacturing Practices

**15.5**

1. Ministry of Food Processing Industries
2. 2012
3. Agri Export Zones
4. 2017
5. Pradhan Mantri Formalisation of Micro Food Processing Enterprises scheme
6. Production-Linked Incentive Scheme for Food Processing Industry

GLOSSARY

Food Processing: Treatment given to raw food materials to convert them into edible, less perishable and value-added products. Examples are milling, pasteurization, fermentation, etc.

Food: Material, usually of plant or animal origin that contains essential body nutrients such as proteins, fats, carbohydrates, vitamins and minerals for nourishment.

Foreign Direct Investment (FDI): When a company/organization based in one country such as India invests their money in another country such as China, it is referred to as foreign direct investment.

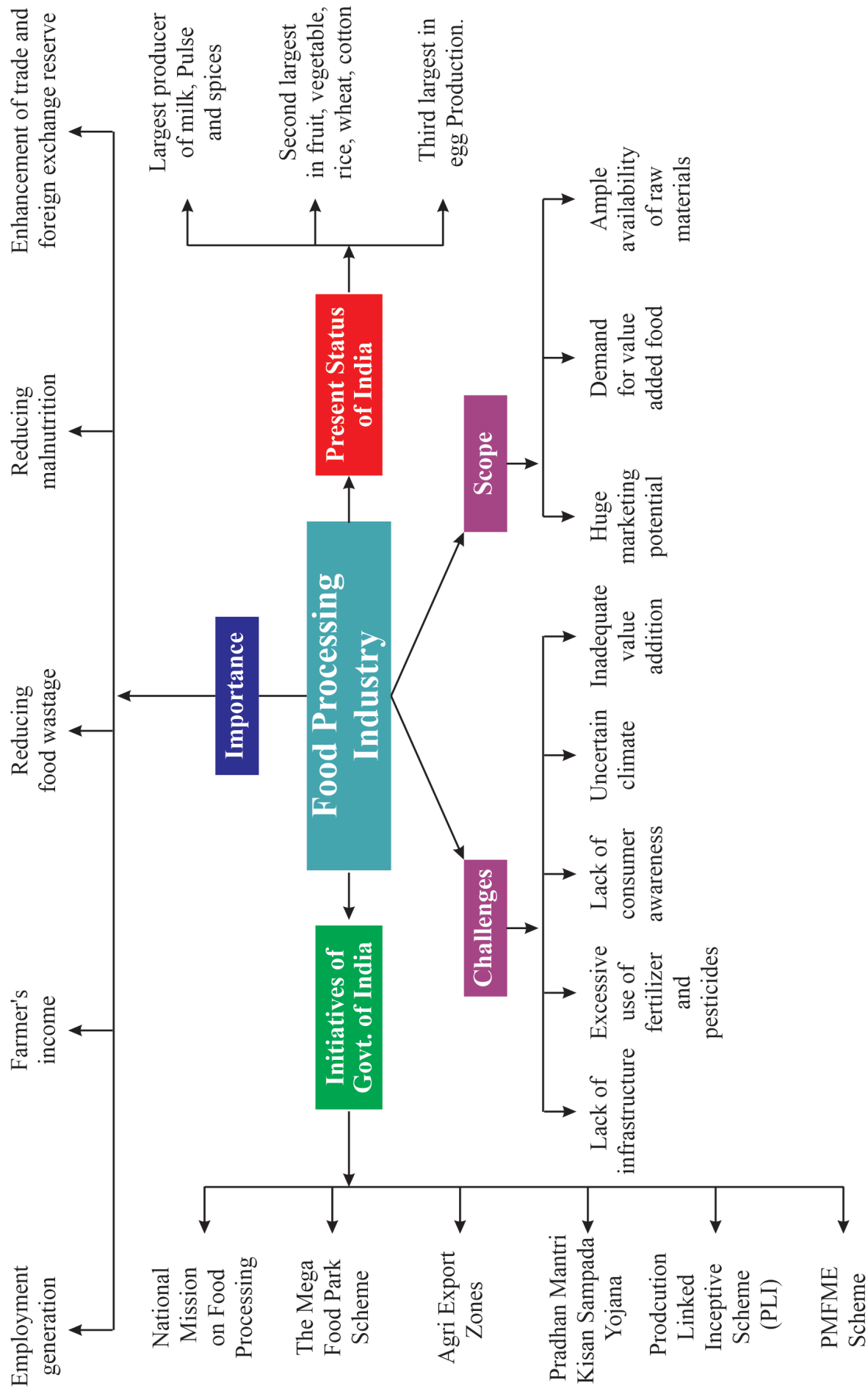
Gross Value Added (GVA): GVA is defined as the total value of all goods and services produced within a country. It can be computed for different sectors of economy like agriculture, manufacturing, mining, etc.

Value Addition: It is the process of transforming original products into a more valuable form, which has higher economic value in the market. For example, production of jam or jelly from fruits, conversion of wheat into *atta* or *maida*.

SUGGESTED READINGS

1. Khader, V. (2013). *Textbook of Food Science and Technology*, Indian Council of Agricultural Research, New Delhi.
2. Srilakshmi, B. (2018). *Food Science*, New Age International Publishers.

WHAT YOU HAVE LEARNT



*Notes*

FOOD GROUPS AND NUTRITIONAL IMPORTANCE

We know that food is the substance which provides us the nutrients necessary for our growth and maintenance. The major sources of almost all foods are either plant or animal in origin. All food comes from plants as even animals depend on plants for their food. We obtain food from plants directly or indirectly, and some food products, like mushroom and spirulina, come from microorganisms. Foods are classified into different food groups, based on characteristics like nutrition, functionality, and stability. The objective is to provide nutritious and balanced food to human beings of all age groups through proper and careful selection of the food constituents. The six essential constituents required by our body are carbohydrates, proteins, fats, vitamin, minerals, and water. Proper amounts of these nutrients are needed to maintain health. In this module, we will learn about the various sources of food, different food groups, and the nutritional importance of food constituents.



LEARNING OUTCOMES

After studying this lesson, the learner:

- states the different sources of food;
- classifies food into various food groups;
- explains the importance of a balanced diet;
- lists the nutrients present in food;
- describes the importance of nutrients in our food; and
- identifies important food sources for these nutrients.

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Notes**16.1 SOURCES OF FOOD**

The sources of food are broadly classified into two groups: plants and animals, along with their related products.

16.1.1 Plants as A Source of Food

Many plants or plant parts are eaten as food. There are around 2,000 plant species which are cultivated for food. The plant parts which are eaten are called edible parts and these include roots, stems, leaves, flowers, seeds and fruits.

Plants provide us with vegetables, coffee, cereals, pulses, fruits, sugar, oil, etc.

- Vegetables are a type of plant matter that is commonly eaten as food. Some nutrient-rich vegetables include beetroot, spinach, cauliflower, etc. Roots, leaves, and stem of some plants are edible and consumed as vegetables.
 - ❖ Radish, carrot, turnip and beetroot are some of the edible roots that are consumed as vegetables.
 - ❖ Potato and ginger are the examples of modified stems eaten as vegetables.
 - ❖ Spinach, cabbage, lettuce are the examples of edible leaves.
 - ❖ Broccoli and cauliflower are the flowers eaten in the form of vegetables.
 - ❖ Fruits are a healthy source of food from plants. They are the ripened ovaries of plants, including the seeds within. Orange, mango, apple, grapes, etc. are some of the fruits consumed by humans.
- Cereals include rice, wheat, maize, jowar, barley, etc. These are rich sources of carbohydrates provided by the plants.
- Coffee and tea are widely grown in the southern and north-eastern parts of India and are obtained from plants.
- Sugar is processed from the sugarcane plant.
- Oil can be extracted from the seeds and leaves of the plants such as castor, mustard, and sunflower.
- Spices like cinnamon, cardamom, pepper, clove, cumin seeds, and ginger are obtained from the plants.

16.1.2 Animals as A Source of Food

Animals are used as food either directly or indirectly through the products they produce. These include milk and milk products, eggs, meat and honey. These products are rich sources of nutrients.

- **Milk:** It is obtained from cows, buffaloes, sheep, goat, and camels. Milk is also called as an ideal food as it is rich in vitamins, minerals, proteins, carbohydrates and fats. Dairy products made from milk include paneer, cheese, butter, ghee and curd.
- **Eggs:** Chickens, ducks, geese, and quails are raised for eggs and meat. Eggs are rich source of protein and vitamins, phosphorus, calcium and iron. Poultry products are also rich in proteins.
- **Meat:** Meat is an example of direct product obtained from an animal, which comes from muscle systems or organs. It can be categorized into red meat (from cows, goats, sheep, and pigs) and white meat (from chicken and fish). White meat contains less fat and is easier to digest compared to red meat. Meat is rich in proteins, vitamins, zinc, phosphorus and iron.
- **Honey:** It is a sweet liquid produced by honeybees from the nectar (sweet juice produced by flowers). It contains sugar, water, minerals, and enzymes.



INTEXT QUESTIONS 16.1

1. Name the different plant parts from which food is obtained.
2. Foods that share similar nutritional properties are put together in specific food groups (True/False).
3. The root crop which is eaten as vegetable:
 - a. Potato
 - b. Carrot
 - c. Cauliflower
 - d. Brinjal
4. Give example of two dairy products.
5. The meat which has a lot of fat is called



Notes

**Notes****16.2 BASIC FOOD GROUPS****16.2.1 Classification on Type of Food**

Foods that humans eat come from either plant or animal sources and are primarily categorized as vegetarian and non-vegetarian. Foods are grouped into specific categories because they provide similar amount of key nutrients. To meet nutrient requirements essential for good health, it is important to consume a variety of foods from each of the five food groups daily, in appropriate amounts.

Enjoying a variety of foods within each group is crucial because different foods vary in the amount of the nutrients that they provide. Knowledge of food groups is essential for meal planning. Foods with similar nutritional properties are grouped together based on the classification of ICMR (Indian Council of Medical Research) (Fig 16.1), which is described as follows.

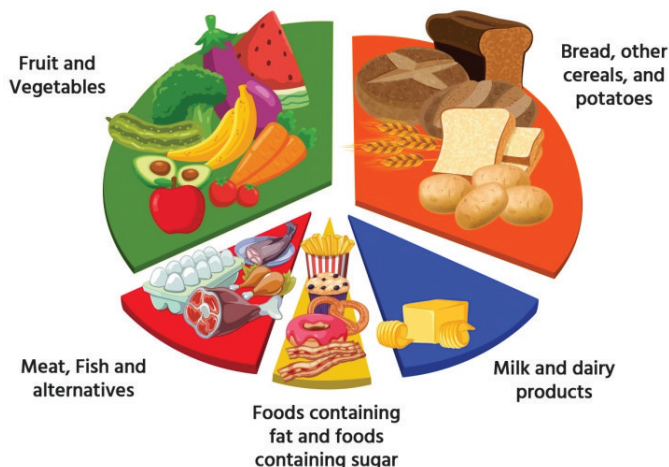


Fig. 16.1: Different Food Groups

A. Cereal Grains and Products

Cereal grains are rich in carbohydrates, fibre, and some vitamins and minerals. These foods act as fuel for our body by providing energy. Examples of this food group are wheat, rice, maize (Fig. 16.2), bajra, rice flakes, wheat flour, sprouted cereals etc. Whole grains are the healthiest choices among this food group. Examples of whole-grain foods include whole wheat bread, oatmeal, whole-grain crackers and breakfast cereals, whole wheat pasta, barley, brown rice, etc.

*Notes**Fig. 16.2: Maize***B. Pulses and Legumes**

Pulses and legumes are rich in fibre, protein, energy, some vitamins and minerals, and are naturally very low in fat. Examples include beans, chickpea (Fig. 16.3), lentil, black gram, green gram, red gram, bengal gram, soybean, etc.

*Fig. 16.3: Chickpeas***C. Milk and Meat Products**

This food group is rich in protein, fat and some vitamins (like Vitamin B₁₂) and minerals (such as Calcium). Important examples are milk, cream, cheese and yoghurt, which are excellent sources of protein and calcium. In addition, dairy products are also high in vitamins A, B and D. The foods in this group are important for maintaining healthy bones. Meat products are important sources of iron, zinc, protein and vitamin B. Eggs are high in protein and iron. Fish is an excellent source of protein, while meat is rich in Vitamin B₁₂.

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D. Fruits and Vegetables

Vegetables such as cabbage, spinach, cauliflower, broccoli and carrots as well as fruits like mangoes, oranges, lemons, grapes, peaches and apricots are rich in essential nutrients that your body needs.

These foods provide many vitamins and minerals in addition to fibre and important enzymes. In addition, these foods are low in fats and sugars. They help in preventing diseases, promoting digestive health and boosting the immune system.

E. Fats and Sugars

Foods that contain fats and sugars, such as cheese, butter, salad dressing and oil are powerful energy sources, as they are high in calories. A **Calorie** is the amount of heat needed to raise the temperature of a gram of water by one degree Celsius.

Likewise, sweets, such as jams, jellies (Fig. 16.4), desserts, candy, syrup and soft drinks, are incredibly high in sugar. These foods are often termed empty foods as they lack essential vitamins and minerals and should be consumed in moderation.

Unsaturated fats from sources like seeds, vegetable oil, nuts, fish, olive oil and avocados are beneficial because of their cholesterol lowering properties.



Fig. 16.4: Jam (left) and jelly (right)

**ACTIVITY 16.1**

Provide a list of five fruits, vegetables, and cereals that you consume on a daily basis.

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16.2.2 Functional Classification of Foods**A. Energy-giving Foods**

This group includes foods rich in carbohydrates and fats. Cereals, roots and tubers, dried fruits, sugar and fats form important energy-giving foods.

B. Body-building Foods

The foods rich in protein are called body-building foods. These may be broadly divided into two groups:

- ❖ Milk, egg, meat and fish – foods rich in proteins of high biological value
- ❖ Pulses, oil seeds, nuts and low-fat oilseed meals - foods rich in proteins with medium nutritive value

Biological value of food is calculated as the percentage of protein intake actually utilized in the body.

C. Protective Foods

Foods rich in proteins, vitamins and minerals are termed as protective foods. These are broadly classified into two groups:

- ❖ Foods rich in vitamins, minerals and proteins having high biological value e.g., milk, eggs, fish and liver
- ❖ Foods rich in specific vitamins and minerals, e.g., green leafy vegetables and some fruits.

**ACTIVITY 16.2**

Collect small amounts of various food items. Group them according to their sources or the parts of plants from where they are obtained.

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*Notes*

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Notes**16.2.3 Classification Based on pH of The Food**

The acidity of food is expressed in terms of pH and it has great influence on distribution of microorganism. Different foods have different pH and lower the pH, greater the ease of processing or sterilization. Foods are categorized into four categories on the basis of pH, which are described as follows:

A. Low Acid Foods

These foods have pH above 5. Examples include peas, corn, meat, fish, milk, poultry, eggs, etc.

B. Medium Acid Foods

These foods have pH between 4.5 and 5. Examples include soups, sauces, pumpkin, spinach, asparagus, etc.

C. Acid Foods

These foods have pH in between 3.7 and 4.5. For example, tomato, pineapple, pear, etc.

D. High Acid Foods

Foods having pH 3.7 or lower are known as high acid foods. Examples include citrus juices, pickles, jam, jellies, berries, etc.

16.2.4 Classification Based on Shelf Life

Foods can be classified into three groups based on how long they can be kept without any treatment. The term 'perishable' refers to food items that have a short shelf life and are susceptible to spoilage.

A. Perishable Foods

These foods deteriorate (spoil) quickly unless special methods are used to prevent spoilage. These foods cannot be stored for more than one or two days at room temperature. Milk, meat, fish, poultry are good examples of perishable food. The rate of spoilage depends upon temperature and moisture content of the product.

B. Semi-perishable foods

They have less moisture content and a longer shelf life than perishable foods.

These foods can be stored for a couple of weeks to even a month or two without any detectable signs of spoilage. Examples are cereal and pulse products like wheat flour, semolina, and certain fruits and vegetables like citrus fruits, aonla, apples, roots and tubers, potatoes, onions, garlic, etc.

C. Non-perishable Foods

These can be kept for months or years without spoiling, provided they are handled and stored properly. They have very low moisture content and are not easily susceptible to spoilage by microorganisms and enzymes. Examples of non-perishable foods include cereals, pulses and nuts, oil seeds, fats and oils, honey, sugar, jaggery, salt, and some spices.



Notes



INTEXT QUESTIONS 16.2

1. Give any four examples of perishable foods.
2. pH of low acid foods is
 - a. Above 4.5
 - b. Below 2.5
 - c. Above 6.5
 - d. Below 1.5
3. Which foods are known as body building fruits?
4. Citrus is a high acid food (True/False).
5. Foods rich in, and are known as protective foods.

16.3 BALANCED DIET

A balanced diet is essential for maintaining a healthy body and mind. No single food can provide all the essential nutrients that the body needs to stay healthy and function efficiently. A balanced diet should include the right amounts of protein, fats, carbohydrates, fibre, vitamins, minerals, and fresh drinking water. This balance comes from consuming a variety of fresh vegetables, fruits, whole grains, and lean protein sources.

An inadequate supply of essential nutrients can result in

- Poor growth and development

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- Poor physical and mental health
- Increased susceptibility to infections
- Higher risk of disease
- In extreme cases, death also

Therefore, consuming foods in proportion to their nutritional value helps in preventing infections, disorders and diseases.

The term “**Optimum Nutrition**” can be defined as eating the right amount of nutrients on a proper schedule to achieve the best performance and the longest possible lifetime with good health.

**ACTIVITY 16.3**

Record your diet for a day. Evaluate each meal in terms of inclusion of the five food groups. Do you think that your diet is balanced? Justify your answer with reasons.

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The **food pyramid** (Fig. 16.5) is a graphic depiction of the daily food guide. The size of each section in food pyramid represents the recommended number of servings per day. The broad base at the bottom emphasizes that grains should be consumed in abundance and serve as the foundation of a healthy diet. Fruits and vegetables are positioned at the next level, indicating that while they play a vital role in nutrition, their intake should be moderate. Meat and dairy products appear in a smaller band width near the top, highlighting that although they provide essential nutrients like proteins, vitamins and minerals, they should be eaten in limited quantities to avoid excessive fat and cholesterol intake. Fats, oils and sweets occupy the tiny space, indicating that they should be consumed sparingly.



Fig. 16.5: Food Pyramid

**ACTIVITY 16.4**

List 10 foods that you commonly eat. Identify the food group to which each food belongs. Then, list the macronutrients and micronutrients present in each of the listed foods. Identify the foods which are the richest sources of energy.

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.....

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**INTEXT QUESTIONS 16.3**

1. Define optimum nutrition.

.....

.....

2. What do you mean by balanced diet?

.....

.....

*Notes*

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3. Enlist some of the disorders that result from an inadequate supply of essential nutrients.

.....

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16.4 NUTRIENTS PRESENT IN FOOD

Food is a complex substance composed of chemical constituents called nutrients. These nutrients are required for the proper functioning of cells, tissues and different organs in all living organisms. These constituents give foods their structure, texture, colour, flavour and nutritive value. Since our body cannot synthesize these nutrients on its own; these need to be supplied through external sources, such as food. The six general kinds of nutrients are carbohydrates, fats, proteins, vitamins, minerals and water. These nutrients are broadly classified into two categories: Macronutrients and Micronutrients.

The nutrients that are essential for the body in lesser amounts are known as micronutrients, whereas the nutrients that are required by the body in greater amounts are known as macro-nutrients.

A. Carbohydrates

Carbohydrates are naturally occurring sugars, starches and fibres found in fruits, grains, vegetables and milk products. They constitute the major part of our diet and are the primary source of energy. Carbohydrates are composed of sugar molecules, and about 70% of the energy required for all our body functions is obtained from them. The recommended minimum intake of carbohydrates is 100 g/day to ensure proper fat metabolism. Carbohydrates provide 4 calories of energy per gram.

Functions of carbohydrates

- ❖ Carbohydrates provide fuel for the central nervous system and energy for muscles.
- ❖ They also prevent protein from being used as an energy source and enable fat metabolism.
- ❖ They play an important role in proper functioning of the brain.



Sources of carbohydrate

The main sources of carbohydrates in the diet are starch, sugar and fibre. The sources of starch are mainly cereal grains (wheat, rice, etc.) or tubers (potatoes, sweet potatoes, cassava, etc.). Starches include bread, cereal, and pasta. They also include certain vegetables, like potatoes, peas, and corn. The sources of sugar are sugarcane and fruits. Fibre is found in many foods that come from plants, including fruits, vegetables, nuts, seeds, beans, and whole grains.

B. Proteins

Protein is one of the principal nutrients along with carbohydrates, fat, vitamins, minerals, and water. It is one of the most abundant components in the body. Proteins provide 4 calories of energy per gram and are essential for life. There is no life without protein. Protein is contained in every part of your body, the skin, muscles, hair, blood, organs, eyes, fingernails, and even bones. Next to water, protein is the most abundant substance in our body.

Proteins occurring in animal and plant tissues are called **native proteins**. Proteins are composed of the smaller units called amino acids, which are referred as the building blocks of protein. There are about 20 different amino acids which are commonly known.

Amino acids consist of carbon, hydrogen, oxygen, nitrogen, and, in some cases, sulfur. The body cannot synthesize or produce nine of the amino acids, so they must be obtained through food. These are known as essential amino acids namely histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. Eggs are a good source of all essential amino acids in appropriate quantities.

Functions and requirement

Protein is primarily used in the body to build, maintain, and repair body tissues. The amount of protein needed varies depending upon age, body size, and growth stage. Different stages of growth, including infancy, childhood and pregnancy, increase the protein need to provide building materials. Physiological states such as injury, surgery, or burns, increase the need for protein to provide repairing materials.

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Sources

Protein is available from both animal and plant sources. The animal foods like eggs, milk, meat (white and red) and fish contribute to animal protein sources. Whereas, examples of plant sources of proteins are cereals, millets, legumes, nuts, seeds and green leafy vegetables.

C. Fat

Fat is a major source of energy and helps our body to absorb vitamins. It is also important for proper growth, maintaining healthy skin, and promoting proper eyesight and brain development in children. Fats, also called lipids, are insoluble in water but soluble in organic (i.e., non-polar) solvents like chloroform, benzene, ether, etc.

The insolubility of lipids in water, in several cases, is due to the presence of one or more fatty acids in them. Dietary fat is divided into two types: saturated (solid at room temperature) and unsaturated (liquid at room temperature).

Essential fatty acids (EFAs) are the ones that cannot be synthesized within the human body, and therefore must be obtained from the diet. Our body is incapable of producing the EFAs, like linoleic acid and alpha-linolenic acid and therefore, must be obtained from food. Therefore, you must remember that **‘Every fat is a lipid but every lipid is not fat’**.

Functions of fat:

- ❖ Fats supply energy and heat to the body (9 calories of energy per gram).
- ❖ Fats are the most concentrated source of energy as it produces twice the energy than carbohydrates.
- ❖ Fat is necessary for maintaining healthy skin, and it plays a central role in promoting proper eyesight and brain development in children.
- ❖ Fat supplies essential fatty acids (EFAs).
- ❖ Vitamins A, D, E, and K are fat-soluble vitamins which transport fat into and around the body.

Sources

Saturated fats are sourced primarily from animal products like red meat, lard, butter, poultry with skin and whole milk dairy products. Vegetable oils like palm

and coconut are also some of the examples of saturated fats. Unsaturated fats are found primarily in vegetable oil sourced from plants like peanut, canola, sunflower, corn, etc.

D. Vitamins

Vitamins are low molecular weight organic (carbon containing) substances needed for normal function, growth and maintenance of good health. The vitamins may be soluble in water or fat. Water-soluble vitamins dissolve in water while fat-soluble vitamins are absorbed and transported by fat.

Water soluble vitamins are vitamin C (Ascorbic acid) and B complex group. The water-soluble vitamins are carried in bloodstream and are not stored in the body. Vitamin B complex is group of several compounds that are essential for normal cell functioning. Vitamin B complex contains: Thiamine (B₁), Riboflavin (B₂), Folic acid (Folacin) (B₉), Niacin (B₃), Pantothenic acid (B₅), Biotin (B₇), Cyanocobalamin (B₁₂) and Pyridoxine (B₆)

Excess amounts of these vitamins may cause extra work on kidneys. Fat soluble vitamins are vitamins A (Retinol), D (Calciferol), E (*α*-Tocopherol) and K (Phylloquinone, menaquinones). Vitamin A and D in excess can be harmful; however vitamin E and K are usually not associated with toxicity.

The functions, sources and diseases caused due to deficiency of various water- and fat-soluble vitamins are presented in Table 16.1 as given below.

Table 16.1 Functions, sources and deficiency diseases of various water- and fat-soluble vitamins

S. No	Vitamin	Functions	Deficiency diseases	Sources
1.	Vitamin A (Retinol)	• Vision • Immune system • Healthy skin • Bone and tooth growth	Night Blindness	Meat, milk, fish, cheese, cream, butter etc.



Notes

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S. No	Vitamin	Functions	Deficiency diseases	Sources
2.	Vitamin C (Ascorbic acid)	• Maintain healthy bones, skin, and teeth • Healing of wounds and fractures	Scurvy	Aonla, citrus fruits, oranges, sweet lime, grapefruit, berries, guava, capsicum and green leafy vegetables
3.	Vitamin D (Calciferol)	• Needed for proper absorption of calcium and phosphorus • Promotes the development of bones and teeth	Rickets (bones become soft)	Egg yolks, liver, fatty fish, fortified milk, fish liver oils, etc.
4.	Vitamin E (Tocopherol)	• Acts as antioxidant • Protects cell walls	Nerve and muscle damage that affects movement and coordination, vision problems, weakened immune system	Wheat germ oil, oils from cereal seeds, salad oils, fruits, nuts, and vegetables etc.
5.	Vitamin K (Phylloquinone)	• Needed for synthesis of prothrombin, which functions in blood clotting	Excess bleeding and lower bone density	Green leafy vegetables, especially spinach, cabbage etc.
6.	Vitamin B ₁ (Thiamine)	• Needed for energy metabolism • Important for nerve function	Beriberi	Cereal grain (particularly wheat) germ layers, pulses (peas, beans), nuts, poultry, egg yolk and fish etc.

*Notes*

S. No	Vitamin	Functions	Deficiency diseases	Sources
7.	Vitamin B ₂ (Riboflavin)	• Energy metabolism • Building tissues • Maintain good vision	Slow growth, sore eyes	Dairy products, lean meats, poultry, fish, grains, broccoli, spinach etc.
8.	Vitamin B ₃ (Niacin)	• Needed for energy metabolism, proper digestion, and healthy nervous system	Pellagra	Lean meat, fish, poultry, groundnuts, pulses and whole grain cereals
9.	Vitamin B ₅ (Pantothenic acid)	• Needed for oxidation of carbohydrates and fats	Acne and paresthesia	Whole grain cereals, pulses etc.
10.	Vitamin B ₆ (Pyridoxine)	• Needed for protein metabolism • Helps to make red blood cells.	Pink eye and neurological symptoms (epilepsy)	Meat, especially liver, some vegetables and grain cereals with bran
11.	Vitamin B ₇ (Biotin)	• Required for the metabolism of proteins and carbohydrates • For production of hormones and cholesterol	Reduced development and nervous syndromes in children	Liver, kidney, egg yolk, groundnuts and some vegetables etc.
12.	Vitamin B ₁₂ (Cobalamin or Cyano-cobalamin)	• Essential for the metabolism of carbohydrates	Loss of memory	Milk, muscle meat, cheese, eggs and sea foods, liver and kidney

Food Processing and
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S. No	Vitamin	Functions	Deficiency diseases	Sources
13.	Folic acid (Folacin)	Prevents birth defects that damage the brain and spinal cord	Lack in expectant females may cause delivery faults, mainly neural tube defects.	Yeast, kidney, liver and green leafy vegetables, especially spinach, asparagus and broccoli, dried beans, whole wheat bread etc.

E. Minerals

The minerals are inorganic components of food that leave ash as residue when burnt. They make up about 5% of the body weight and play crucial roles as catalysts in many biological reactions within the body. Their other functions include building of bones and other structural parts of the body, facilitation of muscular contraction, transmission of messages through the nervous system, and assist in the digestion and utilization of nutrients.

The human body requires about 20 mineral elements. Each has a specific function and they can be found in a wide variety of foods. Unlike vitamins, minerals cannot be destroyed by heat. Depending upon their amounts in the adult body, the minerals are classified as macronutrients and micronutrients. The macronutrients are present in the amounts greater than 0.005% of the body weight, while the micronutrients are present in less than 0.005% of body weight.

The macro minerals are required in the adult human diet at levels higher than 100 mg/day. Micro minerals (also known as trace elements) are required in the amounts less than 20 mg/day. The functions and sources of various macro and micro minerals are presented in Table 16.2 as given below.

Table 16.2 Functions and sources of various macro and micro minerals

S. No	Minerals	Functions	Sources
1.	Calcium	Healthy bones, teeth and immune system	Blackberries, dates, milk, egg, pomegranate, almonds, wheat, soybeans etc.

*Notes*

2.	Sodium	• Helps in the regulation of blood pressure • Proper functioning of nerves and muscles	Onions, fresh fruits, sweet potato, broccoli, pumpkin seeds, eggs, milk etc.
3.	Iodine	• Promotes healthy hair, nails, skin and teeth • Controls body weight and growth	Sea foods, iodized salt, milk and foods that are grown in iodine-rich places
4.	Phosphorus	• Formation of bones, teeth etc.	Pomegranate, dates, beef, tuna, oats etc.
5.	Flourine	• Healthy teeth • Prevents dental caries • Strengthen bones	Drinking water
6.	Magnesium	• Production and transport of energy • Important for the contraction and relaxation of muscles	Milk, dairy products, legumes, nuts, and leafy green vegetables
7.	\Potassium	• Maintain intercellular osmotic pressure • Regulate pH • Promotes metabolism	Fruits and vegetables, dried peas, dairy products, meats, and nuts
8.	Sulphur	• Essential part of various amino acids, thiamine, insulin, biotin	Meats, milk, eggs, and legumes
9.	Chlorine	• Maintain the osmotic pressure of extracellular fluids, regulates pH, and maintains electrolyte balance.	Onions, fresh fruits, sweet potato, broccoli, pumpkin seeds, eggs, milk etc.

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10.	Iron	• Catalyzes the formation of Vitamin A	Liver, meat products dried apricots, raisins, whole-grain cereals, legumes, and molasses
11.	Molybdenum	• Necessary for the metabolism of sulfur-containing amino acids, such as cysteine	Legumes such as lentils, beans and peas
12.	Manganese	• Necessary for healthy bone structure • Component of several enzyme systems	Nuts, legumes, whole-grain cereals, leafy green vegetables and fruits
13.	Copper	• Normal functioning of muscles, nervous system and immune system • Required for normal growth and health	Vegetables, legumes, beans, nuts and legume seeds, mushrooms, avocado and whole grain cereals
14.	Selenium	• Acts as an antioxidant that works with vitamin E	Poultry, meats, fish, and nuts
15.	Cobalt	• Component of cyanocobalamin (Vitamin B₁₂) • Needed for the synthesis of several enzymes	Liver, lean meats, and milk
16.	Chromium	• Essential for the use of carbohydrates • In the absence of chromium, there is disturbed glucose mechanism in the body	Liver, lean meats, spices and wine

D. Water

Water, a most essential nutrient, is second only to oxygen in importance for the body. It serves as an ideal medium for transporting dissolved nutrients throughout the body and excretion of wastes. Water is a component of every cell, tissue, and organ, accounting for about 60% of body weight.

In addition to drinking water, some foods contain a high percentage of water. Apart from this, oxidation of carbohydrates, fats and proteins in the body also produces water.

Functions of water

- ❖ It is the chief component of all body fluids.
- ❖ It helps in
 - a) Muscle contractions
 - b) Nutrient transport
 - c) Regulation of body temperature
 - d) Excretion of waste products
- ❖ It helps in digestion.
- ❖ It is a source of dissolved minerals such as fluorine and calcium.
- ❖ It keeps the body fluids liquid, so that they may flow easily.

**INTEXT QUESTIONS 16.4**

1. Mention the general kinds of nutrients required for our health.
.....
.....
2. The substances that protect body cells and the immune system from damage by harmful chemicals in air and foods are called
3. The required minimum amount of carbohydrates isg/day to ensure efficient oxidation of fat.
4. Proteins occurring in animal and plant tissues are called

*Notes*

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Notes

5. Lipids are insoluble inand soluble in
6. Give examples of any three essential amino acids.

.....



WHAT YOU HAVE LEARNT

- Foods that share similar nutritional properties are grouped together in specific food groups.
- Perishable is a term which is used for the food that spoils within a very short period of time.
- A balanced diet should contain the right amounts of protein, fats, carbohydrates and fibre, which can be obtained from fresh vegetables and fruits. This ensures a good supply of essential amino acids, essential fatty acids, vitamins, minerals, and fresh drinking water.
- Foods are complex substances composed of chemical constituents called nutrients. The six general kinds of nutrients are carbohydrates, fats, proteins, vitamins, minerals and water.
- Amino acids are made up of the elements carbon, hydrogen, oxygen and nitrogen, with the exception of sulphur in some amino acids.
- Water, a most essential nutrient, is second only to oxygen in importance for the body.
- Vitamins can be either water-soluble or fat-soluble. Water-soluble vitamins dissolve in water and are carried in the bloodstream; and are not stored in the body; excess amounts are eliminated with waste products. Fat-soluble vitamins are absorbed and transported by fat; excess amounts are stored by the body for later use.
- Every fat is a lipid, but not every lipid is a fat.



TERMINAL QUESTIONS

1. Define an essential nutrient.
2. List some common sources of carbohydrates.

3. Explain how fats provide energy.
4. List some common sources of protein.
5. Distinguish between essential and non-essential amino acids.
6. Define a calorie.
7. Discuss the general characteristics of fat-soluble vitamins.
8. List the fat-soluble vitamins and describe the major functions of each vitamin.
9. Explain what is meant by the vitamin B complex.
10. Describe the major functions of water-soluble vitamins.
11. Discuss the general characteristics of minerals.
12. List the major minerals and describe the major functions of each mineral.
13. List some good sources for each of the major minerals.
14. Define a balanced diet.
15. Why are vitamins and minerals called micronutrients?
16. Compare water-soluble and fat-soluble vitamins.
17. Why is folate a very important vitamin?
18. What can occur due to vitamin A deficiency?
19. Why are sodium, chloride, and potassium called electrolyte minerals?
20. Why is fluoride needed in the diet?
21. Explain the Food pyramid.



Notes



ANSWERS TO INTEXT QUESTIONS

16.1

1. Roots, stems, leaves, flowers, seeds and fruits
2. True
3. Carrot (option b)

Food Processing and
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Notes

4. Paneer and curd
5. Red meat

16.2

1. Milk, meat, fish, poultry
2. Above 4.5 (option a)
3. The foods that are rich in protein are known as body building foods.
4. True
5. Proteins, vitamins and minerals

16.3

1. Optimum nutrition can be defined as eating the right amounts of nutrients on a proper schedule to achieve the best performance and the longest possible lifetime in good health.
2. Failure to flourish, poor growth and development, poor physical and mental health, infections or even death.
3. A balanced diet contains protein, fats, carbohydrates and fibre in the form of fresh vegetables and fresh fruit, all in the right amounts, providing a good supply of essential amino acids, essential fatty acids, vitamins, minerals, and of course fresh drinking water.

16.4

1. Carbohydrates, fats, proteins, vitamins, minerals and water
2. Antioxidants
3. 100
4. Native proteins
5. Water, organic solvents
6. Histidine, leucine and lysine

GLOSSARY

Body building food: Such foods are rich in protein. Milk, egg, meat fish, pulses come under this group.

Energy giving food: Foods rich in carbohydrates and fats are referred to as energy giving foods. Examples include cereals, roots, tubers, and dried fruits.

Food pyramid: It is a graphic representation of daily food guide. The size of each section in the food pyramid represents the number of daily servings of each type of food that a person should eat.

Non-perishable foods: These foods can be stored for months or years without spoiling. Examples include are cereals, pulses, nuts, jaggery etc.

Perishable foods: These are foods which deteriorate (spoil) quickly and they cannot be stored for more than one or two days at room temperature. Milk, meat, fish, fruits and vegetables are good examples of perishable food.

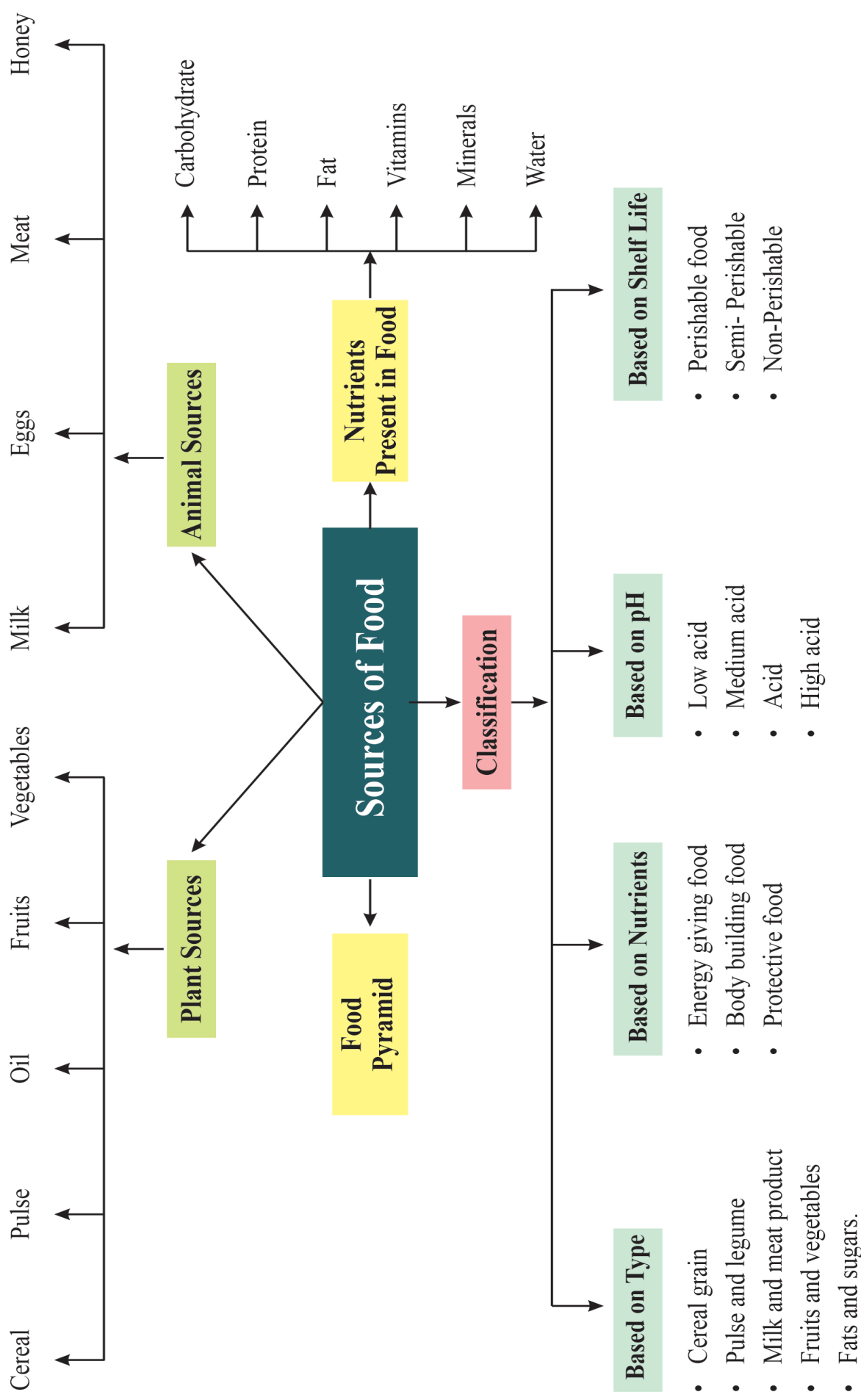
Protective food: Foods rich in proteins, vitamins and minerals are termed as protective foods. E.g., green leafy vegetables, fish liver.

SUGGESTED READINGS

1. *Fundamentals of Food Technology*, B.Sc. (Horticulture), e-Krishi Shiksha, Agricultural Education Division, Indian Council of Agricultural Research, New Delhi (<https://ecourses.icar.gov.in/>).
2. Khader, V. (2013). *Textbook of Food Science and Technology*, Indian Council of Agricultural Research (ICAR) Publication, New Delhi.



WHAT YOU HAVE LEARNT





TYPES AND METHODS OF FOOD PROCESSING



Notes

In this lesson, we will learn about the transformation of raw food materials into safe, nutritious, and stable food products on the journey from farm to fork. In the first two lessons, we covered the basics of food science and the importance of a balanced diet. This lesson will explain the processing operations involved in making our ready-to-eat food products, including fruit juice, pasteurized milk, UHT flavored milk, noodles, canned fruits, and various other processed food products. The food processing industry is evolving to meet market demands, with automated operations enhancing safety, productivity, and cost-effectiveness.

Food is a living entity and can spoil easily, affecting human health. Today's consumers are health-conscious and seek safe, convenient, and nutritious food. This lesson covers the principles of important traditional methods like thermal processing, food dehydration, cooling and freezing, as well as emerging technologies such as high hydrostatic pressure and pulse electric field, etc.



LEARNING OUTCOMES

After studying this lesson, the learner:

- recognizes the common food spoilage factors;
- explains the principle of food preservation;
- describes different levels and important methods of food processing;
- lists the advantages and disadvantages of different processing techniques; and
- enlists the emerging techniques in food processing.

Food Processing and
Value Addition

Notes

17.1 TYPES OF FOOD PROCESSING

Food processing is the process of transforming agricultural products into food, or converting one form of food into another. It involves various physical and chemical techniques to convert raw materials into edible food products. Food processing can be classified into three categories: primary, secondary, and tertiary.

Primary Food Processing

Primary food processing involves basic cleaning, grading, and packaging of horticultural items such as fruits and vegetables. For example, processing cereal grains to produce flour.

Secondary Food Processing

Secondary food processing uses primary processed products and further processes them into prepared-to-eat meals. It includes the alteration of the basic product to a stage just before final preparation. For instance, milling of paddy to rice or using cereal flour to make the batter for bread.

Tertiary Food Processing

Tertiary processing involves the production of high value-added ready-to-eat foods such as bakery products, instant foods, pizzas, health drinks, and more.

**INTEXT QUESTIONS 17.1**

1. Differentiate primary processing from secondary processing.
.....
.....
2. Utilizing cereal flour to make batter is an example of processing.

17.2 PRINCIPLES OF FOOD PRESERVATION**Food Spoilage**

When food items are kept for a long period of time and not stored properly, they get spoiled. Once the food is spoiled, it cannot be eaten and has to be thrown away. Spoilage is a process in which food items deteriorate to the point where it is not safe for human consumption. The different causes of food spoilage are discussed as follows:

Causes of Food Spoilage

- Growth and activities of microorganisms, principally bacteria, yeasts, and molds. For example, mold growth on bread.
- Activities of food enzymes lead to changes such as browning in apples, potatoes, etc.
- Infestation by insects, parasites, and rodents. For example, spoilage of food products in a field or warehouse.
- Chemical changes in food cause browning of fruits and vegetables.
- Physical changes or damages such as those caused by freezing (freezer burn), drying (caking), etc.
- Contamination with chemical agents. For example, chemical contamination by using too much detergent or sanitizer to clean food preparation surfaces.
- Presence of air. For example, spoilage of fat and oil-based foods.
- The temperature at which the food is stored. For example, spoilage of meat and milk when stored at improper temperatures.
- The gaseous atmosphere surrounding the food. For example: spoilage of canned foods.
- The relative humidity of the atmosphere surrounding the food. For example, spoilage of cereal and bakery products.
- The pH of the food and its ability to resist pH change. For example, spoilage of fermented foods.
- High water activity of the food supports microbial growth in all food products.
- Moisture content. For example, when a coffee pouch is opened, it starts absorbing moisture which can lead to caking.



Notes

Food Processing and
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Notes



ACTIVITY 17.1

Collect different food products from your day-to-day life that have spoiled and specify the causes of spoilage.

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.....

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Principles of Food Preservation

To combat spoilage of foods, various preservation methods are used in food industries based on the following principles:

a) Prevention or delay of microbial decomposition of food

- ❖ By keeping out micro-organisms (asepsis)
- ❖ By removal of micro-organisms (filtration)
- ❖ By hindering the growth or activity of micro-organisms (use of low temperature, drying, creating anaerobic conditions or chemicals)
- ❖ By killing the micro-organisms (using heat or irradiation)

b) Prevention or delay of self-decomposition of food

- ❖ By destruction or inactivation of food enzymes (blanching or boiling)
- ❖ By prevention or delay of chemical reactions (use of antioxidants to prevent oxidation)

c) Prevention of damage by external factors such as insects, animals, mechanical causes etc. (use of fumigants, packaging etc.).



INTEXT QUESTIONS 17.2

1. The main cause of browning of apples is.....
2. is the method of inactivating food enzymes.
3. is the main cause of spoilage of coffee.

17.3 METHODS OF FOOD PROCESSING**Thermal Processing**

Thermal processing is a food sterilization technique in which the food is heated at a temperature high enough to destroy microbes and enzymes. There are two main temperature categories employed in thermal processing: Pasteurization and Sterilization. There are a number of types of heat processing methods employed in the food industry that are discussed as follows:

A. Blanching

It is a pretreatment process applied to foods, particularly fruits and vegetables, using mild heat for a specific time followed by rapid cooling or transferring immediately to the next processing stage. The time and temperature combination varies from product to product, the conditions, and size of the product. Generally, the temperature varies from 88-99° C. The primary purpose of blanching is to destroy enzymes that cause spoilage and deterioration in fruit and vegetables. While blanching is not used as a sole method of preservation, it serves as an important pretreatment step before freezing, drying, and canning.

Functions of blanching

- ❖ To preserve the natural color
- ❖ To eliminate air from the product
- ❖ To destroy undesirable enzymes
- ❖ To avoid damage to the product
- ❖ Reducing surface microbial contamination.

Methods of blanching

- ❖ **Hot water blanching:** In this method, vegetables are immersed under pre-warmed water (70 to 100 °C) for varying amount of time, depending on type and quantity.
- ❖ **Steam blanching:** In steam blanching, the food product is carried on a belt through a steam chamber into which live steam is constantly injected.

Advantages

- ❖ Smaller loss of water-soluble components

*Notes*

Food Processing and
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Notes

- ❖ Lower capital cost
- ❖ Better energy efficiency

Disadvantages

- ❖ There is loss of texture and sensory characteristics.

B. Pasteurization

The process of pasteurization is named after the French chemist and microbiologist Louis Pasteur, who discovered in 1862 that applying heat at temperatures below boiling point could inactivate spoilage organisms in wine. The method was later adapted for milk and has become a critical operation in milk processing.

Pasteurization is a heat-processing method designed to kill pathogenic (disease-causing) organisms and most spoilage organisms. It is a short-term preservation method that extends the storage life of the product while ensuring it has safe bacterial activity. This method is commonly used for pasteurizing milk, as shown in Figure 17.1



Fig. 17.1 Pasteurized milk

Methods of pasteurization

- ❖ **HTST (High Temperature Short Time) method:** In this method, raw milk is heated to 72 °C (161 °F) for 15 seconds.
- ❖ **LTLT (Low Temperature Long Time) method:** In this method, raw milk is heated to 62.8 °C (145 °F) for 30 minutes.

- ❖ **UHT (Ultra High Temperature) method:** In this method, raw milk is heated to 138 °C (280 °F) (or higher) for 2 seconds.

Advantages

- ❖ Less floor space is required
- ❖ Easier to clean and sanitize
- ❖ Lower operating cost
- ❖ It extends shelf life of product for days or weeks
- ❖ It reduces the risk of food poisoning

Disadvantages

- ❖ There is some nutritional loss
- ❖ It kills only pathogenic microorganisms

C. Sterilization

Sterilization is more intensive heat process aimed at destroying all microorganisms, including both pathogenic and non-pathogenic types. In this process, food products are sealed in containers and exposed to temperatures above 100 °C. Temperatures above 100 °C, usually ranging from 110-121 °C, are used depending on the type of product, and it must be reached inside the product.

Some organisms, such as *Clostridium botulinum* can survive during the sterilization process if the sterilization process is not performed for an adequate time or at sufficiently high enough temperature.

Types of sterilization

- ❖ **In package sterilization:** In this method, the food product is packed into containers, which are then sterilized. This process is commonly used in canning.
- ❖ **Aseptic or Ultra high temperature (UHT) processing:** In this method, the food product and the package are sterilized separately. Then, sterile product is then filled into the sterile package and sealed under controlled conditions. For instance, tetrapack fruit juices and soups, etc.

*Notes*

Food Processing and
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Advantages

- ❖ It extends the shelf life of product
- ❖ Economic and short processing time

Disadvantages

- ❖ There is some nutritional loss, especially of vitamin C and B group vitamins.
- ❖ Sometimes affect the appearance and taste of food.
- ❖ Microorganisms in their spore forms are difficult to kill.

D. Canning

Canning involves the application of heat to destroy micro-organisms and their spores in food. This process requires that the heat-treated or sterilized food be sealed in an airtight container to prevent contamination. An example of canned food is presented in Figure 17.2.

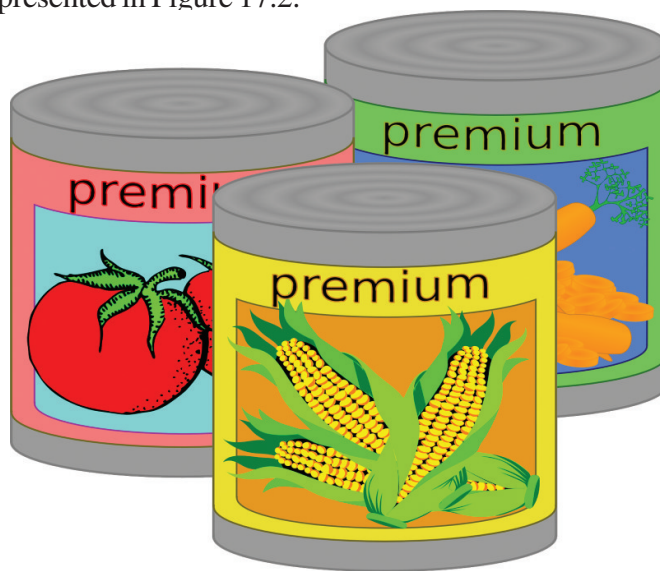


Fig. 17.2: Canned food

Steps of canning

Canning is carried out in following sequential steps:

- Washing, peeling, and slicing:** The food is washed, cleaned, and inedible parts such as bones in meat and stones in fruit are removed.
- Blanching:** Vegetables are usually blanched either by immersing them in boiling water or exposing them to steam. This step inactivates enzymes and removes air bubbles, reducing its bulk.

*Notes*

- c) **Brining (for vegetables) and syruping (for fruits):** The cans are automatically filled with fruits, vegetables and other foods and they are topped up with liquid such as brine (salt water) or syrup to ensure preservation.
- d) **Exhausting and sealing:** The filled cans are exposed to steam or hot water to drive out air (exhausting). The cans are then sealed with a lid using an automatic machine, ensuring they are airtight or hermetic.
- e) **Heat processing and cooling:** The cans are sterilized (121°C) and then cooled gradually.

Aseptic canning

In aseptic canning, both the food and the container are sterilized separately. The food is then filled into the sterilized container in such a way that prevents contamination from micro-organisms.

Quality of Canned Foods

The sterilization process can cause the loss of heat-sensitive nutrients, such as ascorbic acid (vitamin C) and thiamin (vitamin B₁). Additionally, the process can lead to changes in colour, flavour and texture of the food.

E. Drying/Dehydration

Drying is one of the oldest methods that humans have been using for a long time. The process involves reducing the water or moisture content of the product by natural means, such as solar energy. On the other hand, dehydration is performed artificially, using methods such as fryers to lower the moisture content of food and prevent bacterial growth and spoilage. The primary objective of drying is to extend the shelf life of food products. Methods include heat-based techniques (e.g., vacuum drying, tray drying, heat pump drying, etc.) or cold temperatures based techniques (e.g., freeze-drying). Example of dried food (raisin) is shown in Figure 17.3.



Fig. 17.3 Dried raisin

Food Processing and
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Notes

Methods of drying/dehydration

- a. **Sun Drying:** This method is effective in hot dry climates, however the process is slow, and the foods being dried are vulnerable to contamination.
- b. **Tray or cabinet drying:** Hot air flows either through the product or over the product to remove moisture.
- c. **Deep bed drying:** Material to be dried is placed in a bin, and hot air is circulated through it.
- d. **Fluidized bed-drying:** Warmed air is circulated around the fluidized food particles.
- e. **Spray drying:** It is used for liquids. The liquid is sprayed through fine nozzles into a stream of hot air. The water evaporates and leaves behind a fine powder.
- f. **Roller or drum drying:** This is suitable for pasted (thick) foods. The paste forms a thin film on the surface of a heated roller or drum, which dries during rotation of the roller (or drum), and is finally removed by scrapers (doctor blade).
- g. **Freeze-drying:** This involves an initial freezing process followed by gradual heating in a vacuum cabinet. During this process solids (ice crystals) are directly converted into vapour without going through the liquid stage (**sublimation process**).

Advantages

- ❖ Lightweight and easy to transport
- ❖ Longer shelf life
- ❖ Helps to preserve excess food

Disadvantages

- ❖ Alters food structure
- ❖ Loss of vitamins A, B₁, C and E
- ❖ High-fat content foods prone to rancidity and discoloration
- ❖ Taste may differ from fresh food

**ACTIVITY 17.2**

Collect different food products produced by different methods:

- Spray drying
- Freeze drying

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Notes

F. Freezing

Freezing process extends the shelf life of food products by inhibiting the growth of most of the bacteria. It can be carried out using two methods: mechanical freezing and cryogenic or flash freezing (using liquid nitrogen at -196°C). Frozen food (frozen peas) is presented in Figure 17.4.

Freezing controls the growth of micro-organisms in two ways:

- a. Water is unavailable for microbial growth because it has been converted to ice.
- b. Chemical changes in food are slowed down because of the low temperature.



Fig. 17.4 Frozen peas

Before freezing, inedible parts of the food are removed and the food is subjected to blanching (hot water treatment) to inactivate enzymes.

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Notes

Blanching is a mild heat treatment, usually applied to fruits and vegetables before freezing to inactivate enzymes and maintain their quality.

Methods of freezing

- a. **Plate-freezing:** In this method, the food is placed between hollow metal plates through which refrigerant is passed, causing the food to freeze.
- b. **Blast-freezing:** This involves exposure of the food to a blast of pre-cooled air (-40°C) in a specially designed tunnel.
- c. **Fluidized bed-freezing:** This is a development of blast-freezing and is suitable for food of small particle size. Suitable foods include peas, beans and soft fruits.
- d. **Immersion freezing:** This involves immersing the food in the refrigerant such as Brine (salt water) for fish. However, this method is not widely used.
- e. **Cryogenic freezing:** This method uses liquid nitrogen (-196°C) or carbon dioxide (-78°C). It is more costly than other methods.

Food Preservation Using Conventional Methods**1. Chemicals**

Chemical preservation involves the use of chemical compounds to preserve food. Appropriate quantities of certain chemicals added to the food can hinder the undesirable spoilage in the food by various mechanisms.

Mechanism

- ❖ Interfering with the cell membrane of the micro-organisms, their enzyme activity or genetic material
- ❖ By acting as an anti-oxidant

The optimum quantity of preservative as per approved regulation need to be used as higher concentrations can pose health risks.

Examples

Chemical preservatives include benzoic acid and its sodium salt, sorbic acid, potassium meta-bisulphite, calcium propionates, etc. Common antioxidants to prevent flavour (rancidity) in edible oils include butyl hydroxy anisole (BHA), butyl hydroxy toluene (BHT), tertiary butyl hydroxy quinone (TBHQ), lecithin,

etc. Addition of organic acids like citric, acetic and lactic acid in the food inhibits the growth of many micro-organisms.

Advantages

- ❖ They can keep food fresher for longer period of time
- ❖ Extends the shelf-life of foods
- ❖ Slow or prevent changes in colour, flavour and texture and delays rancidity

Disadvantages

- ❖ Inappropriate dosage of chemical preservatives in foods can pose serious health risks such as cancer, neurological disorders etc.

**ACTIVITY 17.3**

Collect different foods that are preserved using chemical preservatives by comparing their shelf-life.

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.....

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2. Fermentation

Fermentation is a value addition process for food products. It is a method of preserving food by allowing microorganisms to act on the food in a controlled environment. Fermentation process preserves the food by production of acid or alkali, enhancing the flavor, increasing the shelf life, and boosting the marketability of the food product. Various factors such as temperature, type of microbes, oxygen levels, pH etc. influence the fermentation process.

Mechanism

The fermentation process involves the oxidation of carbohydrates to generate a range of products, which are mainly organic acids, alcohol, and carbon dioxide. Such products have a preservative effect and inhibit spoilage by limiting the growth of microorganisms.

*Notes*

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Notes**Examples**

Examples of fermented foods include cheese, yoghurt, sauerkraut, pickles, idli, dosa, wine, bread etc.

Advantages

- ❖ It helps in preserving food nutrients.
- ❖ It increases the digestibility of foods.
- ❖ It helps to maintain intestinal bacteria.
- ❖ It exhibits anti-cancer effect.
- ❖ It strengthens the immune system.

Disadvantages

- ❖ Production of gas and alcohol which can cause spoilage.
- ❖ Over-fermentation may allow the growth of harmful bacteria or mold, which can cause food poisoning or spoilage.
- ❖ Fermentation may produce a strong or pungent odor, which some people may find unpleasant or unappetizing.
- ❖ Improperly fermented foods can lead to inconsistencies in flavor, texture, and appearance.
- ❖ Some individuals may have allergies or intolerances to certain fermented foods or the microbes used in the fermentation process.
- ❖ The fermentation process can be time-consuming and require specialized equipment, making it difficult for small-scale producers or individuals to produce fermented foods at home.

3. Salting

Salting is a preservation technique, often used for curing of meat such as bacon. When salt or a salt solution (brine) is applied to food products, it reduces the moisture content and activity of water (a_w) to microorganisms, ultimately inhibiting their growth. This is due to the process of osmosis, which causes the water to pass out of the cell and dehydrate it. With little moisture, the growth of microorganisms is slowed down.

*Notes***Concentration of salt**

Salt acts as preservative when its concentration is increased above 12%. Salt levels between 18 and 25% in solution generally will prevent all microbial growth in foods.

Methods

There are two methods of salting:

- ❖ **Dry salting:** Dry salting is used to draw the moisture out of food, which helps to reduce the growth of unwanted bacteria. In this method, salt is directly applied to food products. Example: fish.
- ❖ **Brining:** The brine, a flavoured solution of salt, both draws out moisture and permeates the food. In this method, food products are immersed in salt/water solution (brine). Example: fish.

Examples

Pickles, smoked meat, preserved tamarind, raw mango, aonla, fish and meat.

Advantages

- ❖ It acts as preservative by inhibiting microbial growth.
- ❖ It regulates fermentation by inhibiting the growth of bacteria, yeast and moulds.
- ❖ It is an excellent source of sodium, an essential mineral.

Disadvantages

- ❖ It increases the sodium content of food.
- ❖ High dosage of salt in food results in raising blood pressure.

4. Sugaring

Sugaring is a preservation method used for fruits such as peaches, plums, and pineapple. The fruit pieces are cooked with sugar or dipped in sugar syrup and then sterilized. Sugar is also used in the manufacturing of jam and crystallized fruits.

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Mechanism

The addition of a large quantity of sugar inhibits the growth of microorganisms by making the water in the fruit cells unavailable. Additionally, the moisture available to microorganisms is reduced by osmosis.

Examples

Sugaring is commonly used for fruits, vegetables, pickles, and fermented foods, among others.

Advantages

- ❖ It facilitates the production of other substances that act as preservatives, like alcohol and acids. Example: in case of beer, wine etc.
- ❖ It increases the shelf-life of foods.
- ❖ It creates an environment that limits microbial survival and growth.

Disadvantages

- ❖ It increases the sugar content of foods.

Food Preservation Using Other Techniques:**1. MAP**

Modified atmosphere packaging (MAP) is the method used to extend the shelf life of food by modifying the composition of the gases inside the food packaging. The gases used in MAP are oxygen (O_2), nitrogen (N_2) and carbon dioxide (CO_2). Example of potato wafers packed with N_2 gas is presented in Figure 17.5.



Fig. 17.5 Potato wafers packed with N_2 gas

**Mechanism**

In this process, the natural ambient air inside the package is replaced by a gas or gas mixture, often nitrogen and carbon dioxide. This packaging under a protective atmosphere preserves the quality of fresh produce over a longer period of time and prolongs shelf-life of foods.

Advantages

- ❖ Prolonged shelf life compared to other conventional storage methods
- ❖ Improvement in visual appeal of packaged products
- ❖ Preservation of food nutrients
- ❖ Prolonged preservation of food freshness
- ❖ Elimination of chemical additives/preservatives
- ❖ Retention of original food flavours

Disadvantages

- ❖ Capital cost of machinery is very high
- ❖ Benefits of MAP are lost once the package is opened
- ❖ High cost of gases and packaging materials

Applications

MAP is widely used in the preservation of foods like meat products, bread, fresh pasta, fish, fruits and vegetables, readymade salads etc.

2. Hurdle Technology

Combining two or more preservation technologies in a single process to destroy microorganisms is known as hurdle technology. This process ensures that food products are safe for consumption and have a good shelf life.

Hurdle technology is used in the food industry for the gentle and effective preservation of foods. In hurdle technology, hurdles are deliberately combined to improve the sensorial and nutritional profile of food products and enhance the microbial stability of foods. Thus, hurdle technology aims to achieve the total quality of foods by applying an intelligent and appropriate mix of hurdles. Examples of hurdles in a food system include low temperature during storage, high temperature during processing, and the presence of preservatives.

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Principle

The principle behind hurdle technology is based on the influence of various food preservation methods on the behavior of microorganisms in foods, including their homeostasis, metabolic exhaustion, and stress reactions. For this purpose, the concept of multi-target food preservation plays an important role in achieving effective food preservation.

Advantages

- ❖ It avoids the reliance on single preservation method.
- ❖ There is greater possibility of using natural preservatives in combination with synthetic ones.
- ❖ This helps in getting safe and tasty products of high quality.
- ❖ It saves energy, money and several other resources.
- ❖ It is suitable for both large- and small-scale industries.

Disadvantages

- ❖ This technique could provide varying results depending upon various bacterial stress reactions.

Applications

Hurdle technology has wide applications in preservation of various food products like dairy products, fruits and vegetables, fruit derived products, meat and meat products etc.

**INTEXT QUESTIONS 17.3**

1. Drying is basically reducing the..... in the product.
2. drying is used for paste (thick) foods.
3. is the principle behind freeze-dried foods.
4. Examples of vitamins lost in the drying process are.....
5. The time and temperature combination in High-Temperature Short Time (HTST) pasteurization of milk is

17.4 EMERGING NON-THERMAL TECHNOLOGIES

Several non-thermal and emerging technologies are used in food processing and preservation, including hurdle technology, high pressure processing, and ultrasonication. Some of the emerging non-thermal technologies in food processing and preservation are discussed in the chapter. Table 17.1 presents a list of both thermal and non-thermal methods used in food processing and preservation.

Table 17.1 Thermal and non-thermal methods of food processing and preservation

S. No.	Type	Methods
1.	Thermal methods	• Microwave heating • Radio frequency heating • Infrared heating • Ohmic heating • Induction heating
2	Non-thermal methods	• High hydrostatic pressure technology • Cold plasma • Pulsed electric field • High voltage arc discharge • Ultrasonication • Irradiation • Ultraviolet light treatment • High pressure carbon dioxide treatment • Use of natural antimicrobials • Oscillating magnetic field • Use of ozone • Chemical treatment



Notes

A. High Pressure Processing (HPP)

High Pressure Processing (HPP) is a cold pasteurization technique by which food products, already sealed in their final package, are placed into a vessel and subjected to a high level of isostatic pressure (300–600 MPa) transmitted by water. The pressure applied is isostatically transmitted inside a pressure vessel. Pressures above 400 MPa inactivate the microorganisms present in food, increasing their shelf life and ensuring food safety.

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Principle

The basic principles of HPP are isostatic and Le Chatelier's principle. The difference in these two principles is summarized in Table 17.2.

Table 17.2: Different principles of high-pressure processing of foods

S. No.	Principle	Mode of action
1.	Isostatic	If a food product contains sufficient moisture, pressure will not damage the product at the macroscopic levels as long as the pressure is applied uniformly in all directions
2.	Le Chatelier's	Any change in phase transition results in decrease in volume which is enhanced by pressure as pressure is inversely proportional to volume

Advantages

- ❖ Excellent food quality
- ❖ Destroys pathogens and ensures food safety
- ❖ Extends product shelf life
- ❖ Improves customer satisfaction
- ❖ Inactivates microorganisms and enzymes
- ❖ Retains quality, such as colour and flavour
- ❖ Only requires water and electricity

Disadvantages

- ❖ Bacterial spores are not inactivated by pressure alone.
- ❖ Most suitable for acid foods

Applications

High-pressure processing has wide applications in meat products, ready-to-eat meals, seafood products, juices and fruit products, dairy products, etc.

B. Ultrasonication

Ultrasonication results in food preservation, food processing, and modification of texture and food analysis. The ultrasonic blades vibrate at high frequencies of 20 kHz, 30 kHz, or 40 kHz.

**Principle**

High intensity ultrasonic waves cause the formation and collapse of bubbles within liquids, a phenomenon known as cavitation. It is the main principle of ultrasonication. This process leads to various effects, including mechanical disruption and microbial inactivation.

Advantages

- ❖ Increased productivity
- ❖ Easily adapted into existing production lines

Disadvantages

- ❖ Needs more input of energy
- ❖ Results in the formation of free radicals that causes changes in food compounds.

Applications

Ultrasonication has its wide applications in meat processing, microbial inactivation, mixing, etc.

C. Pulse Electric Field

Pulsed electric field (PEF) is a non-thermal method of food preservation that uses short pulses of electricity to inactivate micro-organisms while minimally affecting food quality attributes. Pulsed electric field (PEF) is used to preserve food, while high-intensity pulsed electric field (HIPEF) processing involves applying pulses of high voltage (typically 20-80 kV/cm) to foods placed between two electrodes. HIPEF is suitable for preserving liquid and semi-liquid foods, inactivating micro-organisms, and maintaining functional constituents.

Principle

The basic principle of PEF technology is to apply short pulses of high electric fields, with duration of microseconds to milliseconds and intensity in the order of 10-80 kV/cm. The applied high voltage results in an electric field that causes microbial inactivation, with electroporation being the main principle behind the process.

Advantages

- ❖ Reduction in micro-organisms
- ❖ Shorter treatment time

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- ❖ Increased shelf-life of foods
- ❖ Maintains food safety
- ❖ Kills microorganisms while preserving the original color, flavor, texture, and nutritional value of the unprocessed food

Disadvantages

- ❖ It does not inactivate enzymes.
- ❖ Refrigeration is required for improving the shelf-life of food products.
- ❖ It is not suitable for solid food products.

Applications

Applications of PEF include preservation of beverages and semi-liquid food products etc.



INTEXT QUESTIONS 17.4

1. HPP stands for.....
2. The pressure range involved in HPP processing of foods is
3. The main principle involved in HPP of foods is
4. Pulsed electric field (PEF) uses pulses to preserve the food
5. is the main principle involved in PEF processing of foods.
6. Cavitation is the main principle involved in process.



WHAT YOU HAVE LEARNT

- Food processing is a method of converting raw foodstuffs into final, well-cooked consumable products.
- The main aim of food processing is to provide food products of the highest quality.
- Food processing techniques fall into three classifications: primary, secondary, and tertiary.
- Drying is basically the process of reducing the water or moisture content in the product.

- Pasteurization is a processing method that is mainly applied to milk.
- Freezing increases the shelf life of food products and inhibits the growth of most bacterial species.
- Blanching is a mild heat treatment, usually applied to fruits and vegetables, to denature enzymes.
- Foods can be preserved by the application of sufficient heat to kill all microorganisms and inactivate enzymes.
- In hurdle technology, multiple preservation methods are deliberately combined to improve the sensorial and nutritional profiles of food products and enhance the microbial stability of foods.
- High-Pressure Processing (HPP) is a cold pasteurization technique where food products, already sealed in their final package, are introduced into a vessel and subjected to a high level of isostatic pressure.
- PEF uses short pulses of electricity for microbial inactivation.

*Notes***TERMINAL QUESTIONS**

1. Define food processing.
2. What is the importance of food processing?
3. Compare thermal and non-thermal techniques of food processing.
4. How would you differentiate primary, secondary, and tertiary types of food processing? Please provide examples.
5. What is drying? Why is it done?
6. List various methods of drying used for different foodstuffs.
7. How does freezing control the growth of microorganisms?
8. What is blanching? Why is it done?
9. Differentiate fluidized bed freezing from cryogenic freezing.
10. Differentiate HTST pasteurization from UHT pasteurization.
11. How does the sterilization process affect the quality of foods?
12. What is canning? Explain the different steps of canning.
13. What is hurdle technology? How is it beneficial?

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14. What is HPP of foods? Explain its principle.
15. What is the mechanism of HPP of foods?
16. What are the application areas of high-pressure processing of foods?
17. What is PEF processing of foods? What is its importance?
18. Explain the principle of PEF processing of foods.
19. What are the advantages and disadvantages of PEF technology?
20. What is ultrasonication technology? Explain its principle.
21. What are the application areas of ultrasonic techniques in food processing?



ANSWERS TO INTEXT QUESTIONS

17.1

1. Primary food processing is the method of transforming horticultural items into nourishments that can dispose off quickly. On the other hand, secondary food processing is the method of utilizing primary food processed product to make prepared to-eat food meal.
2. Secondary

17.2

1. Action of enzymes
2. Blanching
3. Moisture

17.3

1. Moisture content
2. Drum
3. Sublimation
4. Retinol (vitamin A), thiamin (vitamin B₁), ascorbic acid (vitamin C), and vitamin E
5. 72!/15 seconds



17.4

1. High pressure processing
2. 300–600MPa
3. Le Chatelier's
4. Short electric
5. Electroporation
6. Ultrasonication

GLOSSARY

Fermentation: It is an anaerobic process in which microorganisms release energy from carbohydrates in absence of oxygen.

Food spoilage: It is a process in which food items deteriorate to a point where it becomes unsuitable and unsafe for human consumption. Food spoilage can occur due to physical, chemical and biological changes.

Pasteurization: Pasteurization is a heat-processing method designed to kill only harmful organisms. Here food is heated at temperature below 100°C.

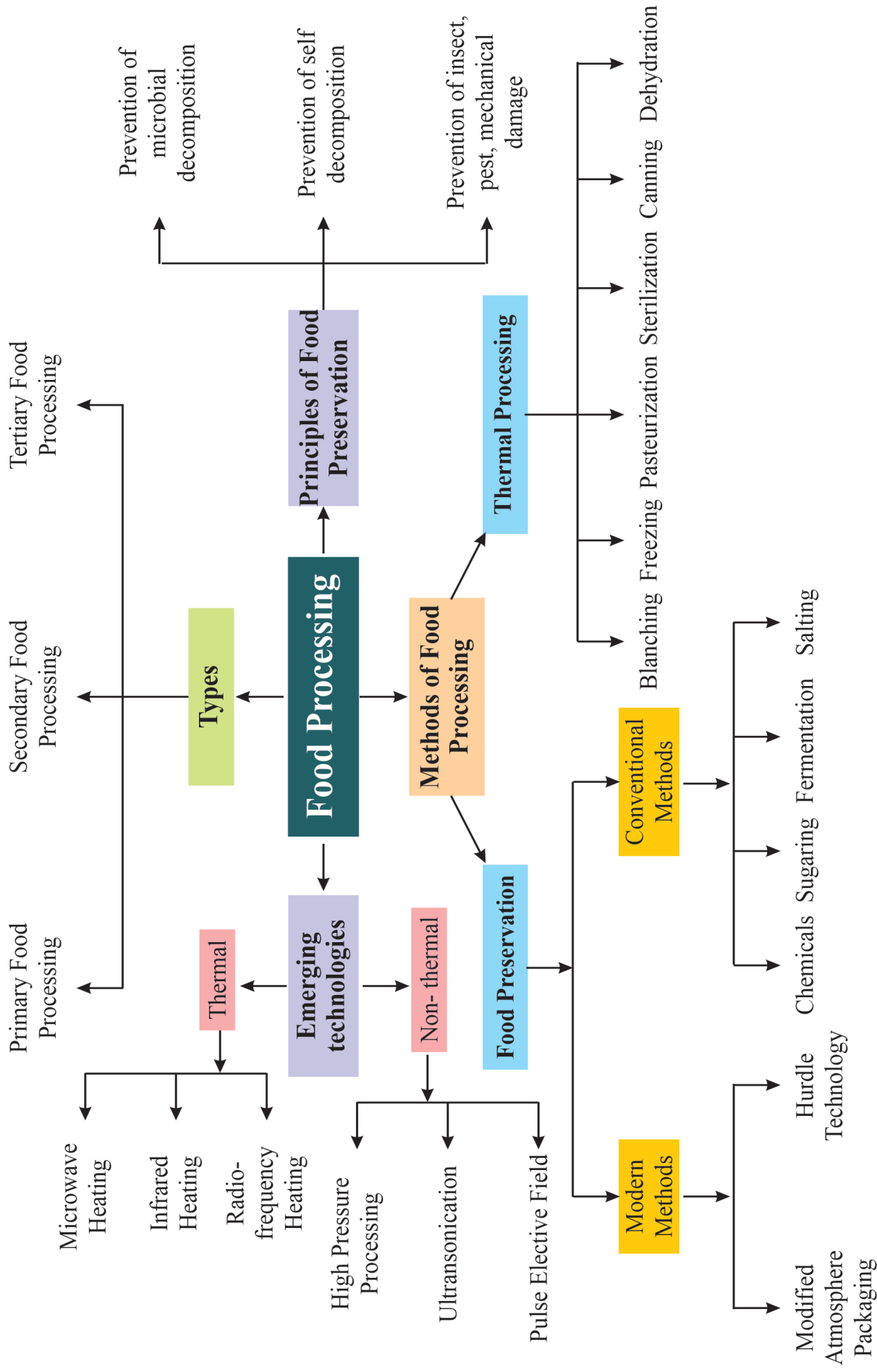
Sterilization: It is a heat processing technique where both harmful and beneficial organisms are killed by exposing the material to temperature above 100°C.

Thermal processing: A food sterilization technique in which the food is heated at a temperature high enough to destroy microbes and enzymes. Pasteurization and sterilization are the commonly employed techniques for thermal processing of foods.

SUGGESTED READINGS

1. Subbulakshmi, G., Udipi, S. A. and Ghugre, P. S. (2021). *Food Processing and Preservation*, New Age International Private Limited, New Delhi.
2. Sinha, S. P. (2012). *Principles of Food Processing*, Adhyayan Publishers & Distributors, New Delhi.

WHAT YOU HAVE LEARNT



*Notes*

VALUE ADDED FOOD PRODUCTS

Value addition is the process of transforming a raw commodity into a high-quality end product. In the case of food products, value addition results in the production of highly nutritious products with excellent quality, longer shelf life, and improved food safety. While value addition is often pursued for profit, it is also undertaken to improve the nutritional quality of food products. This process can be as simple as grading fruits and vegetables by size and packaging them uniquely, or as complex as transforming them into jams, jellies, chutneys, squashes, etc.

In this lesson, we will learn about the importance of value addition in foods, as well as various value added food products derived from fruits, vegetables, cereals, and milk.



LEARNING OUTCOMES

After studying this lesson, the learner:

- defines the value addition;
- lists the different methods used for value addition of foods;
- explains the value addition of fruits and vegetables and different value added products;
- describes the value addition of cereals and various value added cereal products; and
- outlines value addition in milk and different value added dairy products.

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Notes**18.1 VALUE ADDITION**

A value added food product refers to any product that has been subjected to additional processing or been combined with other products/components to increase its overall value. Value added food products have been modified or enhanced to have a higher market value and a longer shelf life.

18.1.1 Importance

The importance of value addition in case of different food products can be understood through the following points:

- Provides profitability to farmers and financial stability to farmers
- Increases employment opportunities
- Offers better quality, safe, and branded foods to consumers
- Promotes primary and secondary processing industries
- Reduces post-harvest losses
- Reduces imports and meets export demands
- Enhances foreign exchange opportunities
- Encourages the growth of the dairy industry
- Reduces the economic risks associated with marketing

18.1.2 Range of Value Added Food Products

- Fruits and vegetables are processed into a variety of food products, such as juices and concentrates, pulp, canned and dehydrated products, jams and jellies, marmalades, pickles, and chutneys, etc. The extent of processing of fruits and vegetables varies from one country to another.
- Value added cereal products include biscuits, corn flakes, bread, pasta, noodles, and other bakery products, milled products.
- Value addition in milk boosts the economy of the farmers and the dairy industry, simultaneously. This is done by processing milk into products like pasteurized milk, sterilized milk, khoa, paneer, ghee, cheese, yogurt, ice cream, butter, and other dairy items, etc.

Similarly, value addition in case of other food products, such as meat, fish, and poultry, when coupled with effective marketing, has the potential to reduce agricultural wastage, create jobs, and ensure better prices for producers.

**ACTIVITY 18.1**

Collect various value added food products. Group them based on their sources.

.....

.....

*Notes***18.2 TECHNIQUES FOR VALUE ADDITION OF FOOD PRODUCTS****18.2.1 Food Fortification**

Fortification of foods means the process of improving the nutritional quality of food by adding essential vitamins and minerals (micronutrients). The objectives of food fortification are to:

- Improve the nutritional value of food products.
- Address health issues caused by nutrient deficiencies.
- Provide a variety of food products with improved nutritional profiles.
- Restore nutrients lost during food processing.
- Add nutrients that may not be naturally present in the food.

The methods of food fortification are divided into four types. They are named according to the method used for fortification.

- Bio-fortification
- Industrial fortification
- Synthetic fortification
- Home fortification

18.2.1.1 Bio-fortification

This technique involves the genetic modification of crops or conventional breeding of

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crops to increase their micronutrient content. For example, “Golden Rice” is a bio-fortified crop that contains higher levels of iron and beta-carotene compared to normal rice. This technique has gained more attention in recent years.

Advantages

- A large group of the population gets benefitted from this technique.
- It requires minimal changes to existing practices.

Disadvantages

- Strict food regulations and strict quality control are required.
- Sensory changes in the food products may be unappealing to consumers.

18.2.1.2 Industrial Fortification

This method of fortification improves the nutritional quality of industrially processed and widely consumed edible food products such as flour, oils, rice, butter, sauces, etc.

Advantages

- Food products can be made available at cheap prices.
- Restores the micro-nutrients lost during processing
- It does not interfere with the natural state of plant and animal species.

Disadvantages

- Some people are too far from the markets to purchase food products.

18.2.1.3 Synthetic Food Fortification

This method of fortification involves the addition of probiotic bacteria such as lactic acid bacteria, to food products to improve their nutritional quality.

Advantages

- It requires minimal changes to existing food products.

Disadvantages

- Sensory changes in the food products may make it less appealing to consumers.



18.2.1.4 Home Fortification

Home fortification involves providing micronutrients in packages or tablets that can be added when cooking or consuming meals at home, such as vitamin D drops. This method of food fortification can improve the diet of young children.

Advantages

- Does not alter the natural state of plant or animal species
- Inexpensive to distribute

Disadvantages

- Requires proper knowledge about food ingredients and their use
- Some people may feel uncomfortable adding a substance to their food without understanding its purpose.

18.2.2 Food Enrichment

An enriched food is a type of food that has been fortified with additional nutrients. These nutrients were originally present in the food, but were lost during the processing stages. For instance, white bread is a commonly consumed enriched food, where certain vitamins are added during the refining process, thereby improving its nutritional value.

Difference between Food Enrichment and Fortification

Food enrichment is the addition of micronutrients lost during processing, while food fortification is the process of improving the nutritional quality of food by adding essential micronutrients that may or may not have been present in the original product.

18.2.3 Packaging

Packaging plays a key role in preserving the quality of processed food products and improving their shelf life, presentation, and marketability. Although food packaging (Fig. 4.1) does not directly contribute to value addition in food products, it helps to maintain their existing quality. Additionally, the materials used for packaging should not have any adverse effect on product quality or safety.

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Fig. 18.1 Food Packaging

18.2.4 Innovation

By using innovative techniques, new food products can be developed with improved shelf life, better food quality, and increased safety.

18.2.5 Preservation

Certain forms of preservation can also help maintain the nutritional quality of food products. For example, freezing or canning can preserve some of the nutrients in the food.

**INTEXT QUESTIONS 18.1**

1. Fortification of foods means enhancing the of foods by adding vitamins and minerals.
2. Different methods of food fortification are.....
3. Bio-fortification includes techniques like and
4. Synthetic food fortification involves the addition of to food products.

**ACTIVITY 18.2**

List any three fortified foods. Identify the nutrients that are fortified.

.....

.....

.....

18.3 VALUE ADDED PRODUCTS OF FRUITS AND VEGETABLES

Value addition in fruit and vegetable processing refers to transforming raw commodities into processed products through the use of raw materials, labor, time, and technology in a way that increases economic returns. Typical value addition techniques for fruits and vegetables include cleaning, cutting, drying, packaging, and freezing. Examples of value added products from fruits and vegetables include:

- Pulp
- Juices and concentrates
- Canned and dehydrated products
- Jams and jellies
- Pickles, chutneys, etc.

The concept of value addition in fruits and vegetables is a strategy to reduce post-harvest losses of fresh produce, extend the storage period, and ensure the availability of fruits and vegetables during off-seasons.

18.3.1 Preparation and Preservation of Juice Products

Fruit juices (Fig. 18.2) have their best taste, aroma, and color when freshly extracted. The most important steps in processing fruit juices are

- (i) Selection and preparation of fruit
- (ii) Extraction of juice
- (iii) Deaeration
- (iv) Straining, filtration, and clarification



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(v) Preservation

All fruits are not suitable for making fruit juice, either because of difficulties in juice extraction or because the resulting juice is of poor quality. Fruits or vegetables have to be thoroughly cleaned to remove any dirt or insecticide residues. The method of juice extraction will vary depending on the structure and composition of the fruit. Before pressing, most fruits are crushed to facilitate extraction.

The extraction of juice should be done as quickly as possible, and the juice should be exposed to the open air as little as possible. Fruit juice contains some air, which is either present on the surface or dissolved within the juice. After extraction, the juice is strained and filtered to remove seeds, pulp, gums, pectic substances, and proteins in colloidal suspensions. The clarification of juice (complete removal of all suspended materials from the juice) can be performed by methods such as centrifugation, enzyme treatment, settling, filtration, freezing (-18°C), high temperature (nearly 82°C), and low temperature (-2 to -3°C).



Fig. 18.2 Fruit Juice

18.3.2 Fruit Beverages

Synthetic drinks contain only water (about 88%) and carbohydrates (about 12%) and provide about 48 kcal per 100 ml. In contrast, fruit-based drinks contain vitamins (A, B, and C) and minerals (iron, calcium, etc.) and provide more calories. Fruit beverages are easily digestible, highly refreshing, thirst-quenching, appetizing, and nutritionally far superior to many synthetic and aerated drinks. They can be classified into two categories: unfermented and fermented beverages.



18.3.2.1 Unfermented Beverages

Fruit juices that do not undergo alcoholic fermentation are referred as unfermented beverages. They include RTS (ready-to-serve) drinks, nectar, cordial, squash, crush, syrup, fruit juice concentrate, fruit juice powder, as well as barley water and carbonated beverages.

1. Juices

Juices may be natural, sweetened or blended.

- ❖ **Natural juice (pure juice):** It is the juice extracted from ripe fruits and contains only natural sugars.
- ❖ **Sweetened juice:** It is a liquid product containing at least 85% juice and 10% total soluble solids.
- ❖ **Blended juices:** These are made by mixing two or more juices to create a well-balanced, rightly flavored, highly palatable and refreshing drink.

2. Ready-to-serve

This is a type of fruit beverage that contains at least 10% fruit juice and 10% total soluble solids, and approximately 0.3% acid. It is called ready-to-serve (RTS) because it does not require dilution before consumption (Fig. 18.3).



Fig. 18.3 Ready to serve beverage (RTS)

3. Squash

This is a type of fruit beverage that contains at least 25% fruit juice or pulp and 40 to 50% total soluble solids. The squash contains added citric acid, sucrose, and preservatives (Sodium Benzoate or KMS). It must be diluted before serving.

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18.3.2.2 Fermented Beverages

Fermented beverages are fruit juices that have undergone alcoholic fermentation by yeasts. Examples include wine and champagne (from grapes), port, sherry (Spanish wine), tokay, muscat, perry (from pears), orange wine, berry wine (from fruits like strawberry, blackberry), nira (from juice of the palm tree), feni (from cashew apple), and cider (from apple, bael, jamun, phalsa and, aonla).

1. Wine

Wine (Fig. 18.4) is a fermented alcoholic beverage made from grape juice without distillation. Wines are categorized based on alcohol content:

- ❖ Light wines: 7 to 9% alcohol
- ❖ Medium wines: 9 to 16% alcohol
- ❖ Strong wines: 16 to 21% alcohol

Sparkling wines contain carbon dioxide, while still wines do not. Fortified wines contain added alcohol in the form of brandy. Brandy is prepared by distillation of wine.



Fig. 18.4 Wine

18.3.3 Jam

Jam is a semi-solid food product prepared by cooking sugar with fruit or vegetable pulp, pectin, acid, and other ingredients to achieve the desired consistency. Jam should contain 68% solids and 45g of fruit pulp per 100g of jam. It can be prepared from one type of fruit or from two or more types. Common fruits used in jam preparation include apple, pear, sapota, apricot, loquat, peach, papaya, carrot, strawberry, mango, grapes, pineapple, etc.

Generally the fruit pulp is cooked with the required quantities of sugar and pectin, and the desired amount of citric acid is then added. The end-point is judged by either TSS (68%), boiling point (105°C), or the sheet test. The product is hot-filled into sterile bottles, followed by cooling, waxing, and capping. The final product is stored at room temperature.

18.3.4 Fruit Preserve (Murabba)

These are made from mature, under-ripe fruits by cooking large cut pieces or small whole fruits in heavy syrup until they become tender and transparent. The procedure includes peeling, puncturing (to promote sugar penetration), blanching (to inactivate enzymes), and chemical treatment, followed by the addition of sugar concentrate.

18.3.5 Pickles

Pickles (Fig. 18.5) are good appetizers that enhance the palatability of meals. Pickles are edible product preserved in a solution of common salt and vinegar.

Pickles can be prepared from fruits and vegetables such as lemon, aonla, mango, onion, cauliflower, cabbage, cucumber, bitter gourd, jackfruit, turnip, etc. Fruits are generally preserved in sweetened and spiced vinegar, while vegetables are preserved in salt.



Fig. 18.5 Pickles

- **Preservation with salt:** This method of preservation is generally used only for vegetables that contain very little sugar. The method involves adding salt to the prepared material, such as mangoes, and leaving the mixture in the sun for one week with shaking twice a day. Then, the required amount of spices is added, and the pickle is stored at an appropriate temperature.



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- **Preservation with vinegar:** In this method, vegetables are preserved in vinegar until they reach a final concentration of 2-3% acetic acid (not less than 2%) for preservation. In vinegar pickles, salt (2-3%) and sometimes sugar (2-5%) are also added. Garlic, chillies, etc., are preserved in vinegar as such.
- **Preservation with oil:** The fruits or vegetables should be completely immersed in edible oil. The pieces of (lemon, cauliflower, turnip, etc.) are mixed with spices and salt. The mix is kept in the sun for 4-6 days, then oil is added to the mix.
- **Preservation with salt, vinegar, oil and spices:** Pickles can also be preserved by combining salt, vinegar, oil, and spices, such as in mango pickles.

18.3.6 Chutneys

A chutney is essentially a mixture containing fruit or vegetables, spices, salt and/or sugar, vinegar. The method of preparation is similar to that of jams, except that spices and vinegar are added. Ripe fruits/vegetables are slowly cooked below the boiling point. Onion and garlic are added at the start to mellow their strong flavors. Vinegar, sugar, and spices are added just before the final stage of boiling.

18.3.7 Tomato Products

The quality of tomato products is judged by their color, which is dependent on the redness of tomatoes used. During processing of tomato products, avoid prolonged heating and cool the product quickly after preparation.

i. Tomato Juice

Good quality juice should have a deep red color, possess the characteristic taste and flavor of tomatoes, uniform appearance, and high nutritive value. It should contain about 0.4% acid (in terms of citric acid), 0.5% salt, and 1% sugar.

ii. Tomato Puree

Skinless and seedless tomato pulp, with or without added salt, containing not less than 9% of salt-free tomato solids is known as “Medium Tomato Puree”. It can be further concentrated to create “Heavy Tomato Puree”, which contains not less than 12% solids.

iii. Tomato Paste

Tomato paste is similar to tomato puree but has a higher solid concentration. It is prepared by concentrating tomato juice through evaporation under vacuum. Tomato paste contains not less than 25% tomato solids, while “concentrated tomato paste” contains not less than 33% tomato solids.

iv. Tomato Sauce and Ketchup

Tomato sauce and ketchup are essentially the same, but sauces are generally thinner and contain more total solids (minimum 30%) than ketchups (minimum 28%). They are made with strained tomato juice or pulp, spices, salt, sugar, and vinegar, with or without onion and garlic, and contain not less than 12% tomato solids and 25% total solids.

Tomato ketchup is a condiment that is made by concentrating tomato paste with water, sugar, vinegar, salt, and seasonings.

*Notes***18.3.8 Drying**

Drying is the most popular method of food preservation. It removes water from the surface of the food through the combined effects of air flow, temperature, and humidity. Fruits and vegetables are dried to such an extent that their moisture content is reduced, which prevents the growth of microorganisms and inhibits the action of enzymes. Dehydrated fruit may contain 12-14% water, while vegetables should be dried to 4-8% water content, depending on the type, as they contain less sugar.

**INTEXT QUESTIONS 18.2**

1. What is value addition?
.....
.....
2. The most important steps in processing fruit juices are.....
.....
3. Different methods used for juice clarification are.....
.....

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4. Fruit juices which do not undergo alcoholic fermentation are termed as.....
5. is a liquid product which contains at least 85% juice and 10% total soluble solids.
6. A fruit beverage which is not diluted before serving is known as.....
7. is a fermented alcoholic beverage produced from grape juice without distillation.
8. Tomato juice is concentrated to not less than tomato solids in the case of tomato paste.

**ACTIVITY 18.3**

Identify and gather five value-added products made from fruits and vegetables. Examine and analyze the processes involved in enhancing their value.

.....

.....

.....

18.4 VALUE ADDED PRODUCTS FROM CEREALS

Value addition is a process by which cereal grains are modified to enhance their value and appeal to consumers. The various value added products derived from cereals are explained below:

18.4.1 Value Added Rice Products**a) Instant Rice (Quick-cooking Rice)**

Instant rice is prepared by dehydrating cooked rice to create a porous structure in the finished product. The cooked rice is first dehydrated in an air dryer and then subjected to a puffing treatment.

b) Puffed Rice from Paddy

To produce puffed rice, paddy is first soaked in water until its moisture content reaches about 20%. The moist paddy is then exposed to sudden heat treatment at 250-270°C for 30-40 seconds. This causes the husk to split off and the rice to puff up.



Notes

c) Rice Flakes (beaten Rice)

The rice is soaked in hot water (70-80°C) for 20 minutes. Thereafter the water is drained off, and the soaked rice is toasted in a pan at about 250-275°C until a few grains start puffing. The toasted rice is immediately subjected to flaking.

d) Rice Flour

Rice flour is added to other ingredients to enhance their utility. For example, adding rice flour to gram flour during the preparation of *pakor*as improves crispiness.

18.4.2 Value Added Wheat Products

Wheat is unique among other cereal flours as it has the ability to form dough with water. The various products prepared from wheat flour include *chapatti*, bread, biscuits, cookies, pasta products, and more.

a) Cookies

Cookies (Fig. 18.6) are soft wheat-based chemically-leavened products with high sugar, shortening content (fats like margarine, lard, vegetable oil) and relatively have low water content. The leavening is achieved through carbon dioxide, water or ethanol vapours, ammonia, and air. The most common leavening agent is sodium bicarbonate, which is low cost, non-toxic, easy to handle, and leaves no taste in the final product.



Fig. 18.6 Cookies

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The major steps involved in cookie preparation include:

- ❖ Creaming the fat and powdered sugar to make a fluffy mixture.
- ❖ Sifting together the dry ingredients (flour, salt, and baking powder).
- ❖ Mixing the dry ingredients into the fat-sugar cream mixture with limited water.
- ❖ Forming smooth dough.
- ❖ Sheeting the dough and cutting it with a rotary cutter.
- ❖ Baking at 210°C for 9-10 minutes.

b) Cakes

The cakes differ from cookies in following aspects:

- a) Higher sugar level
- b) The main structural ingredients are fat and eggs.
- c) Tendering agents include sugar and fat.

Cakes are of two types;

- ❖ Shortened cakes (containing butter or fat)
- ❖ Sponge cakes (without fat).

A higher level of gluten is not desirable in cake making. The cakes are baked at 190°C for 30 minutes.

c) Biscuits

In order to prepare biscuits, initially a mixture of five parts flour and one part milk is combined with baking powder, fat, and salt to create a dough.

The procedure includes:

Mixing the ingredients → Kneading the dough for 10-20 minutes to achieve the desired cohesion → Sheeting → cutting the dough to the desired size → Baking at 210-232°C for 15 minutes.

An under-kneaded dough results in biscuits that are very tender, coarse in texture, small in volume, and have a rough crust. The optimum kneading time of 10-20 minutes will give a fine structure, smooth crust, and better appearance. Over-

kneading results in a compact and tough biscuit.

d) Pasta Products

The pasta products (Fig. 18.7) are cost effective, easy to prepare, palatable, versatile, have a long shelf life, and have good nutritional value. The process involves sieving, purifying, and conditioning the dough by adding water, extruding it, and drying it until it reaches moisture content of 2%. The mixing process must be carried out in the absence of air to prevent air bubbles from appearing on the product's surface, otherwise which would result in an opaque appearance. This opaque color interferes with the perception of the yellow color of pasta.



Notes



Fig. 18.7 Pasta



INTEXT QUESTIONS 18.3

1. The moist paddy is puffed by subjecting to sudden heat treatment at°C forseconds.
2. Cookies are baked at°C for minutes.
3. Cakes are of two types..... and

18.5 VALUE ADDED PRODUCTS FROM MILK

Value addition in milk can be a great tool for enhancing the farmer's income and increasing profitability through the use of certain techniques. With rising consumer

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awareness, people are more conscious about healthy diets, which has expanded the market for value added functional dairy products. Some of these value added products are described below:

A. Pasteurized Milk

Pasteurization is the process of heating each and every particle of milk to a suitable temperature below the boiling point for a definite time to destroy all pathogenic microorganisms. Cooling of milk immediately after pasteurization is essential because not all bacteria are killed during the heating process.

Temperature-time combination for LTLT (low temperature long time) is 63°C for 30 minutes. Temperature-time combination for HTST (high temperature short time) is 72°C for 15 seconds.

B. Sterilized Milk

Sterilization is a heat treatment method used to destroy both pathogenic and non-pathogenic microorganisms in milk. The milk is heated above 100°C for a specific time period to ensure that it remains safe for consumption for at least seven days at room temperature.

Generally, the milk is heated at 110°C for 30 minutes or 120°C for 15 minutes. When packaged in sealed bottles and stored at room temperature, sterilized milk can have a shelf-life of over six months. However, sterilization causes more nutritional loss than pasteurization, as vitamins B and C get destroyed during the process.

C. Butter

Butter is a fat concentrate obtained by churning cream, which gathers the fat into a compact mass and then process it further. It is a semi-solid product that contains no less than 76% milk fat and no more than 20% moisture. Butter is usually yellow or white in color, with a bland flavor and a slightly salty taste.

D. Cultured or Fermented Dairy Products

Lactose intolerance is a condition in which individuals cannot digest the sugar (lactose) in milk. However, fermented dairy products such as yogurt allow those with lactose intolerance to consume milk, as the fermentation process breaks down the lactose.



Fermented milk products such as yogurt and sour milk contain *Lactobacilli* bacteria, which naturally occur in the digestive tract and have a cleansing and healing effect. Introducing these products into the diet can help prevent the growth of certain harmful yeasts and bacteria that may cause illness.

The technology of cultured milk products, such as yogurt, curd, and cheese, is based on the microbial conversion of lactose to lactic acid, which gives these products their characteristic sourness. Lactic acid-producing bacteria are essential for this conversion process.

E. Curd (Dahi)

Curd is a fermented milk product obtained by souring pasteurized or boiled milk with lactic acid bacteria inocula.

F. Yoghurt

Yoghurt is a fermented milk product. In the manufacture of yoghurt, milk is typically heated to 70°C for 15-20 minutes, then cooled to 30- 40°C and inoculated with a mixed culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, in a ratio of 1:1.

G. Cheese

Cheese (Fig. 17.8) is produced from milk by the combined action of lactic acid bacteria and the enzyme rennin (also known as rennet). Like cream, which is a concentrated form of milk fat, cheese is a concentrated form of milk protein. Hard cheese should contain no more than 43% moisture and no less than 42% milk solids in the dry matter.

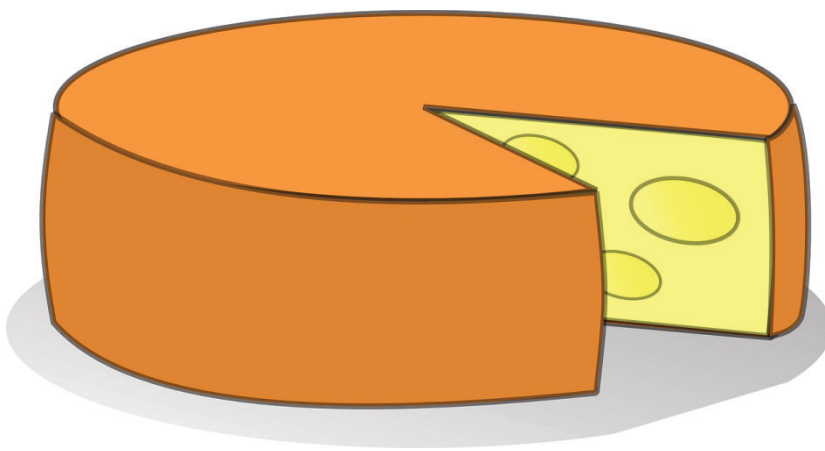


Fig. 18.8 Cheese

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H. Ice Cream

Ice cream is a frozen dairy product made from milk, sugar, fat, and optional stabilizers, colors, and flavors. The product may include permitted stabilizers and emulsifiers that do not exceed 0.5% of its weight. The mixture must be heated sufficiently before freezing to destroy all pathogenic bacteria. Ice cream should contain at least 10% milk fat, 3.5% protein, and 36% total solids.

I. Dehydrated Milk Powder

Powdered milk is produced by evaporating liquid milk until it becomes dry. Drying of milk extends its shelf life and eliminates the need for refrigeration due to its low moisture content. Additionally, it reduces bulk, making transportation more economical. Types of milk powders include whole milk powder, non-fat dry milk, buttermilk powder, whey products, and dairy blends.

**INTEXT QUESTIONS 18.4**

1. Temperature-time combination for LTLT (low temperature, long time) pasteurization of milk is.....
2. is the heat treatment of milk to destroy both pathogenic and non-pathogenic micro-organisms.
3.may be defined as a fat concentrate obtained by churning cream and gathering the fat into a compact mass.
4. Fermented-milk products such as yoghurt, contain bacteria from the group.
5. Cheese is made from milk by the combined action of..... bacteria and the enzyme.....

**WHAT YOU HAVE LEARNT**

- Value addition leads to the production of highly nutritious products with excellent quality, shelf life, and food safety.
- Food enrichment involves adding micronutrients lost during processing, back into the food product.

- The concept of value addition for fruits and vegetables is aimed at increasing their storage life and ensuring availability during off-seasons.
- Juices can be natural, sweetened, or blended.
- Jam is a semi-solid food product made by cooking sugar with fruit or vegetable pulp, pectin, acid, and other ingredients to create a specific consistency.
- The quality of tomato products depends on the redness of the tomatoes used.
- Cookies, cakes, biscuits, and pasta are value-added wheat products that undergo specific processes for their production and development.
- Value addition in milk can be a great tool for enhancing farmers' income and increasing profit by using certain techniques.

*Notes***TERMINAL QUESTIONS**

1. What are the differences between pasteurization and sterilization?
2. Differentiate between fortification and food enrichment.
3. What is the importance of adding value to foods?
4. Explain the different methods of food fortification.
5. What are the advantages and disadvantages of each method of food fortification?
6. How can we prepare and preserve fruit juice products?
7. What is the difference between fermented and unfermented beverages?
8. How is fruit preserve prepared?
9. Explain the preservation of pickles with vinegar.
10. Differentiate between puffed rice and instant rice.
11. How are cookies prepared?
12. Why is mixing of pasta done under vacuum?
13. How is sterilized milk prepared?
14. How is ice cream prepared?
15. What is the composition of butter?

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Notes**ANSWERS TO INTEXT QUESTIONS****18.1**

1. Nutritional quality
2. Bio-fortification; industrial fortification; synthetic fortification; home fortification
3. Genetic modification, conventional breeding
4. Probiotic bacteria

18.2

1. Value addition is the transformation of a raw commodity or commodities into a processed product through the use of raw materials, labour, time and technology in such a way that assures increased economic return.
2. Selection and preparation of fruit, extraction of juice, deaeration, straining, filtration, clarification and preservation.
3. Centrifugation, enzyme treatment, settling, filtration, freezing (-18°C), use of high temperature (nearly 82°C) and low temperature (-2 to -3°C).
4. Unfermented beverages
5. Sweetened juice
6. Ready to serve
7. Wine
8. 25%

18.3

1. 250-270, 30-40
2. 210, 9-10
3. Shortened, sponge



18.4

1. 63°C/30 min
2. Sterilization
3. Butter
4. *Lactobacilli*
5. Lactic acid, rennin

GLOSSARY

Value added product: A value added product refers to any product that has been undergone additional processes or combined with extra products to increase its overall value and quality.

Dough: Dough is a semi solid mixture of flour, water and other ingredients like sugar, salt, leavening agents and flavours.

Chemical leavening: It is a process where a special compound (leavening agent like baking powder) is added to dough to release gas upon reacting with heat or moisture. This gas increases the volume of the baked product.

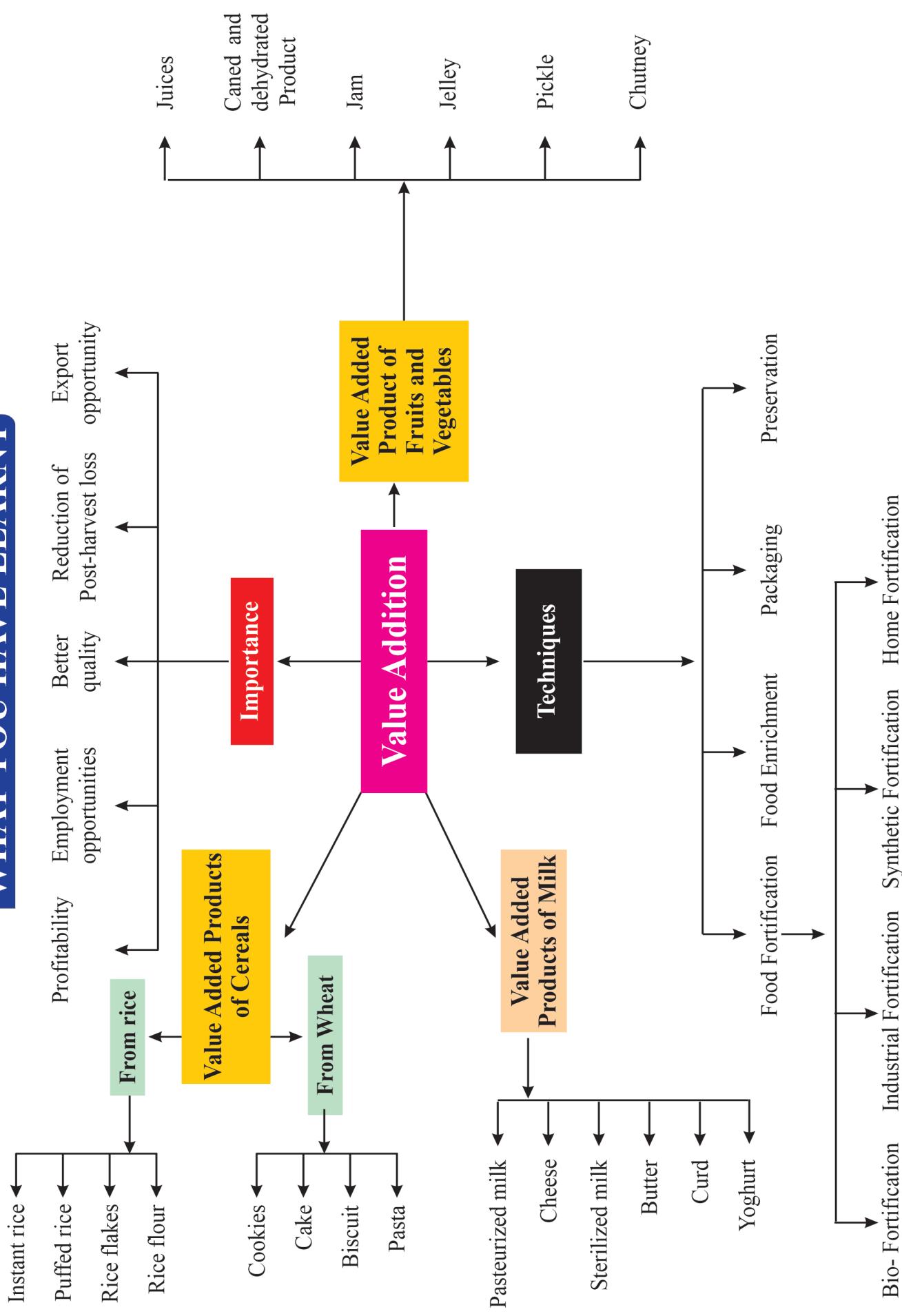
Fruit beverage: Fruit beverages are easily digestible and nutritionally rich fruit based drinks.

Jam: Jam is a semi-solid food product prepared by cooking sugar with fruit or vegetable pulp. It should contain 68% solids.

SUGGESTED READINGS

1. *Processing of Horticultural Crops*, B.Sc. (Horticulture), e-KrishiShiksha, Agricultural Education Division, Indian Council of Agricultural Research, New Delhi (<https://ecourses.icar.gov.in/>).
2. *Value addition*, TNAU Agritech Portal, Tamil Nadu Agricultural University, Coimbatore. (http://www.agritech.tnau.ac.in/horticulture/horti_valueaddition.html)

WHAT YOU HAVE LEARNT



*Notes*

FOOD SAFETY AND QUALITY CONTROL

Food safety and quality are important at the home level, but they are critical in large-scale food production and processing, as well as in freshly prepared and served food. The quality of food products is determined by sensory attributes, chemical composition, physical properties, levels of contaminants, shelf life, packaging, and labelling. Understanding these quality characteristics and being familiar with the appropriate measuring tools is necessary for quality control and the quality assurance of food products. Advancements in technology and processing, higher per capita incomes, better purchasing power, and increased consumer demand have led to the manufacture of a variety of processed and functional foods. The safety of such foods needs to be assessed. In this lesson, we shall learn about the concept of food safety, different hazards involved in food safety management systems and practices, methods of food quality control, and the concept of food adulteration, including the different adulterants present in foods.



LEARNING OUTCOMES

After studying this lesson, the learner:

- identifies the characteristics of food quality;
- interprets the concept of food safety;
- differentiates between quality control and quality assurance
- evaluates various food safety management practices like GMP, GHP, HACCP; and
- discovers the features and functions of national and international food quality certifying bodies.

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Notes**19.1 FOOD QUALITY**

Quality is a term that denotes a degree of excellence, a high standard, or value. The quality of food may be defined as the combination of characteristics that differentiate individual units of a product and have significance in determining the degree of acceptability.

19.1.1 Characteristics or Attributes of Food Quality**A. Physical Characteristics**

Appearance and color are important physical characteristics of food quality, described as follows.

❖ Appearance

Factors such as size, shape, defects, and color are important appearance attributes that greatly influence the initial consumer acceptability of food products.

❖ Color

Color is a quality factor that significantly influences the appearance of a product. It is a characteristic of light, measurable in terms of intensity and wavelength.

B. Chemical Characteristics

The nature and amount of substances in a given food product determines its nutritive value and other properties. The analysis of the molecular composition of food substances is used to study the protein, fat, carbohydrate, ash, and water content of foods.

❖ Moisture Content

Moisture content is the most significant constituent in food products. As a medium, water supports chemical reactions, and therefore, removing moisture from food inhibits the growth of microorganisms, improving the shelf life of several food products. The following Table 5.1 provides an indication of the moisture content in different food products.

Table 19.1 Moisture content of different food products

Products	Moisture content (g/100g)	Products	Moisture content (g/100g)
Meat	65-75	Butter	16-18
Milk	87	Margarine	16-18
Fruit	70-90	Cereal flour	12-14
Vegetable	70-90	Coffee beans, roasted	5
Bread	35	Milk powder	4
Honey	20	Edible oil	0

*Notes*

- **Fat and Oil Content**

Fat and oil quality depend on the composition of the food product, the size of the product, the type of processing, and the type of oil used. Higher fat products are more susceptible to rancidity, which is defined as the amount of free radicals that can cause an off-odor or off-flavor in foods.

- **pH-Acidity**

The pH is an indicator of the amount of acid or base present in a food. pH also affects flavor, color, and texture and is measured using a pH meter.

- **Pigments**

Pigments are compounds in food that give them color. For example, the green color of vegetables is due to chlorophyll, and the red color in tomatoes is due to lycopene.

19.1.2 Effect of Microorganisms

There are many types of microbes that can cause food borne diseases. These are discussed below:

- **Bacteria**

Bacteria are the most important microorganisms for food processors. There are thousands of species of bacteria, but all are single-celled and fall into three basic shapes: spherical, spiral and rod.

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- **Yeasts and Molds**

Yeasts are oval-shaped and slightly larger than bacteria. Yeasts and molds grow on most foods, equipment, and building surfaces where there are small amounts of nutrients and moisture.

- **Viruses**

Viruses are the smallest and simplest microorganisms. They are capable of infecting closely related species.

19.1.3 Sensory Attributes

Consumers accept food based on certain characteristics that they define and perceive with their senses. These attributes are sometimes referred to as qualitative or sensory qualities. They include color, size, shape, and physical aspects; other factors such as texture, viscosity, consistency, finger feel, and mouth feel; and flavor factors or sensations combining odor and taste.

- **Appearance and Color**

Color and other aspects of appearance influence food appreciation and quality, especially by the consumer.

- **Texture**

Texture can be described as the properties of a foodstuff that are sensed by touch in the mouth and with the hand.

- **Taste and Flavor**

When food is consumed, the interaction of taste, odor, and texture provides an overall sensation that is best defined by the term “flavor”. Flavor is the most important sensory property of many food products.



INTEXT QUESTIONS 19.1

1. Quality is a term that denotes
2. Examples of physical properties determining food quality are
3. Color is a character of light, measurable in terms of and



4. Rancidity is defined as
5. The pH is an indicator of the amount of..... or present in a food.
6. are the compounds in food that give them color.
7. Three basic shapes of bacteria are, and
8. are the smallest and simplest microorganisms.

19.2 METHODS OF FOOD QUALITY CONTROL

Quality control involves maintaining the standards that ensure food products meet the acceptable quality criteria of customers. The primary objective of food quality control is to protect the consumer. To ensure consistency and standardization of these procedures, food laws and regulations cover various aspects, including marketing, production, labeling, use of food additives, dietary supplements, enforcement of good manufacturing practices (GMPs), hazard analysis and critical control points (HACCPs), federal laws and regulations, factory inspections, and import/export inspections.



INTEXT QUESTIONS 19.2

1. GMP stands for.....
2. HACCP means.....

19.3 FOOD QUALITY INSPECTION

Food quality inspection, as defined by the International Organization for Standardization (ISO), involves measuring, examining, and testing one or more characteristics of a food product and comparing the results against specific requirements to determine whether they meet the required standards.

19.3.1 Objectives of Food Quality Inspection

- To separate poor quality products from good quality products
- To increase the reputation by protecting customers from receiving poor quality products

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- To ensure that the quality policy is followed
- Successful inspection helps in timely delivery of products
- To earn a reputation in the market

19.3.2 Stages of Inspection

- Inspection of incoming raw materials
- Inspection of production process
- Inspection of finished goods

19.3.3 Drawbacks of Inspection

- Inspection adds to the cost of the product without adding value.
- It is partially subjective; the inspector often has to judge whether a product passes or not.
- Inspection merely separates good and bad items; it does not prevent the production of bad items.

19.3.4 Difference between Food Inspection and Food Quality Control

Inspection assesses the manufacturing of non-conforming products and acts as a filter to remove them from the production flow (Reactive system).

Quality control attempts to prevent the manufacture of non-conforming products in the first place and attempts to predict, reduce, or eliminate the causes (Proactive system).

**INTEXT QUESTIONS 19.3**

1. Food inspection is a system, whereas quality control is a system.
2. The stages of food quality inspection are
3. ISO stands for.....

19.4 FOOD QUALITY CONTROL (QC)

It is the procedures that a company must follow to ensure that its products meet food quality regulations and acceptable standards, thus ensuring consumer safety.

Some of the other food quality control procedures include product standards, Critical Control Point (CCP) identification, label specifications, cleaning and sanitizing programs, recall programs, and warehousing and shipping.

19.4.1 Purpose

- Provide routine and consistent checks to ensure data integrity, correctness, and completeness
- Identify and address errors
- Document and record all quality control (QC) activities

Higher QC activities include technical reviews of source categories, activity and emission factor data, and methods.

19.4.2 Importance and Functions

Quality control ensures the production of high-quality products, which is immensely helpful in attracting more customers and increasing sales. It is significantly beneficial for maintaining existing demand and creating new demand for the company's products.

19.4.3 Difference between Quality Control and Quality Assurance

Quality Control (QC) is a system that verifies and maintains a desired level of quality in an individual test or process. On the other hand, Quality Assurance (QA) is a part of quality management that focuses on providing confidence that quality requirements will be fulfilled. Table 18.2 presents the main differences between QC and QA.

Table 19.2 Difference between quality control (QC) and quality assurance (QA)

QUALITY ASSURANCE	QUALITY CONTROL
A medium to long-term process; cannot be implemented quickly	Can be implemented at short notice.
Focus on processes- how things are made or delivered	Focus on outputs- work-in progress and finished goods.



Notes

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Achieved by improving production processes	Achieved by sampling & checking (inspection)
Targeted at the whole organization	Targeted at production activities
Quality is built into the product	Defected products are inspected out



INTEXT QUESTIONS 19.4

1. QA stands for
2. QC stands for
3. Quality control is a long-term process (True/False).

19.5 FOOD SAFETY

19.5.1 Definition

Food safety refers to the practices observed during the handling, processing, and distribution of food to ensure that contaminants that can cause foodborne illnesses are not present. Food safety is an important aspect of food production and handling as it protects the health and safety of consumers from any food-related issues.

19.5.2 Food Safety and Hazards

Knowledge of food safety is very important and can be improved by understanding 'toxicity' and 'hazard'. These two terms can be defined as follows:

- **Toxicity** is the ability of a substance to create harm under specific conditions.
 - **Hazard** is an estimation that toxicity will happen if a substance is not used properly by following prescribed terms and conditions. Hazards are categorized into three types: physical, chemical, and biological. Each type of hazard can cause adverse effects on the health of consumers.
- a) **Physical hazard** is any physical material not typically found in food that can cause harm to consumers' health.

Sources of physical hazards

- ❖ Materials from the field like stones, insects, wood, insects etc.

- ❖ Materials arising from handling and food processing operations such as bones, metal, wood, bolts, glass, wire etc.
 - ❖ Materials entering food products during distribution like metal, insects etc.
 - ❖ Materials intentionally placed in food by employees.
- b) **Chemical hazards** are chemicals or unwanted substances added intentionally or unintentionally to foods. Examples include pesticides, several additives, chemical residues, toxic metals, etc.
- c) **Biological hazards** are living organisms and include microorganisms associated with food, which cause diseases known as foodborne pathogens. There are two types of foodborne diseases caused by pathogens i.e., food infection and food poisoning.

*Notes*

The various food safety hazards are presented in Fig. 19.1.



Fig. 19.1: Various Food Safety hazards

19.5.3 Food Infection

Food infection is caused by the ingestion of a sufficient number of microorganisms of public health significance, resulting in illness. Examples of food infections include salmonellosis and listeriosis.

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19.5.4 Food Intoxication

Food intoxication is caused by the ingestion of bacterial toxins. Examples of food intoxications include staphylococcal poisoning and botulism.

Among the various hazards, biological hazards are of significant concern in the context of foodborne illness. It is important to understand several key terms related to food safety, including contamination and adulteration.

19.5.5 Contamination

Contamination refers to the presence of harmful or objectionable substances in food items, such as microorganisms or chemicals, before, during, or after processing and storage. Major sources of food contamination include water, air, dust, equipment, sewage, insects, rodents, and employees.

19.5.6 Adulteration

Adulteration refers to the addition of inferior substances to food or the lowering of food quality by extracting valuable ingredients. Adulteration can be intentional or unintentional and may occur during processing, storage, transportation, and distribution of food.

19.5.7 Adulterants

Adulterants are substances that are added to make food products unsafe and unfit for human consumption. These adulterants can be present in all food products we consume daily, including dairy products, cereals, pulses, grains, meat, vegetables, fruits, oils, and beverages. Some common adulterants found in food products are presented in Table 19.3.

Table 19.3 Common adulterants in Foods

S. No.	Food Products	Adulterant
1.	Cereal grains	Dust, pebbles, stones, straw, weed seeds, damaged grain, etc.
2.	Sugar	Chalk powder, washing soda, urea, etc.
3.	Milk and curd	Water and starch powder

4.	Coffee powder	Chicory, tamarind seeds powder
5.	Pepper	Dried papaya seeds and blackberries
6.	Mustard seeds	Argemone seeds
7.	Edible Oils	Mineral oil, karanja oil, castor oil and artificial colours
8.	Tea	Artificial colouring agents
9.	Pulses	Dyes, chemical and lead chromate
10.	Ghee, cheese and butter	Mashed potatoes, vanaspati and starch powder

*Notes***INTEXT QUESTIONS 19.5**

- Types of hazards are, and
- Presence of stone or wood in food material is an example of
 - Chemical hazard
 - Physical hazard
 - Biological hazard
 - None of these
- Presence of a sufficient number of microorganisms in food may cause food infection (True/False).

**ACTIVITY 19.1**

Visit local shops and collect various food materials – both raw and cooked. Examine the foods for the presence of adulterants.

.....

.....

.....

19.6 FOOD SAFETY MANAGEMENT PRACTICES (FSMS)

Food safety has become a major issue throughout the entire supply chain in the food industry. Therefore, food manufacturers should take all preventive measures to eliminate

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harmful substances from food. Government laboratories use analytical techniques to analyze food and detect toxic substances, as well as to ensure that the food is safe for consumers.

In addition to ensuring safe and healthy food for consumers, product manufacturers and service industries have realized that competition in a global market requires a continual and committed effort towards improving product and service quality. Therefore, they follow the process improvement cycle (PDCA), which comprises:

- a) PLAN (plan improvement)
- b) DO (implement plan for improvement)
- c) CHECK (analyze the collected data)
- d) ACT (take action)

A food hazard can enter food products at any stage of the food chain; therefore, proper control throughout the food chain is essential. Food safety and quality in food products can be ensured by following practices such as:

- Good Manufacturing Practices (GMP)
- Good Handling Practices (GHP)
- Hazard Analysis Critical Control Points (HACCP)

19.6.1 Good Manufacturing Practices (GMP)

GMP is an important tool that enables the reduction of food contamination and false labeling practices, thereby protecting consumers in all aspects of the food industry. Good Manufacturing Practices (GMPs) are the minimum sanitary and processing requirements necessary to ensure the production of wholesome food. GMPs are broad and general in nature, but their implementation results in safe and high-quality food.

Foundation of GMP

GMP is based on two components: effective manufacturing operations and effective food control operations.

Preliminary process in GMP

A manufacturing organization adopting GMP principles can:

- Consistently meet its own and customers' requirements.

- Meet industry standards and codes of practice.
- Comply with regulatory requirements.

GMP Activities

GMP is intended to build quality into the product at all stages of the operation. Good manufacturing practices are usually written for each of the following areas:

- Personnel
- Buildings and facilities
- Equipment and utensils
- Production and process control
- Records and reports
- Defect action levels and others

Benefits of GMP

GMP is a dynamic program that enables the organization to make and maintain quality improvements. An effective GMP program can offer several benefits to the organization including:

- Creates awareness of food quality and safety among the staff.
- Increases confidence in product safety.
- Provides a starting point for the HACCP program.
- Provides international recognition.
- Prevents expensive failures.
- Reduces customer complaints.
- Improves profits.

19.6.2 Good Handling Practices (GHP)

GHP ensures that all individuals who handle food follow good hygiene practices. GHP represents a systematic approach from the farm to the store or consumer to identify hazards and outlines procedures to minimize the risk of food contamination. It covers various aspects of the food industry, including the food supply chain, sanitation facilities,



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workers' hygiene practices, pest control, and prevention of physical and chemical pollutants.

Purpose of GHP

The overall objective is to ensure that the food is safe for human consumption, by ensuring compliance with the basic hygiene and sanitary practices. These objectives include:

- Preventing illness caused by food consumption
- Assuring safe food for human consumption following certain principles
- Increasing the knowledge of food safety within the entire food supply chain by providing health education programs

Areas covered/examined under GHP

- Food production area
- Design and facilities in the production area
- Control of operation
- Maintenance and sanitation of plant
- Personal hygiene
- Transportation facilities
- Product information and consumer awareness
- Training for employees

19.6.3 Hazard Analysis Critical Control Point (HACCP)

HACCP is an approach to providing assurance about food safety. It involves the identification of hazards and the assessment of the likelihood of their occurrence at each step in the food chain. The HACCP system can be implemented at all stages of the food chain, from food production and preparation processes to packaging, distribution, etc.

Principles of HACCP

There are seven basic principles of HACCP.



- **Conduct a hazard analysis:** Plan to determine the food safety hazards and identify the preventive measures the plan can apply to control these hazards.
- **Identify critical control points:** A critical control point (CCP) is a point, step, or procedure in a food manufacturing process where control can be applied, and as a result, a food safety hazard can be prevented, eliminated, or reduced to an acceptable level.
- **Establish critical limits for each critical control point:** A critical limit is the maximum or minimum value to which a physical, biological, or chemical hazard must be controlled at a critical control point to prevent, eliminate, or reduce that hazard to an acceptable level.
- **Establish critical control point monitoring requirements:** Monitoring activities are necessary to ensure that the process is under control at each critical control point.
- **Establish corrective actions:** Corrective actions are necessary to ensure that no product is injurious to health.
- **Establish procedures for ensuring the HACCP system is working as intended:** Verification procedures may include activities such as review of HACCP plans, CCP records, critical limits and microbial sampling and analysis.
- **Establish record keeping procedures:** The HACCP regulation requires that all food processing plants maintain certain documents, including their hazard analysis and written HACCP plan, and records documenting the monitoring of critical control points, critical limits, verification activities, and the handling of processing deviations.

Benefits of HACCP

HACCP provides a systemic approach to food safety. The benefits of HACCP include:

- i. **Benefits to Consumers**
 - ❖ Reduction in the risk of food borne diseases
 - ❖ Increased confidence in the food supply
 - ❖ Increased awareness of basic hygiene
 - ❖ Increased quality of life

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ii. **Benefits to Industry**

- ❖ Increased access to markets
- ❖ Reduction in food wastage
- ❖ Increased customer confidence

iii. **Benefits to Government**

- ❖ Improved public health
- ❖ Reduction in public health costs
- ❖ Enhancement of international trade
- ❖ Increased confidence of the community in the food supply



INTEXT QUESTIONS 19.6

1. GHP stands for
2. Identification of hazards, assessment of chances of their occurrence during each step in the food chain are important steps of
 - a. GMP
 - b. GHP
 - c. GSP
 - d. HACCP

19.7 CERTIFYING BODIES

India has a comprehensive system of product certifications governed by laws enacted by the Parliament of India. Key certifying bodies and standards include:

A. National Food Security Act (2013)

The Act aims to ensure food and nutritional security by providing access to adequate quantities of quality food at affordable prices.

Salient features

The major features of the Act are described below:

- ❖ The Act legally entitles up to 75% of the rural population and 50% of the urban population to receive subsidized foodgrains under the **Targeted Public Distribution System (TPDS)**.
- ❖ About two-thirds of the population is covered under the Act to receive highly subsidized foodgrains.



Notes

B. FSSAI (Food Safety and Standards Authority of India)

FSSAI is a government agency under the Ministry of Health and Family Welfare. It was established by the Food Safety and Standards Act of 2006 to supervise the activities and operations of food enterprises. It plays a crucial role in promoting public health by monitoring and regulating food-related activities. To ensure safety, all food distributors, processors, storage facilities, and retailers are required to obtain an FSSAI license.

FSSAI uses scientifically determined criteria to regulate a wide range of food products. It is responsible for setting hygienic standards for food manufacturing, storage, distribution, and warehousing. Furthermore, FSSAI aims to raise awareness among consumers about these standards to ensure their safety.

Basic principle

The Food Safety and Standards Act, 2006 defines food safety as the ‘assurance that food is acceptable for human consumption according to its intended use’. Food safety ensures that the food is safe for human consumption and involves the proper handling, preparation, and storage of food to prevent food-borne illnesses.

Salient Features and Functions

- ❖ Promote general awareness about food safety and food standards.
- ❖ Frame regulations to establish standards and guidelines for food products.
- ❖ Provide scientific advice and technical support to the Central and State Governments on food safety policy.
- ❖ Establish procedures and guidelines for laboratory accreditation and notification of accredited laboratories.

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- ❖ Collect data on food consumption, incidence and prevalence of biological risks, contaminants in food products, and identification of emerging risks.
- ❖ Create a nationwide information network to disseminate rapid information about food safety and related concerns to the public, consumers, and Panchayats.
- ❖ Provide training programs for individuals involved in or intending to start food businesses.

C. BIS

The Bureau of Indian Standards (BIS), formerly known as the Indian Standards Institute, is responsible for the development, maintenance, and application of standards for products, services, and processes in India. It verifies the quality and standard of products and issues a BIS certification mark. Legislation enacted in 1986 permits BIS to provide certification, and the BIS certification mark is mandatory for the sale of certain products in India.

Difference between ISI and FSSAI

ISI previously stood for Indian Standards Institute, but it has now been renamed to the Bureau of Indian Standards (BIS). Additionally, the mandatory certification mark is now referred to as the BIS certification mark rather than the ISI mark. BIS is responsible for the development, maintenance and application of standards for products, services, and processes in India. On the other hand, FSSAI is the authority responsible for setting guidelines for all food items manufactured and traded in India.

D. AGMARK

It is a certification mark used on agricultural products in India to ensure that they fulfil a set of requirements established by the Directorate of Marketing and Inspection, a government agency. Each product's grading criteria are determined using scientific methods. Samples of agricultural goods are collected from across the country, straight from the producing area, wholesale marketplaces, etc. These items are then tested in AGMARK Regional Laboratories. The standards are developed and framed based on the information gathered.

Objectives

- ❖ To provide customers with high-quality, hygienic food items
- ❖ To confirm the quality and purity of agricultural goods produced by local farmers

Benefits

- ❖ It increases the quality of crops.
- ❖ It stabilizes the prices of the crops.
- ❖ It facilitates peaceful resolution of market disputes.
- ❖ It makes interstate and international marketing more convenient.

E. ISO

ISO (International Organization for Standardization) standards are essential for improving food safety and hygiene in India and increasing the country's share in the global food trade. ISO has a series of international standards aimed at ensuring food safety throughout the supply chain. The ISO 22000 family addresses food safety management by providing guidelines and best practices for managing risks in all areas of food production.

ISO 9000 is an international reference for quality requirements, focuses on the "Quality Management" of an organization. Adoption of these standards is voluntary.

Key areas

Within its broad scope, the ISO 22000 family includes standards specific to catering, food manufacturing, farming, packaging, and animal foodstuffs and feed production.

Benefits

- ❖ It improves customer confidence in food safety.
- ❖ Demonstrates a commitment to supplying safe foods.

F. FPO

The Fruit Products Order Mark (FPO Mark) is a mandatory certification mark for all processed and packaged fruits in India. The Ministry of Food Processing

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Industries is the regulatory authority responsible for certifying and developing standards for the manufacturing of fruit products in India.

Products covered under FPO

- ❖ Synthetic beverages
- ❖ Vinegar
- ❖ Pickles
- ❖ Dehydrated fruits and vegetables
- ❖ Squashes
- ❖ Jam, jelly and marmalades
- ❖ Tomato products
- ❖ Preserved, candied and crystallised fruits
- ❖ Chutneys
- ❖ Canned and bottled fruits, juices, pulps and vegetables
- ❖ Frozen fruit and vegetables etc.

G. International Codex Alimentarius

The Codex Alimentarius Commission (CAC) is an international food standards body established jointly by the Food and Agriculture organization (FAO) and the World Health Organization (WHO) in May 1963. Its objective is to protect consumer health and ensure fair practices in food trade.

Purpose

The main purpose of this programme is to protect the health of consumers, ensure fair practices in the food trade, and promote coordination of all food standards work undertaken by international governmental and non-governmental organizations.

Difference between Codex and ISO

Codex	ISO
The Codex is a set of international standards recommended for regulating food safety in different countries.	ISO standards are voluntary guidelines that focus on improving food safety management systems.

**ACTIVITY 19.2**

Visit a nearby hotel and observe the following:

- The area where food is prepared and served.
- How the food is prepared and stored.
- How the food is served.
- The food service area
- Washing area
- All persons involved in handling the food from pre-preparation to service.

Comment on the cleanliness and hygiene and give suggestions for improvement.

.....

.....

.....

Labelling requirements

Food label in the context of food safety is most crucial as it directly communicates important information to the consumer. The most important food labelling requirements that holds special place regarding food safety include:

- Name of the food
- List of ingredients in descending order
- Nutritional information
- Declaration regarding food (vegetarian or non-vegetarian)

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- Declaration regarding food additives
- Name and complete address of the manufacturer or packer
- FSSAI logo and license number
- Net content by weight or volume
- Retail sale price
- Consumer care details
- Lot/Code/Batch identification
- Date Marking – “Date of manufacture or packaging” and Expiry/Use by and manner of declaration of date of manufacturer or expiry/use by
- Labelling of imported foods
- Country of origin for imported products
- Instructions for use
- Declaration regarding food allergens
- Symbol for food materials not meant for human consumption



INTEXT QUESTIONS 19.7

1. mark is a mandatory for all processed fruit products in India.
2. FSSAI stands for
3. Codex Alimentarius Commission is jointly formed by
 - a. WHO & United Nations
 - b. FAO & United Nations
 - c. WHO & FAO
 - d. United Nations & UNDP

**WHAT YOU HAVE LEARNT**

- Every food product has characteristics and indices that can be measured using sensory, physical-chemical, or microbiological methods.
- Quality of foods may be defined as the blend of those characteristics that differentiate individual units of a product and have significance in determining the degree of acceptability.
- Quality control refers to the standards that maintain the quality of food products according to the customer acceptability.
- According to ISO, inspection of food quality is defined as an activity of measuring, examining, testing one or more characteristics of a food product and comparing the results with specific requirements to determine whether conformity is achieved for each characteristic.
- Quality Control (QC) is a system of routine technical activities used to measure and control the quality of the food production process.
- Quality Assurance (QA) involves a planned system of review procedures conducted by personnel not directly involved in the food production process.
- Food safety means assuring the acceptability of food for human consumption.

**TERMINAL QUESTIONS**

1. What are the different factors determining food quality?
2. What are pigments? Give examples.
3. Explain the different types of microbes responsible for food borne-illness.
4. Define food quality control. Why is it important?
5. What is PDCA approach?
6. What are the objectives of food quality inspection?
7. What is the difference between food inspection and food quality control?
8. What are the differences between QA and QC?
9. What is the importance of food safety?
10. What is a hazard? How is it linked with food safety?

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11. Explain the different types of hazards.
12. What is food adulteration? Give some examples.
13. What is the difference between GHP and GMP?
14. What is HACCP?
15. Explain the different principles of HACCP.
16. Discuss ISO and FSSAI.
17. What is the importance of FPO and BIS?

**ANSWERS TO INTEXT QUESTIONS****19.1**

1. Degree of excellence, a high standard, or value.
2. Appearance, color etc.
3. Intensity, wavelength.
4. The amount of free radicals that can cause an off-odor or off-flavor in foods.
5. Acid, base
6. Pigments
7. Spherical, spiral and rod
8. Viruses

19.2

1. Good Manufacturing Practices
2. Hazard Analysis Critical Control Point

19.3

1. Reactive, proactive
2. Inspection of raw material, inspection of production process and inspection of finish goods.
3. International Organisation for Standardization

**19.4**

1. Quality assurance
2. Quality control
3. False

19.5

1. Physical, chemical and biological
2. Physical hazard (option b)
3. True

19.6

1. Good Handling Practices
2. HACCP (option d)

19.7

1. Fruit Product Order
2. Food Safety and Standards Authority of India
3. WHO & FAO (option c)

GLOSSARY

Food quality control: It is the process of monitoring and maintaining food quality according to set guidelines to ensure that consumers receive safe and secure food.

Food contamination: The presence of harmful or objectionable substances in food items, such as microorganisms or chemicals, before, during, or after processing and storage is termed as food contamination.

Food adulteration: It is the addition of inferior substances to food or the lowering of food quality by extracting valuable ingredients.

Toxicity: The ability of a substance to cause harm under specific conditions.

Hazard: It is potential of a substance to cause toxicity. All toxic substances are hazardous, but not all hazardous substances are toxic.

GMP: Good Manufacturing Practices (GMPs) are the minimum sanitary and processing requirements necessary to ensure the production of wholesome food.

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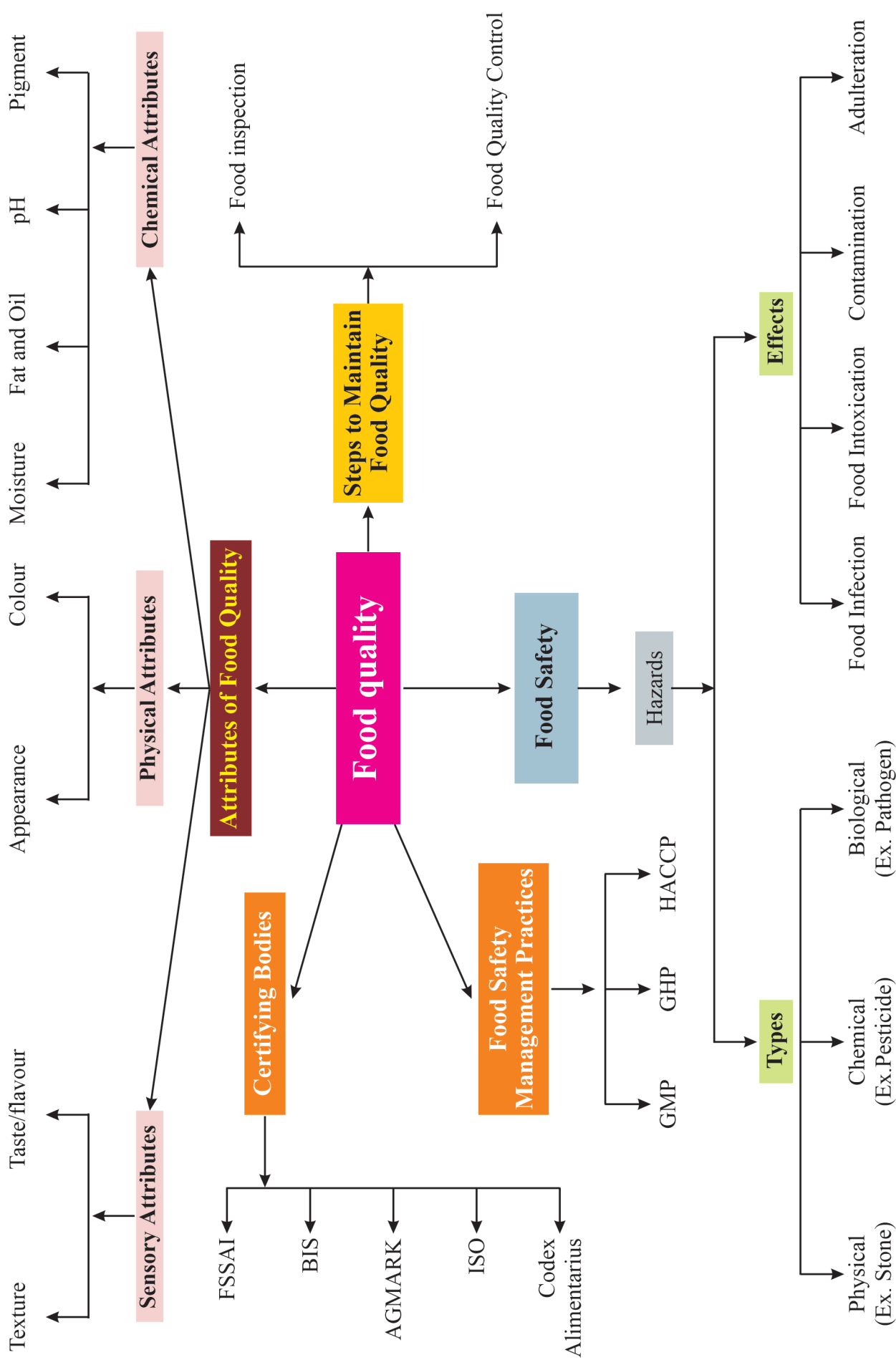
Notes

GHP: Good Handling Practices (GHPs) ensures that all individuals who handle food follow good hygiene practices.

SUGGESTED READINGS

1. *Food Safety and Quality*, TNAU Agritech Portal, Tamil Nadu Agricultural University, Coimbatore.
(<http://www.agritech.tnau.ac.in>)
2. *General Principles of Food Hygiene*, Food and Agriculture Organization, Rome, Italy.
3. *Principles of Food Safety and Quality Management*, eGyanKosh, Indira Gandhi National Open University, New Delhi.

WHAT YOU HAVE LEARNT



MODULE - 5

Agricultural economics, marketing and policy

- 20. Basics of Agricultural Economics
- 21. Agricultural Marketing and Policy
- 22. Agricultural Finance and Credit in India

*Notes*

BASICS OF AGRICULTURAL ECONOMICS

To meet the total demand of the country through local production by using own resources need large quantity of inputs. But no nation has all the resources to produce everything. For instance, India does not have a championship in producing pulses and oilseeds. These are largely imported. So, the demand for these products by India is fulfilled from local production and also through imports. Similarly, within India, not all states produce everything. Cotton is largely grown in Maharashtra and Gujarat, while people across India wear cotton textiles. You must appreciate the fact that it is good to produce something when the resources to produce it are available at the least possible cost to generate profits. Only then the production is sustainable and the business expands. So far, we have used several important terms such as demand, supply, and costs. You shall learn the basic concept of agricultural economics in terms of demand, supply, price, and cost in this lesson.



LEARNING OUTCOMES

After studying this lesson, the learner:

- explains the importance of learning economics;
- describes agricultural economics in terms of definition, nature and scope;
- infers characteristics of Indian agriculture industry;
- identifies the factors of production;
- summarizes the concept of demand and supply as well as their factors;
- defines the cost and revenue concepts; and

**Notes**

- demonstrates the practical applications and utility of demand, supply, price, and costs.

20.1 ECONOMICS - IT IS ABOUT SCARCITY AND CHOICES

In simplest terms, economics is the study of choice under conditions of scarcity. Scarcity arises because our wants are unlimited while resources are limited. We have less labour, less land, less time, less spending power, and less income, resulting in a shortage of resources. As all these things have limitations, we are forced to make choices. We choose to eat but not spend on expensive food outside. We choose to buy clothes from a local brand to feel good and not spend on more expensive brands. Economists study these choices that individuals make and their consequences. They also study the direct and indirect impact of these choices on society. Therefore, the scarcity of resources and the choices we make related to them form the base of economics.

Households have to make choices regarding different goods and services since their income is limited. They have to allocate their resources efficiently between consumption expenditure and savings. Business firms have to spend on raw materials and pay for wages, among other expenses. As these firms have to make choices on what to produce and what not to, they do so wisely by limiting their costs and allocating resources effectively. The government also makes choices and allocates budgets for different developmental projects, announces policies and programs, and carefully chooses which goals to pursue. Economists study these decisions and try to explain how individuals, society, and systems work and behave in a certain way. Adam Smith who is considered as ‘the father of economics’ wrote a famous book called ‘The Wealth of Nations’ regarding this phenomenon.

20.2 PRINCIPLES OF ECONOMICS

Economics is about the scarcity and management of scarce goods and services by people. For example, it involves how people decide on what and where to buy, as well as at what prices they would like to purchase a product or service. It’s all about making choices. We may encounter such questions daily, such as how to decide the amount of work to do, how much time to spend studying, or whether to go and play cricket or stay home and finish our lessons. Thus, under each of these scenarios, a choice has to be made with respect to time, which is a crucial resource. If you choose to go outside and play cricket, you will lose time for studying. Even if you wanted to do both, no two things can be done simultaneously. Spending more time playing cricket may reduce your time for any other activity, such as studying, listening to music, painting,

dancing, singing, or swimming, etc. Therefore, time has to be allocated in a way that maximizes the satisfaction derived from all of these activities. This is known as optimal allocation of resource (which here in this case is your time and labour).

When it comes to the economy, you may wonder how a firm (or a unit or a company) decides how much to produce. Is the decision of the firm guided by the price or the demand? How are demand and supply related to prices? Making such decisions is what economics is all about. Moving from people to firms and to the society, the society decides how much to spend on food and non-food items like health, education, etc. So, there seems to be an interaction between individuals and firms, and their interaction determines how much should be supplied for a particular demand. The prices at which the buyer agrees to buy and the seller agrees to sell are called the equilibrium price or market price.

The principles of economics therefore are categorized into three categories.

1. How do people decide?
2. How do people interact?
3. How does the whole economy work?

20.2.1 Principles of Individual Decision Making or How do People Decide

There are four economic principles related to it:

A. People make trade offs

The desire for the consumption of goods and services is limitless, but their production is limited by the availability of resources. For instance, you may want to grow all types of fruits, but your resources, including land, labour, and capital, are limited. Hence, you need to make decisions regarding which fruits to grow that can bring in the most profit with the existing resources. Therefore, the allocation of resources becomes crucial, and people have to make trade-offs. They have to sacrifice one goal to achieve another. You cannot grow all types of fruits, and you must prioritize the ones that align with your goals and available resources.

Similarly, if a society or nation decides to spend more on defence, it will have to spend less on other things like entertainment. However, it's crucial for a society to protect its borders from aggressors, so more spending is allocated towards safety and security rather than entertainment. This represents a trade-off; both



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cannot be achieved as the budget is limited. Therefore, it's necessary to allocate the budget efficiently and effectively.

B. People sacrifice something to get another thing

Because resources are scarce by nature, one has to make trade-offs and sacrifice something to gain another thing. This is also known as the principle of opportunity cost. In the examples discussed above, society sacrificed entertainment to gain protection from enemies, and student sacrifices sleep to get good results. Why do you do that? Simply because we assess the returns of every choice over the cost paid for it. You chose and paid for the music class over a painting class only when you assessed that learning music could potentially lead to singing on stage and making millions of rupees, which a painter might not earn. In other words, you sacrificed painting over music because you believed that music would give you better returns.

C. People make rational decisions by thinking at margin

Several times, we often make decisions by making incremental or decremental adjustments. These are known as marginal adjustments and are a common phenomenon that we see in people around us. For example, taking an additional course in the next semester. You will analyze the situation and consider whether those extra credits are good for your focus and time allocation to other subjects. You will add courses as long as the additional or marginal benefits are more than the additional or marginal costs. Therefore, marginality is the principle of intelligent or rational decision-making. Being rational means thinking at the margin. You are rational when you decide not to have an extra slice of bread when you feel full. Eating more will not give you any benefit and might make you sick. This is rationality. Growing an extra acre of land does not mean that you have to buy an extra tractor. One tractor can serve that extra acre as well. This is rationality. When is it good to get an extra tractor? Think!

Another example is the **principle of diminishing marginal utility**. But what is 'Utility'? The total satisfaction derived by consumers from consuming these goods and services is called 'Utility'. 'Marginal utility' means the additional satisfaction that a consumer derives by consuming the additional unit of a product. It is a good way to understand how consumers make decisions. As the amount of satisfaction derived from the consumption of a commodity increases, the consumption of the good decreases. This is known as the **principle of diminishing marginal utility**, and is an effective principle in making choices.

Let us understand it from an example, when you are hungry, the first bite of food gives you satisfaction and as you finish your first bread, your satisfaction increases. There is a time when you feel full and are not able to derive same happiness anymore from third, fourth or fifth bread. So your consumption is limited by the level of satisfaction that you derived.

D. People respond to incentive

Old but true proverb. Yes, we all respond to incentives. Remember what your mom told you when you were a child and wanted her to buy you a chocolate? She would have told you to behave nicely or finish your homework, and you happily did it in anticipation of the chocolate. Have you ever noticed how quickly you grab items from the shelf in the supermarket if there's a discount or an attached offer? This is what an incentive means. We respond positively to bonuses and interest received, and interest makes us keep our money in banks or other financial instruments. This money goes into the economy of the nation and is utilized for different purposes to build the nation's economy. So incentives are important. Wearing a seat belt is an incentive as it can save your life.



ACTIVITY 1

Go to a big retail chain (i.e. shopping mall or showroom) of your area and check wheather any offer is available for products. See if you really got attracted to these offers or not. If you did, that means you responded to the incentives offered by the shop. Share your experience.

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20.2.2 Principles of how do people interact

Somebody's decisions may affect others. The decision to sell can also bring benefits to the buyer. There are several interactions in the economy of this kind. Therefore, this set of principles consists of three principles in total, which are:

A. Trade makes everybody better off

A country cannot produce everything and cannot stand in isolation. Therefore,



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**Notes**

trade makes any country better off as some other country may produce what India is not producing or does not have resources to produce. As the world is now open with no boundaries, it is good to import from where there is a surplus. Trade balances demand and supply, stabilizes prices, and provides a large basket of consumption goods. It, therefore, makes everybody better off. This is also known as principle of comparative advantage.

B. Markets can organize a good economic activity

Markets are the places where the buying and selling of goods and services takes place. Households and firms interact with each other. Households make decisions related to what they want to consume and how much they can pay for it. They also provide labour. On the other hand, firms produce goods for these households by combining all the necessary resources, including labour. The interaction between households and firms leads to a market for labour (input) and finished goods (output).

C. Government's role is critical to improve market outcomes

Sometimes, markets fail to allocate resources effectively, and this is known as market failure. In such situations, the government can intervene and improve market outcomes. For example, in the absence of proper regulation, it is often found that pollution levels may be high or that there may be a high level of food adulteration. Laws and regulations help control these extremes and therefore improve market outcomes.

20.2.3 Principles of how the whole economy works

It covers three principles

A. Any country's standard of living is guided by its ability to combine resources to produce different goods and services

Around the world, countries differ from each other in the standard of living they provide for their citizens. Some parts of the world suffer from poverty, high mortality rates, high birth rates, low income, poor health and education, hunger, and malnutrition. Developed nations, on the other hand, do not face any of these issues. The level of effectiveness in combining resources plays a crucial role in determining a nation's prosperity. If a worker is more productive in America than in India, America can produce more in less time. This increased production may result in generating a surplus to export. Through export earnings,

incomes rise, leading to better consumption of food and non-food items, thereby improving the standard of living. However, if a country lacks resources or has scarce resources like water, it cannot produce a significant amount and heavily relies on imports. When you import, money goes out, and income does not improve, resulting in a lower standard of living. There are also countries that have resources, but they lack the technology to extract them. In such cases, someone else deploys the technology to extract these resources and exports them, and the money goes to the person who owns the technology, not the country where the resources are located. In this scenario, the standard of living of the country owning the resources does not increase. Please think about it!

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B. Price rise when the government prints too much money

Persistent price rise in General Price Level is known as inflation. If more money is circulated in the economy to chase goods and services, prices rise and inflation prevails.

C. Society faces a short-run trade-off between inflation and unemployment

In the short run, the response of prices to changes in the quantity of money in circulation is very slow. Hence, even when the government reduces the quantity of money in the short run, prices do not change immediately (inflation still persists). As a result, the demand for goods and services goes down, affecting productivity which then decreases. Due to low production, firms start laying off workers, resulting in short-term unemployment.



INTEXT QUESTIONS 20.1

1. Too many demands chase too.....resources
2. The cost of giving up something to get something else is called.....
3. People have to make choice as they are limited by the.....
4. Rational people think at
5. Too much printing of money leads to

**Notes****20.3 AGRICULTURAL ECONOMICS: DEFINITION, NATURE AND SCOPE****Definition:**

Agricultural economics is an applied social science dealing with how human choose to use technical knowledge and the scarce production resources such as land, labour, capital and management to produce food and fibre and to distribute it for consumption to various members of the society over a time (Cramer & Jensen).

Nature:

As agricultural economics is an applied social science, and is related with the allocation of scarce resources (land, labour, capital and management) in farm production, processing, and consumption; it is both theoretical and applied in nature. Theoretical, because it focuses on the development of principles of resource economics, production and distribution economics. It is applied in nature as it deals with the applications of these principles to production, consumption and distribution activities in agriculture. These principles have emerged from the basic principles in economics as discussed above.

Scope:

The scope of agricultural economics can be summarized precisely as follows –

- a. Agricultural economics deals with the relationship between different enterprises indicating choice of farming as an occupation and also between different streams or branches of farming, for example cultivation of crops, raising livestock, fisheries, poultry etc. or even between various crops.
- b. The optimum choice between the factors of production (example: how much should labour and capital be combined to produce a certain output) to maximize profit and reduce costs.
- c. Cost-benefit relationship or the relationship between factors of production and price
- d. Commercial relationships of farmers with the national and global markets

It is very important to know that agricultural economics as is applied branch, so it does not differ much from general economics. All tools that are used in general economics are also used in agricultural economics specialized towards agricultural goods and services.

20.4 CHARACTERISTICS OF INDIAN AGRICULTURE AS AN INDUSTRY, ROLE IN THE NATIONAL ECONOMY

- Indian agriculture sector is the primary sector of the economy that contributes around 18% (2nd advanced estimates of National Income 2022-23) to the national income and engages more than 55 per cent of the national population as workforce.
- India is one of the major agricultural players, globally and is one of the largest producers of many agricultural commodities. It is global leader in milk, pulses, and spices production, is second largest producer of wheat, rice, cotton, sugar, fruits, vegetable, and tea. For the year 2022-23, India's estimated production of food grains is 330.53 million tons as per 3rd advanced estimates of food grains released by the Ministry of Agriculture and Farmers Welfare and horticulture production is 351.92 million tons. Dairy is a fast-emerging sector in India. Milk production was 221 million tons in 2021-22, and poultry is a fast-growing sector in India. Today the combined gross value added by wheat and rice is lesser than the gross value added by the Milk alone.
- Agriculture provides raw material to the food processing industry which is poised for a larger growth year on year basis, indicating that the agriculture sector will tend to grow in the coming years. However, there are challenges. According to the last Agricultural Census held in 2015-16, the average land holding in India is 1.08 hectare which is continuously declining posing several challenges like use of advanced technologies on farm. Mechanisation is increasing, still the investment in the sector is low and that prevents gross capital formation hampering long term growth and development.

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Based on area of land, a landholding can be classified as

Less than 1 ha = marginal land

1 to 2 ha = small

2 to 4 ha = semi-medium

4 to 10 ha = medium

Above 10 ha = large holding

Further 1 hectare or 1 ha = 2.47 acre and 1 acre = 4046 m² (square meter)

**Notes**

- The average household farm income as per the survey conducted by the National Sample Survey Organization (NSSO) in 2019 is only Rs 10, 218 per month (increased from Rs 6446 per month as per previous survey conducted in 2014). The income is not just from crops, it also includes incomes from livestock, and income from off farm and non-farm sources (wages and salaries). Low incomes have prevented young skilled workforce to engage in agriculture. Many want to leave farming. In search of jobs and better resources, many migrate from less developed regions to more developed places for work. This results in the shortage of labour also hampering farm activities in the states from where large-scale migration happens.
- Therefore Government of India formed an Inter-Ministerial Committee under the chairmanship of Dr. Ashok Dalwai, then Additional Secretary to the Government of India, to double farmers' income in 2016, the committee submitted its report in 2018 giving more than 500 recommendations for enhancing yield, and production, building logistics and infrastructure for better marketing, introducing marketing reforms and space for new marketing institutions. The committee suggested improving resource use efficiencies like irrigation, seed and fertilizers, use of digital technologies and stronger extension services. Many recommendations have been put in place; biggest and most revolutionary being the Farmers Producers Organizations (FPO), digital agriculture, start-ups etc.
- Indian agriculture is also highly dependent on South West Monsoon. The changing climatic conditions have brought bigger challenges to the removal of hunger and poverty as part of Sustainable Development Goals (SDGs) 2030. India needs to make huge budget allocation in research and development in agriculture sector.

**ACTIVITY 2**

Visit a vegetable market. Try to purchase some vegetables. Notice and write the factors that affected your decision to purchase from a certain retailer.

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20.5 DEMAND AND SUPPLY**20.5.1 Demand**

Demand is your ability and willingness to buy a certain quantity of good at a certain price, other things being constant. Willingness means you have the desire to buy the product and ability means you can afford to pay for it. Until you have these two, you cannot create demand for any good or service. **The law of demand** states that a quantity demanded of a good and service during a given period relates inversely to its price, considering other factors remain constant.

If the price of good x is P_x and quantity demanded is Q_x , then according to the law of demand

$$Q_x = 1/P_x$$

As the relationship is inverse by nature, when price increases, quantity demanded decreases, and when price decreases, quantity demanded increases.

The nature of the demand curve is therefore downward sloping and it is due to two effects

- a) **Substitution effect:** As many wants to chase few resources, which increases the price of a good, then consumers substitute that good with relatively cheaper goods, and the quantity demanded of the cheaper goods increases (and vice versa). For example, you might consider replacing a costly pulse with a relatively cheaper one. If you do so, you will notice that the demand for the cheaper product rises while that of the costlier one decreases. Therefore, price and quantity demanded are negatively related to each other and the curve is downward sloping.
- b) **Income effect:** Income is of two types: money income, which is simply the total money a person receives, and real income, which refers to the purchasing power of the money earned. A fall in the price of a good increases consumers' real income, making them able to purchase more goods. For a normal good, this leads to an increase in the quantity demanded.

The movement along the demand curve is caused only by the change in price. In figure 20.1 below as the price decreases from P_A to P_B the quantity demanded increases from Q_A to Q_B . This is known as movement along the demand curve.



Notes



Notes

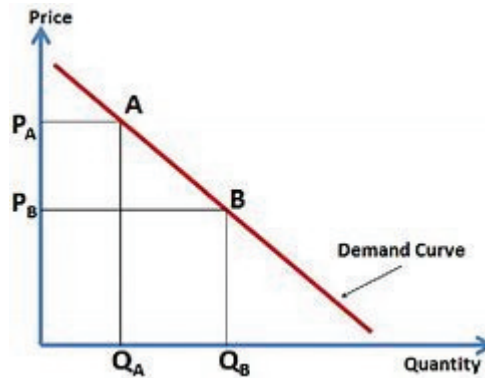


Fig. 20.1: Movement along the demand curve

Exceptions to the law of demand

There are certain exceptions to the law of demand where the inverse relationship between quantity demanded and price does not fit. These are

- For prestigious or luxury goods such as diamonds and BMW cars people prefer to purchase them at high prices. These items are typically bought by high-income individuals for whom prestige and luxury are important. An increase in the price of these items may even lead them to spend more, as the more expensive the possession, the greater the prestige one has in society.
- For necessary goods also, demand rises despite price rise. You will not stop consuming milk or reading the newspaper every morning. While milk prices have increased, people have not stopped consuming it. So the items of necessity do not follow the law of demand.
- Giffen goods do not follow the law of demand. They were named after a Scottish economist, statistician, and journalist named Robert Giffen in the late 19th century. These goods are low-income non-luxury items that have very few substitutes available in the market. As these goods are low-income or inferior, and do not have close substitutes, their demand does not decrease despite an increase in price. For example, bread can become a Giffen good during a war when there is no substitute. Although it may be an inferior good during normal times (when you might prefer to have pasta instead), the demand for bread increases during a war, and people will line up for it. Even if the price increases, demand will not decrease as there is no close substitute available.

Demand and the quantity demanded: It is very important to understand the difference between the demand and quantity demanded of a good. The change in the quantity demanded happens only when there is a change in price and it is represented by the movement along the demand curve as above (Fig. 20.1), the change in demand happens

due to the factors affecting demand i.e., income, price of substitutes, tastes, preferences, consumer expectations. In such cases whole demand curve shifts either upward or downward. An upward shift in the demand is known as increase in demand, while the downward shift indicates the opposite of it (decrease in demand).

Quantity demanded is reflected by movement along the demand curve, demand is reflected by movement of the demand curve. This is very important and shall be understood very carefully.

Factors affecting demand/ shifts in the demand curve: A demand curve indicates the relation between prices of a good and quantities demanded when other factors that could affect demand remain unchanged. These factors are also called determinants and are as follows

- Changes in income of consumer
- Changes in prices of substitute goods or complements
- Changes in expectations of consumers
- Changes in the number or composition of consumers
- Changes in tastes of consumers

The change in these determinants results in a change in the demand. At every price, different quantity is demanded, and so the entire demand curve is shifted either up or down (Fig. 20.2). This is known as movement of the demand curve and is possible only when the determinants change.

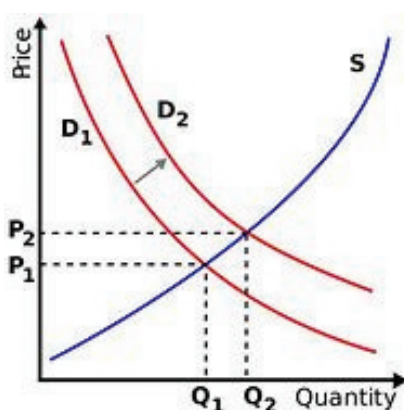


Fig. 20.2: Shift in Demand Curve (Change in demand)

Change in demand: When the demand increases, at each and every price, more of the good is demanded. The demand curve hence shifts to the right. In the following sections, we will discuss the shift in the demand curve and factors affecting these shifts.



Notes

**Notes**

- a. **Change in consumer income:** The goods are classified into two categories- Normal good and Inferior good, depending on the response for their demand to the change in consumer income.

A good is said to be normal when its demand increases when consumer income increases. An increase in income shifts the demand curve to the right means more of the good is demanded at each and every price. An increase in income will raise the demand for air conditioners.

An inferior good is a good whose demand increases as consumer income falls. For example, demand for public transport increases when income falls.

- b. **Change in price of related goods:** Related goods are of two types

I. **Substitutes:** These can be substituted for each other and cannot be consumed together. For example, wheat and maize, Pepsi and Coca-Cola. These goods are related in a way that an increase in the price of one shifts the demand curve for the other rightward. If the price of wheat rises, people tend to shift to a close substitute, such as maize, and therefore the demand for maize increases. The reverse also holds true. A decrease in the price of Coca-Cola leads to a decrease in the demand for Pepsi, simply because people demand more Coca-Cola at low prices.

II. **Complements:** Complementary goods are always consumed or utilized together, for example, a car and fuel, bread and butter. Therefore, when the price of a car increases, the demand for cars goes down, and as a result, the demand for fuel also decreases. This is because an increase in the price of one complement leads to a decline in the demand for the other. Similarly, when the price of bread decreases, there is a greater demand for butter because the low price of bread increases the demand for it, and since bread and butter are consumed together, the demand for butter also increases.

- c. **Change in consumer expectations:** Consumers expectations also change the demand. When they expect price to rise in the future, demand for the goods increases today. For example, if you expect that price of onion will shoot to Rs 150 per Kg tomorrow as against only Rs 50 today, your demand for onion will increase today. Opposite of it happens when consumer expects that prices will decline in the future. In that case demand slows down today.

- d. **Changes in consumer taste:** A change in taste of consumers creates altogether a new demand. For example, if you have developed a taste for momos, and many more like you, then the signal that goes to the momo maker is that more demand has come at all prices that he or she is offering for the product.
- e. **Changes in composition and number of consumers:** If there is a rise in population, demand for food will increase. If only vegetarian population increases, demand for fruits and vegetables will increase more than demand for meat and eggs.

**ACTIVITY 3**

Creation of demand is not easy. Try to sell a pen to your friend. See if you could convince him to purchase it. What did you do to convince him? How did you create the demand for this pen that you just sold? Share your experience.

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20.5.2 Supply

A supply is from the side of the producer. Supply refers to the relation between the price of a good and the quantity that the producers are willing and able to offer for sale during a given period, while other things are constant.

The law of supply states that the quantity of a good supplied during a given period is usually directly related to the price of the good. Increase in price leads to increase in quantity supplied and vice versa. The Supply curve is therefore upward sloping (Fig. 20.3)



Fig. 20.3: Supply curve



Notes

**Notes**

Like demand, movement of supply curve is caused by the change in . In that event it is known as change in quantity supplied (Fig. 20.4)

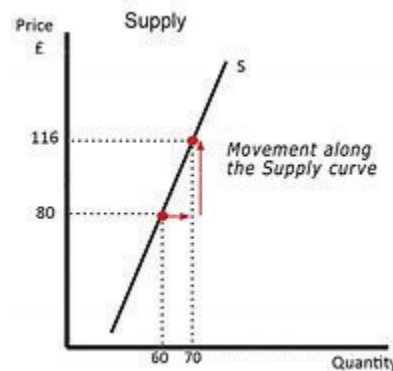


Fig. 20.4: Movement along the Supply Curve

Factors affecting supply cause movement of the supply curve

For the change of supply or movement of supply curve, following factors are involved. These factors are

- Technological changes
- Changes in prices of relevant resources
- A change in price of alternative goods
- Changes in expectations of producers
- Changes in the number of producers or suppliers

Changes in supply therefore are caused by changes in the factors or determinants to the supply curve. It results in changes to the relationship between the price and quantity supplied, and at each and every price, a different quantity is supplied. As a result, we get a new supply curve

A. Technological changes

Technology is the economy's stock of knowledge about how to combine resources efficiently. It is easy to supply more when one has an effective technology. For example, you can produce more with high yielding varieties of seeds (which is an improved technology) as compared to low yielding ones. Improvement in technology shifts supply curve right and degradation of technology reduces supply at all prices. Several researches have shown that using Micro Irrigation Techniques (sprinkler or drip irrigation) over conventional technique (flood irrigation) has improved the yield of the crop.

*Notes***B. Changes in price of relevant sources**

When the price of resources increases, it becomes difficult to procure those resources and combine them efficiently to produce goods. Supply increases when raw materials are available at cheaper rates. For example, if seeds, fertilizers, and labour become more expensive, it will be difficult for the farmer to purchase them and produce crops. When production decreases, supply will also decrease. The opposite is true when resources or raw materials become less expensive.

C. A change in price of alternative goods

Let us begin with an example. If the price of meat increases, producers of meat will supply more meat at all prices. As they increase the supply of meat, the supply of leather will also increase. How is this possible? It is possible because when animals are culled for meat purposes, their hides and skins are removed and utilized by the leather and other industries to produce leather and other products. Hence, high meat prices promote meat producers to supply more meat in the market, which leads to more culling and more availability of leather.

D. Changes in expectations of producers

If producers expect that the prices of resources used in the production process will rise in the future, they will supply less in the future (as the cost of production will rise), so the supply curve will shift downwards. If the expectation is the opposite, the supply curve will move upwards.

E. Changes in the number of producers or suppliers

It simply means that when the number of producers increases, generally the supply also increases, assuming other things remain constant. For instance, if there are more chocolate manufacturers, we can expect the supply of chocolates to increase in the market. Right? I hope you can relate to many such items.

**INTEXT QUESTIONS 20.2**

1. Movement of demand and supply curve is caused by
2. Movement along the demand and supply curve is due to
3. When price rise, other things constant, quantity demanded
4. Bread and Jam are.....goods.

**Notes**

5. Wheat and Maize are.....goods.
6. Goods that do not obey law of demand are calledgoods.

20.6 PRICE DETERMINATION

Prices are determined by the interaction of demand and supply forces. At higher prices, sellers are interested in supplying, but at lower prices, buyers are interested in buying. Both these forces interact with each other until there is an agreement on a price between sellers and buyers to sell and to buy, respectively. When this happens, the trade is executed, meaning the commodity is exchanged between the buyer and the seller, and the transaction is settled in cash. The buyer pays cash (the settled price, equilibrium price, or market clearing price) to the seller, and the seller transfers the commodity to the buyer. This market equilibrium is expressed in fig. 20.5. The figure expresses the price of talcum powder and the quantity demanded of the commodity. E is the equilibrium price arrived at by the interaction of demand and supply forces. At higher prices producers are willing to sell more and there is surplus because buyers are not willing to buy (see the quantity demanded at Rs 600 is 10 units while the supply available is 70 units indicated by point A and B). When no sale happens at that high price, sellers reduce the offer price and at E i.e., Rs 300, they find buyers to purchase talcum powder. At any point below E, example at Rs 100, you would see that buyers are willing to buy but sellers don't offer the product. Hence buyers relax themselves and get willing to purchase at a higher price. At low price there is shortage in the market, because sellers don't supply. The pressure again keeps the price back to point E. At E, you would see that both parties agree to trade (buy and sell).

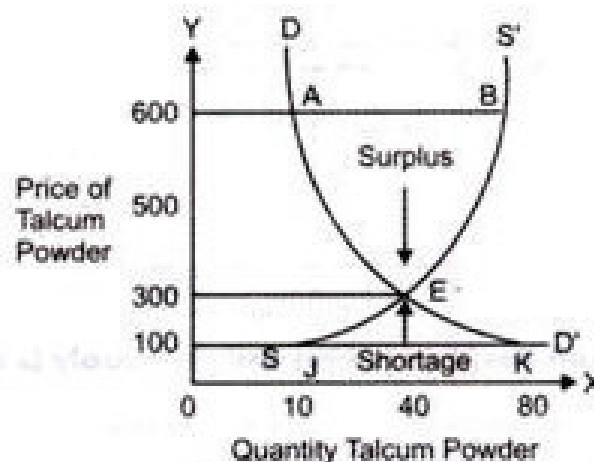


Fig. 20.5: Market Equilibrium example

**INTEXT QUESTIONS 20.3**

1. Price of a product determined by the interaction of demand and supply forces of market is termed as
2. If a product is available at higher price than equilibrium price, market receives surplus (True/False).
3. At lower price, demand is

*Notes***20.7 FACTORS OF PRODUCTION**

The major factors of production are land, labour, capital and management. The technical relationship of these factors is termed as production function. These four factors come together to produce crops and livestock goods and services. Land is the resource you all are aware. Without land, where will you grow? Labour is another crucial factor. It is the human effort that goes in the process of production. It could be a farmer's owned human labour which is known as family labour or could be hired. It is important to know that the labour could be of two kinds. One is just related to the number of humans engaged in the process of production, the other is efficiency of labour which is related to skills the humans have, also known as human capital. Acquiring of skills by workers is known as acquiring human capital. If the amount of human capital by workers can be raised, it will bring more efficiency in production.

Capital is the third factor of production. But what is capital? You might be wondering that any resource is called capital if it satisfies two conditions. i.e., 1. the resource must have been produced and 2. the resource should have the ability to produce other goods and services. One thing that is not considered capital is money. A firm cannot use money directly to produce other goods but it can certainly be used in acquiring capital which can then be utilized by human labor to produce a good or a service. For example, money cannot be grown on land. But from money, you can purchase capital like seeds, fertilizers, machinery, tools etc. which can be combined in different proportions by human efforts (labour) on a certain piece of land to yield a certain output of the crop. Management efforts help in combining all other resources well. A bad management has negative impact on yield and incomes. Hence management is considered fourth factor of production.

Budget in hand is always a limiting resource in combination of inputs or outputs. As a consumer we often think to make decisions of choosing among several commodities,



Notes

but we are constrained by the budget. Consumer makes rational decisions by combining the more number of low priced product and less of high priced product.

20.8 ELEMENTS OF COSTS AND BENEFITS WITH EXAMPLES

20.8.1 Short run and long run costs

In economics, **short run** refers to the time period of production when at least one of the resources or factors of production is fixed and cannot be changed. In short run, a firm can only change its variable resources. **Variable resources** are those that can change with the level of output. Examples of variable resources are seed, fertilizers, plant protection chemicals, manures, hired labour, etc. In short run therefore, a firm can change its level of production by changing its variable resources only. The costs incurred in short run are known as **short run costs**. It means that short run has both fixed and variable costs.

20.8.2 Long run Costs

It is easy for a firm to adjust its fixed and variable factors and hence it has more flexibility in adapting to changing conditions. For example, with changing climatic conditions, no new technology can be adapted in short run because technology development and adoption takes time. However in long run, technology development and adoption is feasible and hence in long run it becomes easy to expand size of firm. One can add more land in long run. The costs associated with these resources are known as long run costs.

20.8.3 Let us now understand fixed and variable costs

Fixed Costs: These are costs that do not change with the level of production, and have to be incurred by the producer irrespective of the increase or decrease in output. For example, land is a fixed resource and remains unchanged regardless of the crop yield. The cost of land is fixed, irrespective of the output a farmer gets from it. Similarly, if the land belongs to somebody else, the farmer has to pay rent, which remains constant regardless of the level of output. Machinery costs are also fixed and cannot be divided to produce less. Therefore, fixed costs are incurred at once in the production system.

Variable costs: These costs vary with the level of output. 1 kg of seed yields 100 kg of crop. To produce 200 kg of crop, one will need 2 kg of seed and hence shall pay for 2 kg. So, the cost of raw materials like seed, fertilizers, pesticides, manure, irrigation and labour cost of weeding, harvesting, ploughing are common variable costs incurred by a farmer in the production of crops.

Total costs: Fixed costs and variable costs together form the total costs incurred by a farmer.

Cost of Production: If the total cost is expressed in terms of the unit quantity produced, it is known as cost of production. Examples include rupees per kilogram (Rs./kg) or rupees per quintal (Rs./q) or rupees per ton (Rs./t).

Cost of Cultivation: If the total costs are expressed in terms of area under cultivation (Rs. per acre or Rs. per hectare), it is referred to as cost of cultivation (as you have cultivated an area under that crop).

An illustration of Cost of Production and Cost of Cultivation: For example, if you have incurred Rs. 10,000 to cultivate one acre of any crop then your cost of cultivation is Rs. 10,000 per acre. Now let us assume that from one acre of this crop, you received 100 Kg of the product then your cost of production will be Rs. 10,000/100 Kg. Right? If I wish to convert it into Rs./Kg then it can be expressed as Rs. 100 per Kg. It means that from one acre if you are producing 100 kg of a crop, your cost of production per kg is Rs. 100 per Kg and your cost of cultivation per acre is Rs. 10,000 per acre. Hope you understood the difference between the cost of cultivation and cost of production.

There are also concepts of average costs and marginal costs

Average cost: This is the cost incurred per unit of output. It is expressed as

$$\text{Average cost (AC)} = \text{Total cost/Quantity}$$

Marginal cost: It is defined as the change in total cost with respect to the change in the total quantity produced.

$$\text{Marginal cost (MC)} = \text{Change in the total cost/Change in the total quantity}$$

Total or returns: Returns are the receipts generated from the sale of the produce. These are the product of the quantity sold in the market and the sales price.

$$\text{Gross returns or total returns} = \text{Total output sold in the market} \times \text{Sales price}$$

Net returns: The net receipts generated after meeting the costs incurred are known as net returns.

$$\text{Net returns} = \text{Gross returns} - \text{Gross or total costs}$$

$$\text{Net returns over variable costs} = \text{Gross returns} - \text{Variable costs}$$

$$\text{Net returns over fixed costs} = \text{Gross returns} - \text{Fixed costs}$$



Notes

**Notes****ACTIVITY 4**

Meet a farmer in your locality. Ask him about his area of cultivation and the costs that he incurred for growing the crop in that season and convert it into per hectare (remember, 1 hectare = 2.47 acre). Please ask the fixed and variable costs both. Then enquire about his yield and price at which he sold the crop. Try to calculate the cost of cultivation of that crop. Find Net returns.

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**WHAT YOU HAVE LEARNT**

- Individuals face trade-offs while making decisions.
- The cost of sacrificing something to get some other thing is known as Opportunity cost.
- Rational people weigh marginal benefits and marginal costs.
- In case of a market failure, Government can improve the market outcome.
- Trade makes everybody better off and is the engine of any economy.
- If money grows in circularity, inflation rises.
- More productive a nation, better is its standard of living.
- Society faces a short-run trade off between inflation and unemployment.
- Agricultural Economics is applied social science which is all about combination of resources to maximize agricultural production, minimize costs and make optimum profits.
- Agriculture sector in India is flourishing but has several challenges.
- Doubling or enhancing farmers' income is important.
- Technology can make lives better, but its cost should not be too high.
- Demand and Supply situations govern the economy.
- A change in quantity demanded is not a change in demand.



Notes

- Change in quantity demanded is caused by a change in price.
- Change in quantity demanded is a movement along the demand curve.
- Change in demand is caused by a change in the determinants.
- Change in demand shifts the demand curve.
- Giffen goods and luxurious goods do not follow the law of demand.
- The quantity of a good supplied is directly related to its price.
- A change in quantity supplied is caused by a change in the price of the product, leading to a movement along the supply curve.
- A change in supply is caused by changes in the determinants, resulting in a shift of the entire supply curve either upwards or downwards.
- The satisfaction which is derived from consumption of a commodity is called utility.
- The principle of utility is an important principle in decision making process, especially the Principle of Diminishing Marginal Utility.
- People are bound by the budget in hand and that leads to substitution between input of output.
- If one wants to use machinery, naturally the labour usage will be low.
- The price at which the quantity demanded to sell and buy is agreed upon by a buyer and seller is called the equilibrium price.
- Total cost is further divided into fixed and variable costs.
- Fixed costs do not change with the level of output, while variable costs do change.



TERMINAL QUESTIONS

1. What is Economics? Who is the father of economics and which book he wrote?
2. Why does the society or the individual face the problem of trade off?
3. Explain the principle of opportunity cost.
4. What is demand? How is it generated?
5. Discuss the factors affecting demand.
6. Explain the characteristics of Indian agriculture.



Notes

7. What is the Principle of Diminishing Marginal Utility? Why it is important?
8. Discuss the short run and long run costs in agricultural economics.
9. Discuss the factors of production.
10. Why is the demand curve downward sloping?
11. Discuss the different exceptions of the law of demand.
12. What are complementary goods? Give examples.
13. What are substitutes? Give examples
14. Give examples of Giffen goods?
15. What kind of relationship do supplied quantity share with the price of that product?
16. Explain the determinants of supply.
17. How market equilibrium is determined?
18. Draw a graph of market equilibrium citing an example on your own and explain the same.
19. Explain the fixed costs that a farmer incurs.
20. What are the different kinds of variable costs incurred by a farmer?



ANSWERS TO INTEXT QUESTIONS

20.1

1. Less
2. Opportunity Cost
3. Income
4. Margin
5. Inflation

20.2

1. Factors affecting demand and supply
2. Only and only Change in price

3. Low
4. Complements
5. Substitutes
6. Giffen goods

20.3

1. Clearing Price
2. Surplus
3. Low

GLOSSARY

Economics: It is the study of choice under conditions of scarcity.

Agricultural economics: It is a branch of economics which studies how scarce resources like land, labour, capital or management can be used efficiently for better agricultural production and distribution to consumer.

Demand: Demand is ability and willingness of a person to buy a certain quantity of good at a certain price.

Supply: Supply is ability and willingness of a seller to provide a certain quantity of good to buyers.

Fixed cost: These are the costs which do not change with the level of production. E.g., cost of land, machinery or farm buildings.

Variable cost: These are the costs which vary with how much a farmer produces or sells. Examples for such costs are cost of seeds, pesticides or fertilizer.

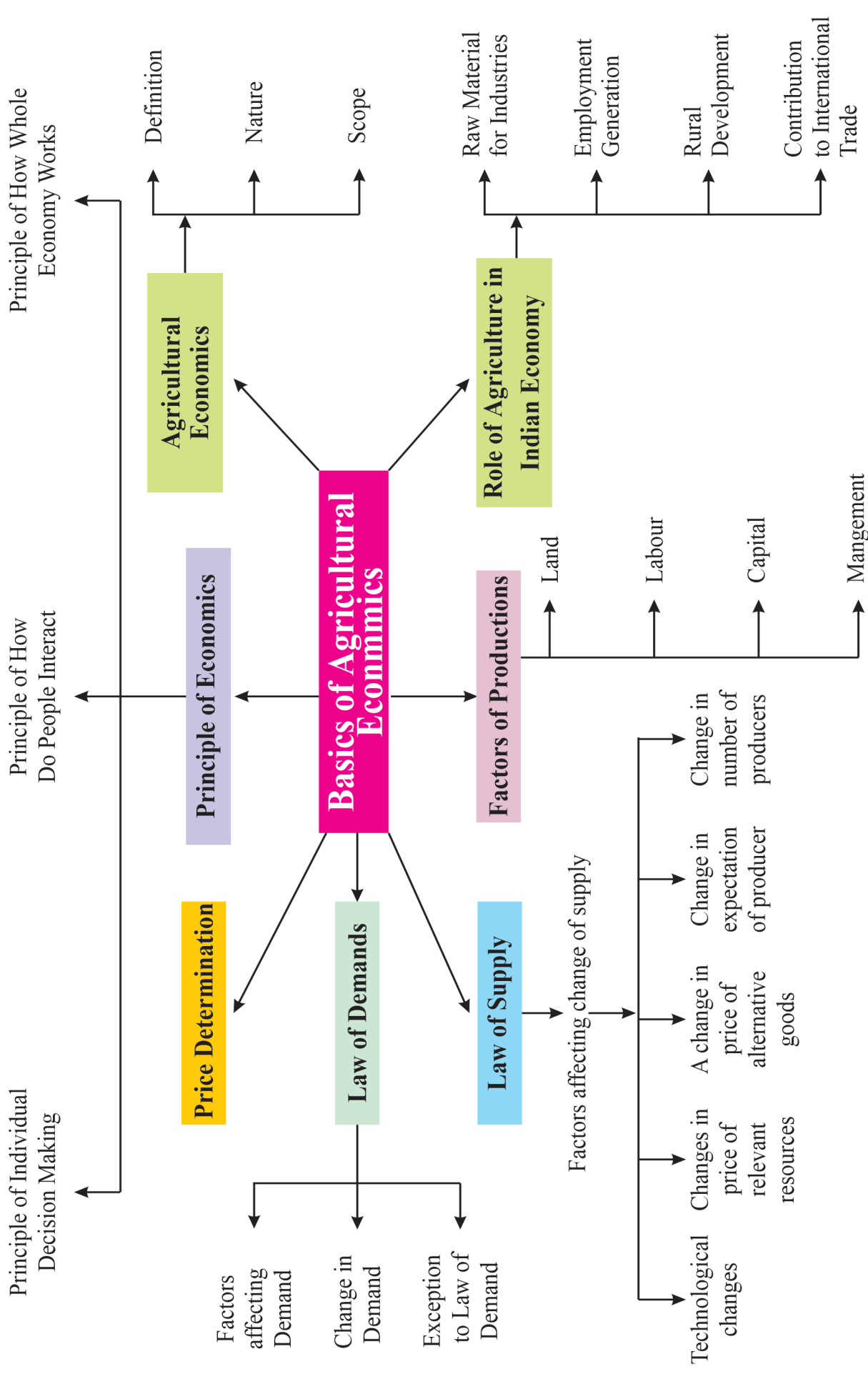
SUGGESTED READINGS

Hand Book of Agriculture, Published by Indian Council of Agricultural Research (ICAR), New Delhi.

Singh, A., Sandhu, A. N. and Singh, J. (2014). Fundamentals of Agricultural Economics, Himalaya Publishing House, New Delhi.

*Notes*

WHAT YOU HAVE LEARNT



*Notes*

AGRICULTURAL MARKETING AND POLICY

While the crops are produced in the fields, they move from producers to consumers to finally reach in their plates. Ever wondered what it takes to make the products reach from field to plate? Now as you know what is demand and supply and their interaction at equilibrium prices causes exchange, you should also know how a product reaches the stage of the exchange. The market is a place where exchange happens. It could be a physical or virtual market. All that needed is a buyer, a seller, the good and the medium of exchange, i.e. money. However in olden days medium of exchange was goods which was called barter system. The activities that facilitate the exchange are known as marketing activities. Marketing leads to the execution of trade and is one of the most important set of activities. In this lesson you will learn about marketing and the institutions engaged in the marketing of agricultural commodities in India. You shall also learn about the important policies of the Government of India to facilitate the marketing of agricultural goods.



LEARNING OUTCOMES

After studying this lesson, the learner:

- explains the concepts of agricultural marketing;
- identifies marketing channels;
- describes marketing functions;
- recognizes different marketing institutions and their role; and
- discusses Government policies to facilitate the marketing of agricultural goods.

**Notes****21.1 AGRICULTURAL MARKETING**

'Market' is a word that originated from the Latin word 'Marcatus' which means merchandise. It is related to a place where trade or business is conducted. To be considered a 'market,' a place must satisfy the following conditions.

1. It must have defined boundaries when it is physical. In e-commerce, the concept of boundaries dilutes.
2. There must be a commodity or a good for which the transaction will be carried out.
3. As the transaction happens (money for a commodity), there must also be buyers and sellers.
4. These buyers and sellers must interact with each other to arrive at equilibrium prices so that the transaction is settled.

Marketing creates time, place, form, and possession utility through various activities. Thomson suggested that agricultural marketing includes the study of all activities that facilitate the movement of goods from one end to another, as well as the agencies responsible for these activities. These activities create time, place, form, possession, and information utility for consumers. It is important to note that marketing ultimately leads to trade (exchange between a buyer and a seller).

21.2 UTILITY IN MARKETING

Demand is generated when there is utility. What is utility then? Utility simply means value and the customer or consumer wants value for money. If something does not generate utility or value or satisfaction for you, you will not spend the money on it or will not have any demand for it. Right? This utility is generated through five ways of marketing.

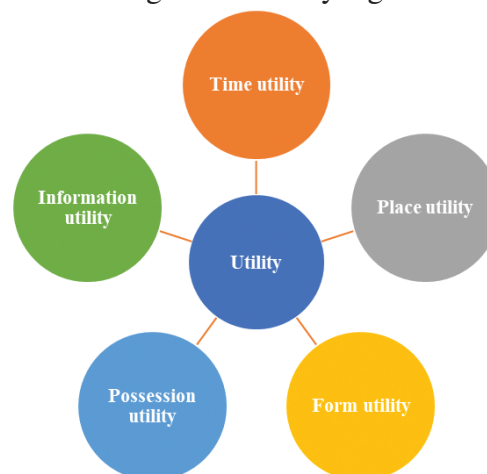


Fig. 21.1: Types of utility

21.2.1 Time utility:

It addresses the question of ‘When’? Is a commodity or good available when a consumer wants it? In other words, do you have a supply when the demand is raised? Only then does the commodity have value. What is the use of supplying woollens in summer? Nobody will purchase it, right? The consumer is willing to pay for any product when it is available at a desired time. The demand for cold drinks decreases in winter, so it is wise to produce less during winter. Crops are seasonal, and potatoes, for example, are demanded throughout the year but produced during only three to four months. To meet the demand in the off-season, potatoes are stored in cold storage. Storage ensures that potatoes are supplied to the population whenever there is a demand. Hence, people are willing to pay for potatoes. This is known as the creation of time utility. Storage adds value in terms of time. If you understand the demand of consumers and their timely needs, you will be able to create utility; otherwise, there will be no demand for your product.

21.2.2 Place utility:

It addresses the question, ‘Where do you need the goods or commodity’? Place utility refers to the activities that add value in terms of the availability of a product at a desired place. If you need mangoes in your location but they are not available, it will not help your business to grow. Transportation and logistics are the marketing activities that create place utility for consumers. Somebody who wants to provide mangoes at a desired place can create value by transporting them. Similarly, take the example of input service providers. If you purchase pesticides, seeds, or a tractor, some companies provide after-sales support or technical support in the field. Farmers prefer companies that provide such support services at a desired place, which is the field or farm for them. Online marketing, such as Amazon, is popular because you get timely deliveries right at your doorstep. Hence, place utility is created.

21.2.3 Form utility:

When value is added for the consumer by changing a good into a desirable form, demand for related products may increase. For example, if people demand pizza, the demand for cheese will increase. However, cheese is a processed form of milk, which adds value to milk. Processing creates form utility for the customer. Similarly, understanding what the consumer wants and serving the good in that form generates demand, known as form utility. Processing is therefore an activity in marketing that creates form utility for the consumer.

*Notes*

**Notes****21.2.4 Possession utility:**

A consumer shall be able to use a good immediately after its possession. Even if you possess something but are not able to utilize it, how can you achieve possession utility? So, possession of anything is useful if it creates a utility for you. For example, if you don't get (possess) money in time (loan/finance), will you be able to purchase the product without it? This happens with the farmer. When farmers don't have money, they would want the loan to carry on their farm operations. For the said purpose, they might want to go to the bank, but they don't take it from bank for several reasons, one of them could be a delay in disbursement of loan from the bank. So, the farmer would go to the middleman or a local trader for an advance and as that money or advance is instant, it creates possession utility for the farmer. The farmer can utilize it immediately for farm operations or other needs. Timely finance thus creates possession utility.

21.2.5 Information utility:

Latest to the list of utilities and not to be missed is information utility. If you have information, you will be able to take timely decisions, otherwise it is not possible in the absence of information. This era itself is known as the era of information technology. Digital connect has made information reach faster to the customer creating value for even new products and services in the market. Hence we can say that digitalization has created information utility for the farmer as timely and right information helps the farmer in taking many decisions related to crop production and marketing in time efficient manner.

**INTEXT QUESTIONS 21.1**

1. The term market is derived from a Latin word.....
2. Demand is generated when there is
3. Agricultural crops are.....in nature.
4. Transportation creates
 - a. Information utility
 - b. Place utility
 - c. Time utility
 - d. Possession utility
5. creates form utility.

21.3 MARKETING CHANNELS

Have you ever wondered how apples from a far orchard in Himachal reach the vendor in your street or the market? The goods move from the point of production to the point of consumption through different channels or routes and in this process, number of stakeholders are involved. These routes are known as marketing channels.

Generally, a contractor can buy the orchard and arrange for the picking and transportation of apples. The apples are picked on the farm and then sorted according to size, adding value to the apples on the farm. They are then properly arranged in crates and stacked neatly on trucks. Transportation adds utility to the apples, ensuring that they reach the right place at the right time, with no spoilage and uncompromised quality. The truck then reaches the cold storage or the wholesaler in the market. The processor can buy apples from cold storage or the wholesale market and use them for manufacturing apple juice. The apple juice is then packed under the brand name (for example, Swastham) and goes to retailers (supermarkets or retail stores in your location). Raw apples from wholesalers are also purchased by retailers, and then some small vendors purchase them from retailers to sell across streets and other markets. Finally, you or your family purchase and relish its taste. Thus, you can see that many intermediaries are involved in getting apples to reach you from markets. There are two routes or channels that you would have noted in the above discussion:

1. Channel I: Farmer → aggregator → cold storage → processor → retailer → consumer
2. Channel II: Farmer → aggregator → cold storage → wholesaler → retailer → consumer

There may be other routes also when there is no aggregator and cold storage

3. Channel III: Farmer → Wholesaler → Retailer → Consumer
4. Channel IV: Farmer → Wholesaler → Exporter
5. Channel V: Farmer → Retailer → Consumer

Every channel delivers the product to the final consumer. In case of cereals, the Food Corporation of India is engaged in procuring and distributing them through fair-price shops. Hence, one of the channels for rice and wheat (through the fair-price shops) is

Farmer → Food Corporation of India → Fair Price Shop → Consumer

If a village trade is involved, then the channel becomes

*Notes*

**Notes**

Farmer → Village trader → Wholesaler → Retailer → Consumer

Rice and pulses go through the millers to finally reach retailers and consumers. Thus millers are important in pulses and rice distribution channels.

A marketing channel is the chain of intermediaries through whom the various food grains pass from producers to consumers. Kohls and Uhl (2002) defined marketing channels as alternative routes through which the product flows from producers to consumers.

There are several factors that affect the length of marketing channels. If a product is perishable by nature, the length of the channel must be short, for example, fruits are harvested from the farmer's field and then are quickly transported to the point of consumption with less number of middlemen. Cereals, on the other hand, are picked from the field, then go to the processor, wholesaler, retailer, and consumer. In case of cereals and millers, processors are added to the channel. In case of oilseeds, we have oil extractors in the channel. The nature of the end product decides the length of the channel. If one wants to consume raw, channel will be short, with refined or processed form of the same product, the length will increase. Small units are sold through retailer; bulk is sold through wholesalers. Sometimes, neither wholesaler, nor retailer is involved; the product is directly sold to the consumers, like in Farmers' markets where one can directly purchase from the growers.

**INTEXT QUESTIONS 21.2**

1. Cereals have..... marketing channel than fruits.
2. Where does the consumer directly purchase product from the growers?
3. Why marketing channels are existing in agriculture market?

21.4 MARKETING FUNCTIONARIES

Following are the marketing functionaries involved in the marketing of the agricultural produce

21.4.1 Producers:

Producers, also known as farmers, are the first functionaries. Farmers perform important marketing functions like, grading, sorting, and cleaning, among others. They also sell

their produce in village or local markets. Farmers who are big and have relatively large produce to handle also perform the function of transporting the produce to distant markets and selling it to wholesalers in cities. Direct selling to wholesalers or large buyers in the cities helps farmers to earn profits.

21.4.2 Middlemen:

Middlemen perform various marketing functions and add value to the produce. However, redundant middlemen who do not add any value to the commodity ecosystem are not desirable. They can be classified as follows:

- A. **Merchant middlemen:** They hold the title of the goods and sell or buy them on their own. Further, the merchant middlemen are of two kinds:
 - a. **Wholesalers:** They trade in bulk. They may buy the agricultural commodities either directly from farmers or other traders (could be other wholesalers too) in the market and then sell it to the retailers either in the same market or in other markets. The functions performed by the wholesalers are:
 - Assembling the goods for consumers from different localities
 - Sorting the goods based on their quality
 - Maintaining the supply during peak and lean seasons
 - Regulate the flow of goods in various markets
 - Provide loan facilities to farmers to meet their requirements
 - They have storage facility also.
 - b. **Retailers:** Wholesalers are the point of purchase for bigger buyers, for example, processors who need the commodity in bulk. But what about the small quantities or small traders? The merchant middlemen who purchase from wholesalers and then sell in small units to the consumers are called retailers. These are closest to the consumers in any marketing channel.
 - c. **Itinerant traders:** These are petty merchants who purchase directly from producers. Generally, small and marginal farmers sell to itinerant traders as they don't have enough income to take the product themselves to the buyers in the markets. Itinerant traders move from one village to another and make this task easy for the farmers by purchasing the produce directly from them, transporting it to the market, and selling it there.



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d. Village merchants: As the name suggests, they function at the village level. It is generally found that in villages, farmers take loans from local traders because they believe that institutional sources of finance (such as banks) involve a lot of paperwork and are hard to access. The easy availability of loans from non-institutional sources of finance, such as these village merchants, binds them to sell their produce only to these village merchants. The village merchants not only provide loans to the farmers, but they also supply essential goods for consumption purposes to these farmers. Another feature of this relationship is that the farmers who sell to these village merchants are poor and therefore cannot go to distant markets to sell their produce.

B. Agent middlemen: Agent middlemen act on the part of their clients. They neither own the produce nor hold its title. The agent middlemen provide services and have nothing to do with the buying and selling of the goods in the market. Now you must be wondering what kind of services are needed in the markets. There are several services like weighing, grading, sorting, packaging, sewing bags, loading, unloading and many more. All these services are provided by the middlemen. In lieu of the services that these agent middlemen provide, they charge the farmer. This is known as their commission or brokerage. The Agent middlemen are of two types.

a. Commission agents or Arhatias: A commission agent acts as a representative of either the buyer or the seller in the market and handles the product in its physical form. Their job is to connect the buyer and seller and help execute the trade. They find prospective buyers and sellers and act as a mediator between them. The agent negotiates on both parties' behalf and is also responsible for arriving at an equilibrium price agreed upon by both parties. Upon the execution of the trade, they collect money from the buyer, deduct their commission, and pay the remaining amount to the seller. In exchange for the money, they deliver the goods in physical form. In unregulated markets, the commission agent is also known as an 'arhatia,' and these are two types: Kaccha arhatia and Pacca arhatia.

Kaccha arhatia: They act on farmers' behalf. They charge interest on the loan they provide to the farmers. Alongside, they also charge commission or arhat to the farmers.

Pacca arhatia: They act on behalf of traders like oil, pulse and rice millers, cotton and jute traders etc.

In regulated markets, the commission agent is only of one type and is known as an 'A' class trader. He occupies a shop or a godown for his client and charges for the service. He provides several other chargeable facilities to his client, who could be either farmers or traders.

- b. **Brokers:** Brokers are also service providers but they do not have the physical possession of the commodity. A broker brings together the buyers and the sellers, so that both parties can negotiate. For rendering this service or facilitating the negotiation between parties, brokers charge 'brokerage' which depends on the kind of services provided. In physical markets, their role is limited; however, they are essential for virtual markets.
- c. **Speculative middlemen:** Speculative middlemen hold the title to goods and make profits by trading them. They have access to a lot of information related to prices, production, weather, and other factors that affect the supply and demand of commodities, which helps them in discovering prices in the market. Their role is important as they help stakeholders make informed decisions. They absorb the risk of price and production by buying at low prices, giving signals to others to buy, and selling at higher prices, giving a sell signal. They make profits on short and long-run market fluctuations and exit the market accordingly. Other stakeholders like farmers and traders simply follow them.
- d. **Facilitative middlemen:** As the name suggests, these middlemen shall make marketing easy. Yes, you understood it right. Facilitative middlemen facilitate various marketing sub-activities and charge fee against rendering them. These middlemen are:
 - i. **Hamals or labourers:** They perform the loading and unloading of commodities on trucks or other transport means. They also assist in weighing bags in the market and also perform functions like, cleaning, sorting, refilling and stitching of bags. The fee that they charge is commonly known by the name of 'hamali'.
 - ii. **Weighmen:** They weigh the commodities and are paid by the commission agents for performing the job.
 - iii. **Graders:** They grade the commodity into desired grades in the market.
 - iv. **Transport agency:** The agency helps in providing transport facility to move the commodity from one to another market.



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- v. **Communication agency:** It communicates the prevailing prices and quantity available in any market.
- vi. **Advertising agency:** It is engaged in advertising about the product and its quality via different modes like newspapers, radio etc.
- vii. **Auctioneers:** They help in putting up the produce for auction purpose and inviting bids.
- viii. **e-marketing:** They help in selling the products online.

Marketing functionaries	Nature of work
Producer	Person who produces the product.
Wholesaler	Person who buys the produce from producer and add services to it. For this service, he charges a price before further selling the product at market.
Retailer	The market functionaries who sell the produce finally to the consumer.
Middleman/Commission agent	The market functionaries who provide the facilities for marketing of the produce.
Consumer	The person who finally pays for consumption of the produce.



INTEXT QUESTIONS 21.3

- Wholesalers trade in
- Merchant middlemen hold the of the good.
- In unregulated markets, commission agents are also known as
- Hamals are..... middlemen.

21.5 MARKETING FUNCTIONS

Marketing function is defined as any single activity which is performed in moving a product from production centre to the consumers. There are several ways to classify

marketing functions.

According to Thomsen, marketing functions are classified as:

A. Primary functions: These include

- a. Assembling or procurement
- b. Processing
- c. Dispersion or distribution

B. Secondary functions: These include

- a. Grading
- b. Standardization and quality control
- c. Packing or packaging
- d. Storage and warehousing
- e. Risk management
- f. Price determination or discovery
- g. Dissemination of market information
- h. Transportation
- i. Buying and selling
- j. Financing

C. Tertiary functions: These include

- a. Banking
- b. Supply of energy
- c. Electricity
- d. Communications – posts & telegraphs
- e. Market information



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Further the marketing functions are classified in following way¹:

- A. Physical functions:** These include
 - a. Grading
 - b. Storage and warehousing
 - c. Transportation
 - d. Processing
- B. Exchange functions:** These include
 - a. Selling
 - b. Buying
- C. Facilitative functions:** These include
 - a. Financing
 - b. Risk taking
 - c. Standardization of grades
 - d. Dissemination of market information

Another classification of marketing functions² is given in following way:

- A. Physical movement functions:** These include
 - a. Grading
 - b. Packing
 - c. Storage
 - d. Transportation
 - e. Distribution
- B. Ownership movement functions:** These include
 - a. Determining need
 - b. Creating demand
 - c. Finding buyers and sellers

- d. Negotiation of price
- e. Rendering advice
- f. Transferring the title to goods

C. Market management functions: These include

- a. Financing
- b. Accounting
- c. Securing information
- d. Formulating policies
- e. Providing organization supervision



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INTEXT QUESTIONS 21.4

1. Banking is function of marketing.
2. Give two examples of exchange functions.
3. Which of the following comes under primary function of marketing?
 - a. Banking
 - b. Processing
 - c. Communication
 - d. Risk management



ACTIVITY 1

Visit to a grain market or APMC market in your area and know about participants in the market and what do they do. Try to find out their margins. Don't you wonder why they are richer than your farmers?

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.....

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**Notes****21.6 MARKETING INSTITUTIONS**

Marketing institutions have a greater role to play in agricultural marketing. Marketing institutions means all government and private bodies including farmer and trader bodies which are involved in marketing functions. Marketing institutions give way to:

- Framing rules and regulations to facilitate trade
- Establishing organizations to perform certain marketing functions
- Establishing market infrastructure like storage, warehousing, grading and standardization facilities, and quality control labs, etc.
- Administering government policy and programmes
- Regulating demand and supply through various measures

21.6.1 Public sector marketing institutions:

- **Directorate of Marketing and Inspection (DMI), Faridabad**

It was established in 1935 to implement the policies and programs of marketing of agriculture and allied produce in the country.

- **Commission for Agricultural Costs and Prices (CACP)**

Established in 1965, CACP recommends two set of prices – Minimum Support Prices and procurement price.

- **Food Corporation of India (FCI)**

Established in 1965, FCI is involved in maintaining buffer storage and distribution of food grains across the country at affordable prices to the needy population.

- **Jute Corporation of India (JCI)**

Headquartered in Kolkata and set up in 1971, JCI works for the betterment of the jute cultivators, especially getting them access to the Minimum Support Prices for Jute.

- **Cotton Corporation of India (CCI)**

It was established in 1970 under Companies Act 1956. It is headquartered in Mumbai and engaged in trade, procurement and export of cotton.

- **Tea Board**

It was established under Tea Act 1953 and advances loan and subsidies to tea

growers for extension, planting, and replanting of tea gardens. It also promotes export, market intelligence, and participation of tea growers in fairs, exhibitions etc.

- **Coffee Board**

It was set up on December 21, 1940 under Coffee Market Expansion Act. It is located in Coorg, Karnataka and engaged in promotion of sales and consumption of Indian coffee in India and rest of the World.

- **Spices Board**

It was established in 1987 at Cochin, Kerala under Spices Board Act 1986. The Board looks after more than 50 crops, their quality production and exports.

- **Rubber Board**

It was established under Rubber Board Act 1947, in Kottayam, Kerala. The Rubber Board conducts research and training programmes to promote production of Rubber. The board also markets the rubber and provides extension services to the rubber growers in India.

- **Cardamom Board**

It was established in 1966 for developing activities to promote extension of cardamom plantation, improving cardamom's quality and for increasing the productivity of cardamom in India.

- **Tobacco Board**

It was established on January 1, 1976 under the Tobacco Board Act 1975. The main function of the board is to get remunerative prices to the tobacco growers in India.

- **Coconut Board**

It was established on 12th January 1981 and is headquartered in Kochi, Kerala. Its main function is to contribute to production and marketing of coconut through research and extension services.

- **Coir Board**

Coir board was established in 1953 under Coir Board Industries Act 1953, at Allepey, Kerala. The Board conducts research on different aspects of coir industry.



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- **Central Silk Board**
It was set up in 1949 under Central Silk Board Act 1949 in Bangalore. The board is engaged in development of the silk industry, export and import of raw silk.
- **National Horticulture Board (NHB)**
It was set up in 1984 under Societies Registration Act to promote horticulture crops in the country. The Board also established suitable infrastructure to facilitate production, processing and marketing of horticultural products in India. Credit its support, India's production of horticulture crops is more than the production of food grain crops (cereals, pulses, oilseeds etc.).
- **National Dairy Development Board (NDDB)**
It was established in 1965 and assigned the job of creating facilities to promote milk production and marketing in the country.
- **Central Warehousing Corporation (CWC)**
Established in 1962 under Warehousing Corporation Act 1962, it provides logistics support to Indian agriculture sector. It has close to 450 warehouses in India.
- **State Warehousing Corporation (SWC)**
- **Agricultural and Processed Food Products Export Development Authority (APEDA)**
It was established in 1986 and mandated with development of agricultural exports and maximizes foreign exchange through promotion and facilitation of agri-exports.
- **Marine Products Export Development Authority (MPEDA)**
It was established in 1972 to undertake promotional work for marine sector, its development and exports from India.
- **Export Inspection Council (EIC)**
It established to ensure quality of commodities for export from India.
- **Agricultural Produce Market Committee (APMC)**
APMCs are regulated markets to trade in agricultural and livestock produce.
- **e- National Agriculture Market (e-NAM)**
This is the unified national electronic market and helps in connecting farmers pan India through expanded market intelligence service.

*Notes***Cooperative Sector Institutions**

- Primary Agricultural Cooperative Marketing Societies
- National Consumers Cooperative Federation
- Farmer Producer Organizations
- National Cooperative Tobacco Growers Federation
- Special Commodity Cooperative Marketing Organizations (Sugarcane, Sugar, Milk)
- National Cooperative Development Corporation (NCDC)
- National Agricultural Cooperative Marketing Federation
- Tribal Cooperative Marketing Federation
- State Cooperative Marketing Federation

**INTEXT QUESTIONS 21.5**

1. The organization which maintains buffer storage on the behalf of government
 - a. National Horticultural Board
 - b. APEDA
 - c. Food Corporation of India (FCI)
 - d. National Dairy Development Board
2. The public sector institution responsible for agricultural export is
3. Which organization does declare the MSP (Minimum support price)?

21.7 GOVERNMENT POLICY SUPPORT**21.7.1 Agricultural Price Policy**

The agricultural product prices are characterized by

- The supply of agricultural produce does not adjust quickly to changes in demand or price.

**Notes**

- The cost of production varies across regions.
- The soil characteristics vary from region to region, resulting in application of diverse inputs and adoption of good agricultural practices. As a result, the output quality has large variations.
- Prices decrease during the harvest period and increase during the sowing period. This is due to the simple relationship between supply and prices. As the supply increases during the harvest period, prices fall. When the buyers absorb the supply from the market, prices start to increase. However, at that time, the farmer has nothing to sell.

What comes from this discussion is that the agricultural prices are volatile in nature for various reasons. The Government takes the responsibility of stabilising agricultural prices and takes the responsibility of public distribution through fair price shops or ration shops, and announcing the Minimum Support Prices (MSP) for 24 crops in India. These crops include cereals, pulses, oilseeds, sugarcane, and fibre crops.

History of Agricultural Price Policy:**Commission for Agricultural Costs and Prices (CACP):**

CACP was set up in 1965 under the Ministry of Agriculture and Farmers' Welfare upon the recommendations of L.K. Jha Committee. The commission's policy contributions are:

- a. **Minimum Support Prices (MSP):** The Cabinet Committee on Economic Affairs reserves the right to recommend the Minimum Support Prices by the CACP. These prices are announced to protect farmers against the steep downward fluctuation in price and act as an assurance against price uncertainty.
- b. **Procurement Prices:** These are the price at which the Government procures the food grains for deficit growing states, for serving the poor and below poverty line population and also to the regions that may face drought, floods or other calamities. These are always higher than the MSP.
- c. **Issue Prices:** These are below open market prices and always higher than procurement prices. Food grains prices supplied through fair price shops and rationing at subsidized rates are issue prices.

21.7.2 Farmer Producer Organizations (FPO):

It is noted that during the sowing season, farmers, especially marginal and small farmers,

don't have enough cash in hand to purchase inputs. These farmers are still at the mercy of bigger farmers or traders. Not only this, they face trouble getting their produce to the market on time and fail to negotiate prices with buyers. Over time, it has been observed that due to the challenges that the average farmer faces in India, the next generation does not want to take up farming as a source of living. A big question, therefore, is how to make agriculture a remunerative enterprise and how to retain farmers in it.

The challenge lies in ensuring that small and marginal holdings stay productive and remain the source of livelihoods for millions of people. Cooperatives have been suggested as one way to address problems and issues related to small and marginal farming in India. As a result, a large number of farmer cooperatives were born. However, the success of these cooperatives was limited to a few sectors and unpleasant in others. The cooperatives had to be registered with the Registrar of Cooperatives and focused more on welfare. It should be noted that commercial business was never the aim of cooperatives, so they could never develop themselves along those lines. As the operational area of cooperatives is confined to the boundaries within the state, there was less freedom for them to operate.

In view of the above constraints, the government thought of taking up an initiative and formulating legislation that would enable the incorporation of cooperatives as companies and the conversion of existing cooperatives into companies while ensuring that the main elements of the cooperative business remain intact in the new legislation. Later, on the recommendation of a committee headed by Dr. Y.K. Alagh in 2002, an amendment was made in the Companies Act of 1956. Part IXA was introduced in the Companies Act, named the 'Producer Companies Act.' The producer company has to be registered with the Registrar of Companies.

'Gujarat Cooperative Milk Marketing Federation' marketing dairy products under 'Amul' brand name, IFFCO, and KRIBHCO are among the largest producer cooperatives in the World.

21.7.3 Contract Farming/Marketing:

Contract farming is an agreement between a buyer and a seller where a seller provides the inputs to the farmers and also extension services as well. Quality is monitored to grow a crop as per seller's requirements, and thereby marketing of produce is assured to the farmers. PepsiCo, Kisan, and several other companies are engaged in contract farming in India. The Poultry sector is highly integrated and more than 90 per cent poultry farms run on contract.



Notes

*Notes***ACTIVITY 2**

Visit as many markets as you can. What are the strengths and weaknesses that you noticed? What can be done to improve these markets?

.....

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**WHAT YOU HAVE LEARNT**

- The term 'Market' is derived from the Latin word 'Marcatus' which means merchandise.
- A market must have defined boundaries. There must be a commodity or good for which the transaction will be carried out.
- As the transaction happens (money for commodity), there must also be buyers and sellers. The buyers and sellers must interact with each other to arrive at equilibrium prices so that the transaction is settled.
- Marketing creates time, place, form, and possession utility via different activities. Storage adds value in terms of time.
- Transportation and logistics are the marketing activities that create place utility for the consumer.
- Processing creates form utility for the customer by adding value to the commodity.
- The goods move from the point of production to the point of consumption through different channels or routes, and in this process, there are stakeholders involved. These routes are known as marketing channels.
- Producers, also known as farmers, are the first functionary in the market.
- Middlemen are essential as they perform different marketing functions, provide services, and add value to the produce.
- Redundant middlemen who do not add any value to the commodity ecosystem are not desirable.

- Middlemen are of four kinds: Merchant Middlemen, Agent Middlemen, Speculative Middlemen, and Facilitative Middlemen.
- In unregulated markets, the commission agent is also known as 'arhatia' and of two types: Kaccha arhatia and Pacca arhatia.
- Brokers are also service providers, but they do not have physical possession of the commodity. A broker brings together the buyers and the sellers so that both parties can negotiate.
- Speculative middlemen have the title to the goods, and they hold this title to make profits.
- Facilitative middlemen facilitate various marketing sub-activities and charge a fee for rendering them.
- The marketing function is defined as any single activity performed in moving a product from the production centre to the consumer.
- Marketing institutions mean all government and private bodies, including farmers and trader bodies, which are involved in marketing functions.
- The Cabinet Committee on Economic Affairs reserves the right to recommend the Minimum Support Prices by the CACP.
- MSP is protection against a steep decline in prices.
- FPOs are farmer collectives engaged in the marketing of inputs and outputs.
- Contract farming is an agreement between a buyer and a seller wherein a seller provides the inputs to the farmers and also extension services and quality monitoring to grow a crop as per his requirements, and thereby assures a market to the farmer.

**TERMINAL QUESTIONS**

1. Why do we need more of Farmer Producer Organizations?
2. Discuss marketing functions.
3. What are the different institutions involved in marketing?
4. What is the importance of middlemen in the market?

*Notes*



Notes

5. Describe the agricultural marketing system in India.
6. What do you mean by marketing channels?
7. What is contract farming?
8. What are the benefits of contract farming?
9. What do you understand by Minimum Support Prices?
10. What is procurement price?



ANSWERS TO INTEXT QUESTIONS

21.1

1. Marcatus
2. Demand
3. Seasonal
4. Place utility (option b)
5. Processing

21.2

1. Longer
2. Farmers' market
3. The market channel existing in the agricultural market facilitates the smooth flowing of product to consumers.

21.3

1. Bulk
2. Title
3. Arhatias
4. Facilitative

21.4

1. Tertiary
2. Selling and buying
3. Processing (option b)

21.5

1. Food Corporation of India (FCI)
2. APEDA (Agricultural and Processed Food Products Export Development Authority)
3. CACP (Commission for Agricultural Costs and Prices)

GLOSSARY

Market: A place where trade or business is conducted.

Marketing function: Any single activity which is performed in moving a product from production centre to the consumers. It includes assembling, processing, distribution, grading, storage risk management, selling etc.

Middlemen: Middlemen are group of persons in distribution chain facilitating flow of products from producer to consumer. They include wholesaler, retailer, village merchants, commission agent or broker.

Title of goods: The speculative middleman has the agreement with the producer to own the product on an agreed price. Further when he sells this product to whole seller or other market actors, he projects as if he is the owner of the product.

Utility: Utility simply means value. Demand is generated when there is utility.

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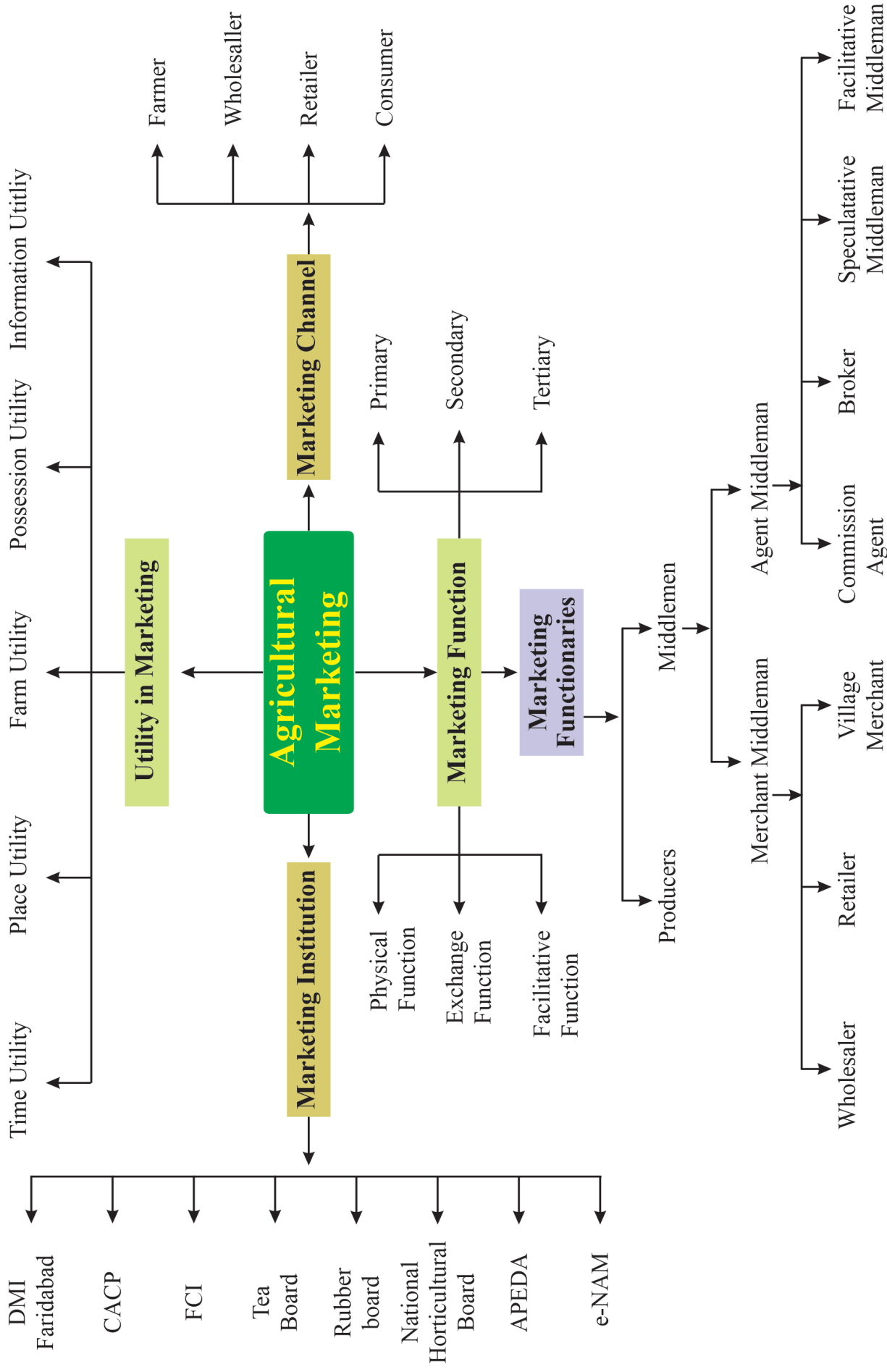
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Notes

WHAT YOU HAVE LEARNT





AGRICULTURAL FINANCE AND CREDIT IN INDIA



Notes

Agricultural credit and finance are the crucial components of the agricultural sector. Agriculture is an unpredictable industry where production relies on various factors, such as, weather, pests, diseases, and market fluctuations, among others. The high cost of inputs, such as, seeds, fertilizers, machinery, and labour require adequate financing. This is where financial institutions play a crucial role by offering a range of financial products and services, including loans, lines of credit, and insurance. Financial institutions help farmers in managing risks and increase productivity by providing the necessary capital to invest on their farms and improve efficiency of operations. Insurance also protects farmers against crop failures, natural disasters, and other unforeseen events. Financial product is the backbone for agricultural growth as it helps in the acquisition of inputs. Purchase of capital assets like, machinery and implements, development of infrastructure for irrigation, etc. depend on the flow of credit in agriculture. These credits are normally financed by financial institutions but in some cases the credit is also financed by non institutional sources, such as, professional money lenders, friends and families etc. Over the year, the share of credit by institutional agencies has been increasing sharply. This may be due to easy accessibility and simple lending process. Therefore, institutional credit system has reduced the burden of high rate of interest which used to be charged by private money lenders.



LEARNING OUTCOMES

After studying this lesson, the learner:

- recalls the necessity of timely availability of credit in agriculture;
- identifies the various public and private agencies working in the field of agriculture finance;

**Notes**

- differentiates between a cooperative bank and commercial bank and describes their role in agriculture finance;
- explains the concept of microfinance and how the model works in India; and
- assesses the significance of crop insurance and the Kisan Credit Card in supporting the farmers.

22.1 CREDIT AND FINANCE

Finance is an essential element required in any organization or business profession for its efficient operation. The process of financing includes activities, such as, lending, borrowing, and fund management. Agriculture is one of the largest livelihood providers in the country, requiring credit and other financial services. These services boost crop production, crop productivity and help farmers in times of distress, such as, droughts, floods, pests, diseases, and meeting their consumption needs. Credit is a crucial financial product because most farmers in India are small and marginal, with an average landholding less than 1.08 hectares (Agriculture Census 2015-16). These farmers, who hold 86.08% of total landholdings, often have poor or negligible savings and depend on credit to invest in inputs and technology. Additionally, crop insurance is necessary to mitigate the risks associated with agriculture¹.

The agriculture financing system in India consists of institutional sources and non-institutional sources. The institutional sources include commercial banks, credit co-operative banks, regional rural banks, microfinance institutions, and insurance companies working in the field of crop insurance. These institutions are under the purview of regulatory agencies such as Reserve Bank of India (RBI) and National Bank for Agriculture and Rural Development (NABARD). Whereas non-institutional sources of financing include money lenders, traders, friends and family, etc. These non-institutional sources are not regulated by any regulatory agencies.

Before independence, credit to agriculture was financed mainly by non-institutional sources (Central Banking Enquiry Committee Report, 1929 and Report on Agricultural Indebtedness, 1935). According to NSSO 77th round survey on agricultural households, out of total loan outstanding by the agricultural households, 69.6% loans were taken from the institutional sources among which the share of schedule commercial banks stood at 44.5%. The survey showed that loans were also taken from the agricultural and professional money lenders and the share of them in the total loan outstanding was 20.5%. This shows that today also non institutional sources of financing are present in India.



Notes

Institutional Credit & Agriculture

In India, the institutional setup for providing credit in agriculture consists of commercial, cooperatives and regional rural banks, which are regulated by the apex bank of our country, i.e., the Reserve Bank of India (RBI), and the National Bank for Agriculture and Rural Development (NABARD). They also refinance the activities of the banks in several areas in the field of agriculture.

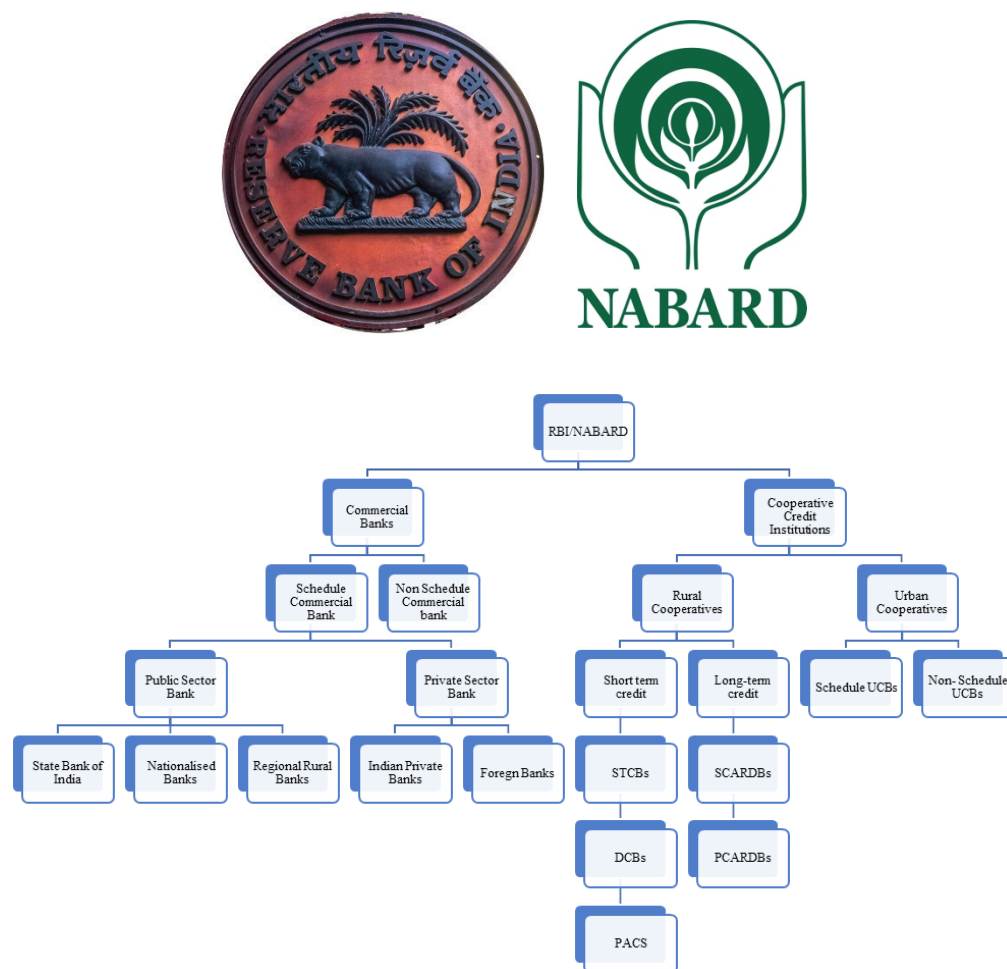


Fig. 22.1: Structure of banking industry in India (Source: RBI, 2007)²

22.2 COMMERCIAL BANKS

These are financial institutions that accept deposits from people and provide financial assistance to various individuals and corporations in the form of loans and advances. Besides that, they also perform several agency functions such as collection and payment of dividends, bills of exchange, interest, purchase and sale of securities, etc. These banks generally operate on a profit basis.

**Notes**

Commercial banks are of two types mainly:

1. Schedule commercial bank
2. Non-schedule commercial bank

Both the above categories of the banks are regulated by Banking Regulation Act 1949. The schedule commercial banks are included in the Second Schedule of RBI. Scheduled bank are those banks which satisfy certain criteria as laid by RBI Act 1934 such as having paid up capital and reserve of not less than Rs. 5 lakhs, their activities should not be detrimental to the interest of its depositors and these banks also need to maintain certain average daily balance with RBI.

These banks could further be divided into five groups based on their ownership and operations. These include:

1. State Bank of India
2. Nationalised Public Sector Banks
3. Private Sector Banks
4. Foreign Banks
5. Regional Rural Banks

The structure of Indian banking has evolved regularly since independence. A number of policy initiatives and reforms have been made so that the banking industry could be able to support the development of the economy as a whole. Few major steps post-independence included:

- ✓ Nationalisation of Reserve Bank of India on 1st January 1949
- ✓ Enactment of Banking Regulation Act, which empowers the RBI to supervise and regulate the banking industry in India.
- ✓ In order to increase the flow of rural credit, the committee on All India Credit Survey Report had recommended to form State Bank of India by integrating Imperial Bank of India, 10 major state associated bank and certain small associated bank. Based on this the state bank of India was formulated in the year 1st July 1955.

Most countries in the world have their own central bank to regulate the banking and monetary structure, especially those that issue their own currency. In India, the Reserve Bank of India acts as the country's central bank.

*Notes*

22.2.1 State Bank of India: Structure and functions

It is a multinational public sector bank of India with headquarter in Mumbai, Maharashtra. At present it is largest public sector bank in India. Origin of this bank dates back to pre-independence period in 1921 when Bank of Calcutta, Bank of Bombay and Bank of Madras were merged to form Imperial Bank of India. After independence, this Imperial Bank of India was renamed as State Bank of India in 1955. Before formation of Reserve Bank of India in 1935, it served as central bank of India.

22.2.2 Nationalised Public Sector Banks

Above initiatives set the ground for the development of banking industry in India, which could be able to support various sectors of the economy and could help the development of the Indian economy. To add to these, 14 largest commercial banks were nationalised during the year 1969 with a deposit of over ₹ 50 crores. These banks were nationalised so that they could give attention to the other priority sectors, such as, agriculture, and small scale industries etc. for the optimum growth of the economy and better utilisation of the resources. These banks include: -

- | | |
|-------------------------------|------------------------------|
| 1 Central Bank of India Ltd. | 2 Bank of India Ltd. |
| 3 Punjab National Bank Ltd. | 4 Bank of Baroda Ltd. |
| 5 United Commercial Bank Ltd. | 6 Canara Bank Ltd. |
| 7 United Bank of India Ltd. | 8 Dena Bank Ltd. |
| 9 Syndicate Bank Ltd. | 10 Union Bank of India Ltd. |
| 11 Allahabad Bank Ltd. | 12 India Bank Ltd. |
| 13 Bank of Maharashtra Ltd. | 14 Indian Overseas Bank Ltd. |

Further 6 more banks were nationalised in 1980 with a deposit liability of above or equivalent to ₹ 200 crores. These banks included Andhra Bank Ltd., Punjab and Sind Bank Ltd., New Bank of India Ltd., Vijaya Bank Ltd., Corporation Bank Ltd., and Oriental Bank of Commerce Ltd.

With nationalisation, 85 per cent of banking business comes under public control. The nationalisation of the commercial banks was done to involve them in developing the Indian economy and their resources could be channelized to rapid economic growth with social justice. These nationalised banks are also called public sector banks and

**Notes**

became utmost important player in providing different kind of credit and saving products to farmers. A number of initiatives had been taken to improve the financial health of public sector banks which includes mergers of banks after 1991 as per the recommendation of the Narasimham report. Today at present there are 12 major public sector banks (RBI, 2022).

Table 22.1: Details of Major Public Sector Banks and their merger

Sl. No.	Name of Public Sector Bank	Merged Public Sector Bank
1.	Bank of Baroda	Dena Bank and Vijaya Bank
2.	Bank of India	-
3.	Bank of Maharashtra	-
4.	Canara Bank of India	Syndicate Bank
5.	Central Bank of India	-
6.	Indian Bank	Allahabad Bank Ltd.
7.	Indian Overseas Bank	
8.	Punjab and Sind Bank	
9.	Punjab National Bank	New Bank of India Ltd., Oriental Bank of Commerce Ltd., and United Bank of India Ltd.
10.	State Bank of India	Merger of SBI with its associated bank
11.	UCO Bank (Formerly United Commercial Bank Ltd.)	-
12.	Union Bank of India	Andhra Bank Ltd., Corporation Bank Ltd.

22.2.3 Private Sector Banks

These are the banks whose major ownership is in the hand of private entities/corporations. These banks are granted license under banking regulation act to conduct banking operations. The report submitted by the committee on the financial system in 1991 under the chairmanship of Shri M. Narasimham Committee recommended the entry of private sector banks in the banking system of India. The committee proposed that there should be no bar to new banks in the private sector if they conform to the startup capital and other requirements. Based on these recommendations, 10 new banks were licensed by the RBI. Today we have a total of 21 scheduled commercial banks working in the private sector (RBI, 2022).

22.2.4 Foreign Bank

A foreign bank is a financial intermediary which operates outside its home country. These banks are required to comply the norms of both the native country and host country where they operate. Today as per the list of scheduled commercial banks, we have 44 foreign banks operating in the country.

22.2.5 Regional Rural Banks (RRBs)

Regional Rural Banks (RRBs) are also a kind of commercial bank, the banking commission in 1972 identifies that there is a need for a special type of banks to meet the credit need of people living in rural areas; as a result concept of rural bank had been emerged.

A working group was formed under the chairmanship of Shri M. Narasimhan in the year 1975 to provide recommendation on rural banks. The working group recommended the need for setting up a commercial bank which is sponsored by the state and are also regional based as well as rural oriented so that they are aware with the rural problems. These institutions are aimed at mobilising the regional resources available in the area in order to reduce the imbalances in the resources. The primary objective of these institution is to cater the credit need of farmers, labourers, small traders, artisans, and other weaker sections of the society for productive purpose mainly.

As a result, the first five Regional Rural Banks (RRBs) were formed in the year 1975 in Uttar Pradesh, Rajasthan, Haryana and West Bengal. These banks were incorporated under the Regional Rural Bank Act (1976). Their ownership is held by the central government, state government and the sponsor bank in the proportion of 50:15:15,



Notes

**Notes**

respectively. Currently we have 43 RRBs operating in India in different regions as per the list of scheduled Commercial Banks available with RBI.

**ACTIVITY 1**

Identify the Regional Rural Banks (RRB) present in your area.

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.....

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22.2.6 Small Finance Bank

On November 27, 2014, RBI issued guidelines for licensing of *small finance banks* in private sector. These banks were registered as a public limited company and granted license under the Banking Regulation Act. These banks were formed with the following objectives:

- ✓ Provision of saving for unserved and underprivileged sectors of the society
- ✓ Help in providing credit to small businesses, micro, small and medium enterprises, small and marginal farmers and other unorganised sectors through the utilisation of high technology which could result into low cost of operation.

Hence, the scope of small finance banks is to serve a niche segment of customers as per the above objectives. There are 11 small finance banks in India at present.

22.2.7 Payments Banks

Payment banks are also granted license by RBI on the recommendation of the Committee on Comprehensive Financial Services for Small Businesses and Low Income Groups formed under the chairmanship of Dr. Nachiket Mor. Payment banks were formed with the objectives of providing small savings accounts, payment and remittance facilities to migrant labours, low income households, small businesses, and other unorganised entities. These banks provide high volume low value transactions for deposits and remittance purpose. These banks were hence restricted to the acceptance of deposits and remittance services with a low value of transactions. At present there are four schedule payment banks in India. These include India Post Payment Bank

Limited, Fino Payments Bank Limited, Paytm Payments Bank Limited, Airtel Payments Bank Limited.

Note: - list of schedule commercial banks are available at the website of Reserve Bank of India (https://rbi.org.in/scripts/bs_viewcontent.aspx?Id=3657)



INTEXT QUESTIONS 22.1

1. Name the various types of commercial banks exists in India.
2. The bank which acts as central bank of India
 - a. Regional Rural Banks
 - b. State Bank of India
 - c. Reserve Bank of India
 - d. Indian Bank
3. Which bank caters the credit need of people living in rural areas?
4. How many regional rural banks are functioning in India?



ACTIVITY 2

Can you name two foreign banks and private sector banks in India?

.....

.....

.....

22.3 COOPERATIVE CREDIT STRUCTURE

The current cooperative structure of the country can be broadly divided into two parts: rural cooperative credit structure and urban cooperative structure.

A. Rural Cooperative Structure:

The *Rural cooperative structure* consists of the short-term and long-term credit structure.



Notes



Notes

The short-term credit structure provides short-term credit requirements of farmers at the grassroot level. It includes

- i. **State Central Cooperative Banks (StCBs):** These act as coordinating and regulatory agency between PACS and DCBs, and also act as a link between NABARD, RBI, and the money market. These banks are the custodian of the surplus funds and also receive financial assistance from NABARD and RBI from time to time. They also frame policies related to the organizational matters of PACS and DCBs. They are the apex institutes in this three-tier short-term credit structure.
- ii. **District Central Cooperative Banks (DCCBs):** The DCBs are affiliated with the SCBs and act as intermediary agencies. They mobilize funds from SCBs to PACS. It is a federation of all the PACS functioning under one district. They provide assistance to PACS and also help them in smooth functioning. They also conduct general banking business through their branches for members and non-members.
- iii. **Primary Agriculture Credit Societies (PACs):** These organizations are organized at the village level to deal directly with individual borrowers. They provide short-, medium-, and long-term loans. Over the years, PACS activities have evolved and now include not only general banking functions but also functions such as input distribution, agro-processing, and storage and warehousing.

The long-term credit structure comprises of a two-tier system

- i. The State Cooperative Agricultural and Rural Development Banks (SCARDBs) at the apex level
- ii. Primary Cooperative Agricultural and Rural Development Banks (PACARDBs) at the grassroot level.

Different states follow different systems under the long-term credit structure. Some states follow the unitary system, where SCARDBs operate at the state level and have various branches that serve at the grassroots level. On the other hand, some states follow the Federal system, where SCARDBs are at the state level, and at the grassroot level, we have PACARDBs. The SCARDBs provide long-term credit to their members for investment in farm and non-farm activities.



Notes

B. Urban Cooperative Structure:

While the urban cooperative structure consists of urban cooperative banks (UCBs), which are primary cooperative banks serving urban and semi-urban areas, providing general banking facilities in those regions. UCBs are registered under the provisions of the State Cooperative Societies Act or the Multi-State Cooperative Societies Act. The banking functions of SCBs, DCBs, and UCBs are regulated by the Reserve Bank of India according to the provisions of the Banking Regulation Act 1949.

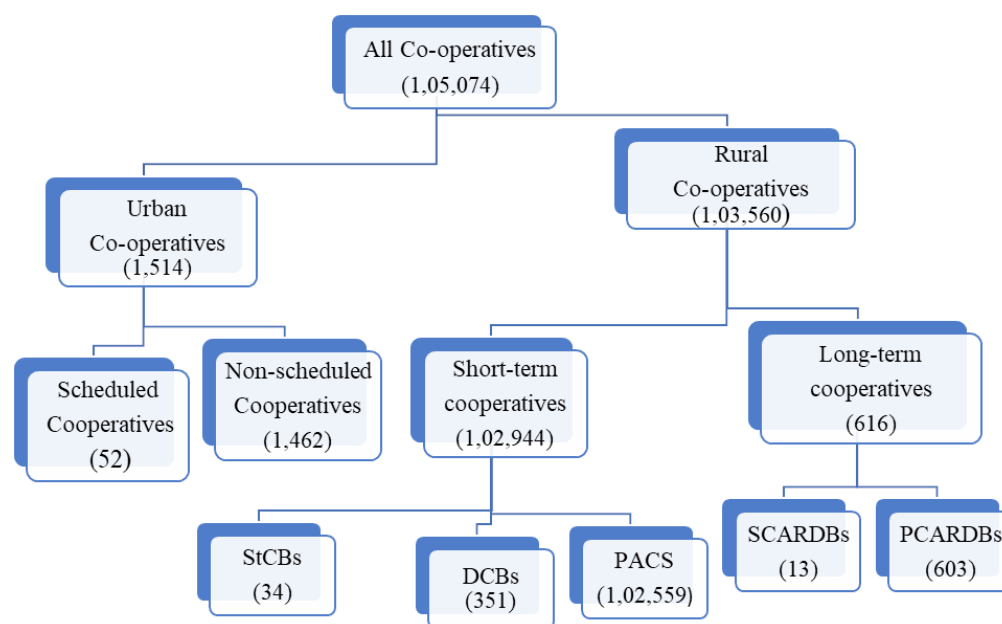


Figure 22.2: Structure of Cooperative in India (Source: RBI, 2022)³



INTEXT QUESTIONS 22.2

1. Which of the following cooperative credit structure is found at village level only?
 - a. Primary Agriculture Credit Societies
 - b. District Central Cooperative Banks
 - c. State Central Cooperative Banks
 - d. State Bank of India



Notes

2. PACARDB provides short term credit in rural areas (True/False).
3. Which cooperative bank does provide banking facilities in urban and semi-urban areas?

22.4 MAJOR TYPES OF INSTITUTIONAL CREDIT

The total credit requirements of farmers in India could be broadly classified into short-term, medium-term and long-term, based on the purpose and duration of requirements.

- A. **Short Term Credit:** It is granted for period of less than 15 months. The short-term credit mainly serves the purpose of farmers such as purchase of seeds, fertilizers, pesticides, and payment of wages to labourers, etc.
- B. **Medium Term Credit:** This is required normally for the purchase of implements and machinery, and cattle, etc. The duration of such loans is between a period of 15 months to 5 years.
- C. **Long Term Credit:** Long term credit need is required by the farmers for purchase of additional lands, and infrastructure improvements in the farms, etc. The duration of such loans is more than 5 years.

Before lending the credits to the farmers, banks make the assessment of repaying capacity and accordingly the amount of credit is decided.

The types of credit provided by these financial institutions to the farmers consist namely of followings:

- i. **Crop Loans:** It is a short-term loan given to farmers to meet their seasonal agricultural operations. The general duration of crop loans ranges from 6 to 18 months.
- ii. **Term Loans:** Loans provided for more than 18 months are called term loans. The main purpose of term loans is to purchase equipment, land, and other investments that support long-term production. Term loans can be categorized into two types:
 - ❖ Medium term loans that are repayable within 2-7 years
 - ❖ Long term loans that are repayable within 7-15 years

In India these credits are provided mainly through the commercial banks, regional rural banks and cooperatives.

Table 22.2: Percentage share of financial institutions in agriculture credit in India (Source: RBI, 2022)

Year	Cooperatives Banks	Regional Rural Banks	Commercial Banks
2015-16	16.7	13.0	70.2
2016-17	13.4	11.6	75.0
2017-18	12.9	12.1	74.9
2018-19	12.1	11.9	76.0
2019-20	11.3	11.9	76.8
2020-21	12.1	12.1	75.8
2021-22	13.0	11.1	76.0

*Notes***INTEXT QUESTIONS 22.3**

- The medium term credit is granted for maximum period of
 - 10 years
 - 5 years
 - 15 years
 - 20 years
- Which type of credit is required for purchase of seeds, fertilizer or pesticides?
- Crop loan is a type of long term loan (True/False).
- Agricultural land or machineries are purchased by the term loans (True/False).

22.5 MICRO FINANCE IN INDIA

Microfinance is the provision of small loans to the poor and vulnerable sections of society. It is a mechanism that ensures that the poor and vulnerable sections receive financial services such as thrift, credit, etc. in small amounts to meet their financial



Notes

product requirements and enable them to increase their income levels and improve their living standards. The concept of modern microfinance was institutionalized by Muhammad Yunus in Bangladesh, who developed a successful model for delivering small loans to rural people through the Grameen Bank.

The emergence of this concept can be traced back to the 16th century when loan funds emerged in Ireland in 1720 to serve the poor. The funds were mainly utilized for lending to traders with poor financial conditions. The loans were interest-free and without collateral. The amount of the loan was small, typically five or ten pounds, and had to be repaid weekly. These funds were seen as an effective tool to alleviate poverty and an excellent example of sustainable microfinance. Several initiatives have been taken by apex authorities to uplift the microfinance movement in India, including the introduction of the self-help group (SHG) bank linkage program and the establishment of microfinance institutions in India.

Generally seven and more people having common interest and goal with mutual understanding can form the self-help group. The members may have equal representation of genders and may involve all communities without any religion bias. The SHG bank linkage approach is based on the savings of group members, usually consisting of 10-20 people from a homogeneous class, who can obtain bank loans. Savings act as partial collateral, and the joint liability characteristic of the group members for the loan ensures timely repayment. The SHG Bank Linkage Programme was introduced in 1992 as a pilot project by NABARD, which aimed to link 500 SHGs to banks. The program was a huge success and emerged as the most popular microfinance model in India. According to NABARD's Annual Report (2022), in 1996, 4,750 SHGs were credit-linked to a bank loan of ₹ 6.06 crore. This number increased to 33.98 lakh SHGs with a credit-linked to ₹ 99729.22 crore and 118.93 lakh SHGs with a deposit of ₹ 47240.48 crore by the year ending March 2022.

The SHG approach helps to build social capital that provides financial services, such as, savings and credit products to the most vulnerable section of society, who were previously not seen as a profitable venture by traditional financial intermediaries due to their income level. The formation of SHGs is based on the concept of “saving first and credit later.” This model has led to the building of significant social capital in rural areas and mobilization of savings. It is worth noting that approximately 80% of these groups are exclusively women's groups. The provision of credit enables individuals and businesses to generate livelihood opportunities, thereby increasing income levels and alleviating poverty. Therefore, to reduce poverty and foster overall economic growth, it is necessary to expand and deepen the coverage of this microfinance movement in India.

**INTEXT QUESTIONS 22.4**

1. Concept of microfinance originated in
 - a. India
 - b. New Zealand
 - c. Netherland
 - d. Ireland
2. Who introduced the concept of modern micro finance?
3. Initiatives to improve microfinance in India are and

*Notes***22.6 CROP INSURANCE**

Crop insurance is a type of insurance that farmers can purchase to protect themselves from losses that may occur to their crops due to natural disasters, such as, floods, droughts, or other unforeseen perils beyond their control. Therefore crop/livestock insurance acts as protection shield for client (farmers) against adverse situations which may be natural or man-made disasters. The Government of India (GOI) runs four major crop insurance schemes, including:

- **Pradhan Mantri Fasal Bima Yojna (PMFBY):** It provides protection to the farmers against financial losses arising from crop failure due to natural calamities such as drought, flood, natural fire, lightning, pest and diseases, etc. It mainly covers food crops like, cereals, millets and pulses, oilseeds, and annual commercial or horticultural crops as notified by the government.
- **Weather Based Crop Insurance schemes:** It is a kind of insurance which aims to protect the farmers from the losses in the crop production/yield arising because of adverse climatic conditions such as rainfall, temperature, and humidity etc. It covers food crops, oilseeds and horticultural or commercial crops as notified by the government.
- **Coconut Palm Insurance Scheme:** This scheme was launched to provide protection to palm growers against the risks arising due to the failure of palms due to pest diseases, climatic changes, and natural disasters.
- **Unified Package Insurance Scheme:** It is a comprehensive scheme that includes not just one insurance policy, but a bouquet of several insurances that

**Notes**

may be needed by farmers to safeguard them from financial losses. It covers a total of seven sections. The sections covered under the scheme include:

- ❖ Crop insurance
- ❖ Personal accident insurance
- ❖ Life insurance
- ❖ Building and contents insurance (Fire and allied hazards)
- ❖ Agriculture pump set insurance
- ❖ Student safety insurance and
- ❖ Agriculture tractor insurance

Among these, crop insurance is a mandatory section that farmers must choose. However, farmers need to select at least two other sections from the remaining six in order to qualify for the applicable subsidy under the crop insurance section. Further animal insurance schemes are also being implemented in India wherein cows, buffalos and other small animals are insured. There are government guidelines for smooth implementation of livestock insurance schemes in the country.

22.7 KISAN CREDIT CARD

The introduction of Kisan Credit Card (KCC) scheme was done in the year 1998. The main aim to issue KCC is to provide credit to the farmers timely and hassle free under a single window system. KCC is short-term credit along with a component of long-term credit which aims to meet the following requirements of the farmers:

- Short-term credit requirement to meet the cultivation cost and maintenance cost
- Post-harvest expense
- Marketing loan for the produce
- To meet the consumption requirement
- Long-term investment need for agriculture and allied activities

The repayment period is generally fixed by banks based on the anticipated harvesting and marketing periods required for the crops for which the loan has been granted. The term loans are typically repayable within a period of 5 years. The financial institutions that introduce KCCs include public and private sector banks, RRBs, and cooperative banks.

**INTEXT QUESTIONS 22.5**

1. A farmer can reduce his loss due to natural disaster by purchasing
2. Give two examples of crop insurance scheme run by Government of India.
3. Kisan Credit Card was introduced in
 - a. 1994
 - b. 1998
 - c. 2000
 - d. 2004
4. What was the main purpose behind the introduction of Kisan Credit Card (KCC)?

**WHAT YOU HAVE LEARNT**

- The term finance means activities, such as, lending, borrowing and management of funds.
- The agriculture financing system in India consists of financial institution namely commercial banks, credit co-operatives banks, regional rural banks, microfinance institutions, insurance companies working in the field of crop insurance.
- Commercial banks are the financial institutions that accept the deposits from the people and provide financial assistance to various individuals and corporations in the form of loans and advances.
- The current cooperative credit structure of the country can be broadly divided into two parts: rural cooperative credit structure and urban cooperative structure.
- Micro finance is the provision of small loan to vulnerable and poor section of the society.
- The main aim to issue KCC is to provide timely and hassle free credit to the farmers under a single window system.

*Notes*



Notes



TERMINAL QUESTIONS

1. Define the structure of Indian banking system.
2. What is the reason behind nationalization of banks in India?
3. Differentiate between crop loan and term loan.
4. Why Crop insurance is important for farmers?
5. Explain the concept of
 - a. Micro Finance
 - b. Crop Insurance
 - c. Regional Rural Banks
 - d. Small finance and payment banks



ANSWERS TO INTEXT QUESTIONS

22.1

1. State Bank of India, Nationalized Public Sector Banks, Private Sector Banks, Foreign Banks, Regional Rural Banks
2. Reserve Bank of India (option c)
3. Regional Rural Bank
4. 43

22.2

1. Primary Agriculture Credit Societies (Option a)
2. False
3. Urban cooperative banks (UCBs)

22.3

1. 5 years (option b)
2. Short term credit
3. False
4. True



22.4

1. Ireland (option d)
2. Mohammad Younus
3. The self-help group-bank linkage program and the establishment of microfinance institutions

22.5

1. Crop insurance
2. Pradhan Mantri Fasal Bima Yojna (PMFBY) and • Weather Based Crop Insurance schemes
3. 1998 (option b)
4. To provide timely and hassle-free credit to the farmers through a single window system

GLOSSARY

Agricultural Cooperative: An agricultural cooperative in India is a voluntary association of individuals who work together in farming to achieve their common goals (e.g., agricultural production, marketing of agri-products etc).

Agricultural Credit: The quantity of investment money made available for agricultural output is known as agricultural credit.

Commercial Bank: Financial institutions that accept deposits from people and provide loans to various individuals and corporations in the form of loans and advances.

Finance: It is an essential element required in any organization or business profession for its efficient operation. The process of financing includes activities, such as, lending, borrowing, and fund management.

Microfinance: It is the provision of supplying small loans to the poor and vulnerable sections of society.

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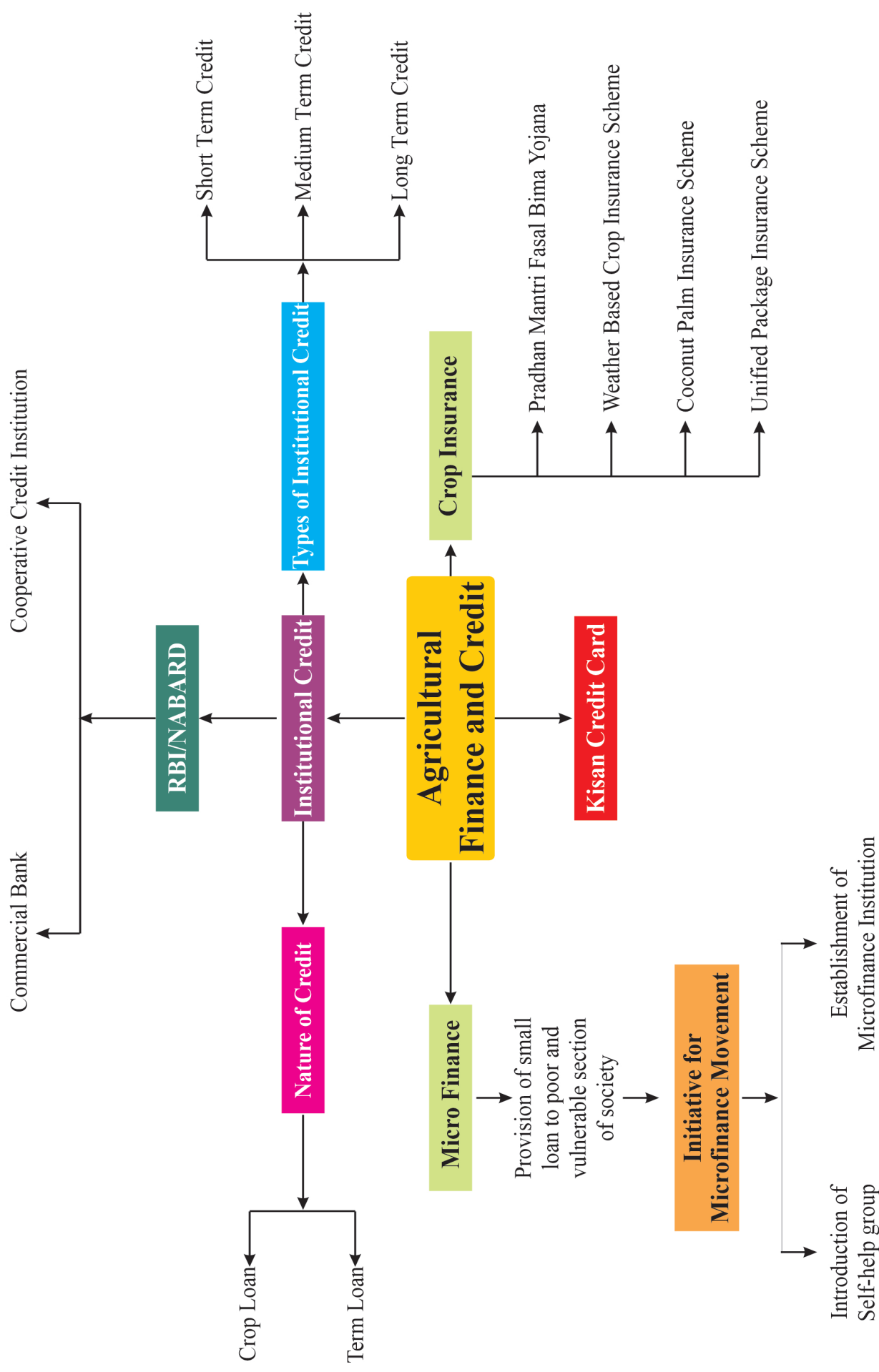
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WHAT YOU HAVE LEARNT



MODULE - 6

Enterprises in Agriculture

- 23. Entrepreneurship: Nature, Types and Levels
- 24. Importance of Self-help Groups in Agriculture and Village Economy
- 25. Career Opportunities in Agriculture Sector



ENTREPRENEURSHIP: NATURE, TYPES AND LEVELS

India's economy is growing rapidly despite the unfavorable geopolitical conditions. Recently, India witnessed corona pandemic, but it took this challenging situation as an opportunity to demonstrate its capability and strength to the world by swiftly manufacturing vaccines and other healthcare services on a large scale. Agriculture has contributed significantly during this period and it has been crucial to India's growth story. Sustainable agricultural growth can be achieved by intensifying, diversifying, and commercializing the agricultural and allied activities.

With changing food habits and increased demand for ready-to-eat foods, a strong and effective food processing sector will play a significant role in diversifying agricultural activities, enhancing value addition, generating employment, creating new job opportunities and generating surplus for the export of agri-food products. This will require policies and plans for improvement of agriculture and allied sectors, including the adoption of advanced technology, enforcement of quality standards, and strengthening the domestic market with a focus on international markets. This would also require promotion of entrepreneurship in the society, particularly in the agriculture sector.



LEARNING OUTCOMES

After studying this lesson, the learner:

- defines the concept of entrepreneur, entrepreneurship and enterprise;
- appraises entrepreneurship as a career option;
- plans to inculcate the skills of a successful entrepreneur;
- identifies the stages of enterprise development;

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- differentiates between MSMEs and large enterprises; and
- cites examples of successful entrepreneurial models in agriculture.

23.1 WHAT DO WE MEAN BY ENTREPRENEURSHIP?

The word 'entrepreneur' is derived from French verb 'entreprendre' which means 'to undertake.' This refers to those who undertake the risk of setting up of new enterprise(s). Entrepreneurship is not merely a technique of conducting a business; it is a mindset originating from the basic human needs or crisis, the desire to create wealth for oneself and add value to the society. It fosters the formation of wealth and adding value to the society through innovation and creativity.

Entrepreneurism is not just about making money, setting up of startup, or owing a business, but a way of life. It reflects a need driven desire to innovate and generate new ideas, keeping businesses contemporary. It embodies the spirit of every individual, in essence, as a knowledge driver's discipline.

Entrepreneurship is the process of identifying, creating, and working on the opportunities to start or manage an enterprise. An entrepreneur is thus someone who organizes, manages and assumes risks of a business or enterprise. This process involves taking calculated risks, innovating, and mobilising resources to establish and grow a business with the goal of generating profits and creating value for the society.

Let us start with definition of Entrepreneurship.

Entrepreneurship is a human activity being instrumental in economic development. Anyone who runs a small, medium or large business is considered an entrepreneur. Entrepreneurs can operate independently or work as part of a team or partnership. An entrepreneur is thus someone who organizes, manages and assumes risks of a business or enterprise. Some important definitions of the entrepreneurship are as follows:

- Entrepreneurship is the process of bearing the risk of buying at certain prices and selling at uncertain prices (Paul Di-Masi).
- An entrepreneur is an individual who bears the risk of opening a business in the expression of uncertainty about the future conditions (Encyclopedia Britannica).
- An entrepreneur is a person, who is capable to look at the environment, recognize opportunities, get enhanced the environment and implement action to maximize these opportunities (Robert E. Nelson).



- Entrepreneur is the one who innovates and introduces something new in the economy (Joseph A. Schumpeter).
- Innovation is a specific tool of our entrepreneurs (Peter F. Drucker).
- Entrepreneurship is defined as self-employment of any sort (Richard Cantillon).
- Entrepreneurs attempt to predict and act upon changes within markets (Frank Knight).

Entrepreneurship is the ability to identify promising opportunities for business development with the appropriate set of resourcefulness, managerial skills, knowledge, risk-taking ability, creativity, persistence and economic motivation to exploit these opportunities in the best possible ways. The practice of starting new enterprises, particularly businesses, generally in response to identified opportunities is all about taking the risks. It has been observed that a large number of new ventures fail. Hence, it is tough and risky to be an entrepreneur but at the same time the ones who are successful create immense wealth not only for themselves but also for the society.

23.2 NEED TO BECOME AN ENTREPRENEUR

There are several reasons why individuals choose to become entrepreneurs. Two important aspects include **the joy of being self-employed** and **the benefits to society**.

A. The joy of being an Entrepreneur (self-employed)

- a. **Autonomy and Independence:** As an entrepreneur, you will have the freedom to make your own decisions, set your own goals, and determine your own path. You are not bound by the constraints of traditional employment, allowing you to explore your passions and interests freely.
- b. **Personal Fulfillment:** Building and growing your own business can be incredibly rewarding. It provides a sense of accomplishment and personal fulfillment that comes from seeing your ideas come to life, overcoming challenges, and achieving success on your own terms.
- c. **Financial Potential:** Entrepreneurship offers the potential for financial independence and prosperity. By building a successful business, you can create wealth and financial security for yourself and your family.

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B. Benefits to the society

- a. Job Creation:** Entrepreneurs are often at the forefront of job creation. They establish new businesses and expand existing ones, leading to increased employment opportunities for others. This helps reduce unemployment rates and stimulates economic growth.
- b. Innovation and Progress:** Entrepreneurs are driven by a desire to solve problems and create value. They develop new products, services, and technologies that address societal needs and improve people's lives. Entrepreneurial ventures often drive innovation and push the boundaries of what is possible.
- c. Economic Development:** A thriving entrepreneurial ecosystem contributes to overall economic development. It attracts investment, fosters competition, and drives productivity. Successful entrepreneurs pay taxes, contribute to the local economy, and can even inspire others to start their own businesses.

It's important to note that entrepreneurship also involves challenges and risks, such as financial uncertainty, need for consistent efforts in the face of adversity, and the necessity to adapt to changing market demands, and a high level of responsibility. However, for those who are motivated, passionate, and willing to embrace these challenges, the joy of being self-employed and the potential benefits to society can make entrepreneurship an attractive and fulfilling choice.

**INTEXT QUESTIONS 23.1**

1. What is one aspect of being self-employed that brings joy to entrepreneurs?
 - a. Financial stability
 - b. Autonomy and independence
 - c. Fixed work hours
 - d. Limited responsibility
2. How can being self-employed as an entrepreneur lead to personal fulfillment?
 - a. By having limited challenges and obstacles
 - b. By aligning personal passions and interests with business pursuits



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- c. By avoiding risks and uncertainties
 - d. By relying on others to make important decisions
- 3. What is one benefit to society that arises from entrepreneurial activities?
 - a. Decreased job opportunities
 - b. Reduced economic growth
 - c. Increased unemployment rates
 - d. Job creation
- 4. How do entrepreneurs contribute to innovation and progress in society?
 - a. By following traditional approaches and methods
 - b. By avoiding risks and sticking to existing ideas
 - c. By addressing societal needs and developing new solutions
 - d. By discouraging creativity and experimentation
- 5. How does entrepreneurship contribute to economic development?
 - a. By discouraging investment and competition
 - b. By limiting productivity and growth
 - c. By attracting investment and fostering competition
 - d. By increasing unemployment rates



ACTIVITY 1

1. Below is an activity to explore the reasons for choosing to be an entrepreneur.
2. Divide the participants into small groups or pairs.
3. Provide each group with a large sheet of paper and markers.
4. Instruct the groups to create a mind map or a visual representation of the joy of being self-employed and the benefits to society.
5. Ask the groups to brainstorm and list as many points as possible related to each aspect.

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6. Encourage them to think creatively and consider personal experiences, real-life examples, and societal impact.
7. After a set time, ask each group to present their mind map to the rest of the participants.
8. Facilitate a discussion by asking the following questions:
 - ❖ What are some common themes or ideas that emerged from the different groups?
 - ❖ Did any unique perspectives or examples come up that were not considered before?
 - ❖ How do the joy of being self-employed and the benefits to society intertwine or complement each other?
 - ❖ Can you think of any real-life entrepreneurs or businesses that exemplify these aspects?
 - ❖ How do these reasons for choosing entrepreneurship align with your personal values and goals?
9. Encourage participants to reflect on their own aspirations and motivations for entrepreneurship based on the insights gained from the activity.
10. Conclude the activity by highlighting the diverse ways in which entrepreneurship can bring personal fulfillment and positively impact society.

This activity aims to stimulate discussion, promote critical thinking, and encourage participants to explore the multifaceted aspects of being an entrepreneur. It allows them to delve into the joys of self-employment and understand the broader implications of entrepreneurship on society.

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22.3 TRAITS OF A GOOD ENTREPRENEUR

Entrepreneurial traits contribute significantly to the entrepreneurial mindset and success. While individuals may naturally possess varying degrees of these traits, they can also

be developed and nurtured through experience, learning, and personal growth. Following are some key traits of a successful entrepreneur:

1. ***Creative and Innovative:*** Entrepreneurs are creative thinkers who generate novel ideas and solutions. They are not limited by conventional thinking and are open to exploring new approaches and perspectives. This enables them to develop unique products, services, and business models that differentiate them apart from others in the market.
2. ***Risk-Taking:*** Entrepreneurs are comfortable with taking risks and embracing uncertainty. They understand that entrepreneurship inherently involves risk and they are willing to take calculated risks to pursue opportunities. Successful entrepreneurs assess risks, make informed decisions, and manage uncertainties effectively.
3. ***Initiative and Drive:*** Entrepreneurs possess a strong sense of initiative and are self-starters. They take the lead in starting new ventures and are proactive in pursuing their goals. Their high level of motivation and drive fuels their ambition and determination to succeed.
4. ***Persistence:*** Persistence is a crucial trait for entrepreneurs, as they often face obstacles, failures, and setbacks along their entrepreneurial journey. Successful entrepreneurs exhibit perseverance and resilience, bouncing back from challenges, learning from failures, and staying committed to their vision even in the face of adversity.
5. ***Opportunity Seeking:*** Entrepreneurs have a keen eye for identifying opportunities. Their entrepreneurial mindset enables them to spot gaps, unmet needs, or untapped markets. By identifying and capitalizing on opportunities, they create value and differentiate themselves from competitors.
6. ***Information Seeking:*** Entrepreneurs are proactive in seeking and acquiring new knowledge. They stay informed about industry trends, market conditions, customer preferences, and technological advancements. This knowledge enables them to make well-informed decisions and stay ahead in their fields.
7. ***Seeking and Using Feedback:*** Entrepreneurs actively seek feedback from various sources, such as mentors, advisors, customers, and employees. They value constructive criticism and use it as an opportunity for improvement. By incorporating feedback, entrepreneurs can refine their products, services, and business strategies, ultimately increasing their chances of success.



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8. **Concern for Standard/Quality of Work:** Entrepreneurs are dedicated to maintaining high standards and delivering quality work. They prioritize customer satisfaction and take pride in their offerings. By ensuring quality, they build a positive reputation, foster customer loyalty, and establish a competitive edge.
9. **Self-Confidence:** Self-confidence allows entrepreneurs to believe in their abilities and ideas. It enables them to take bold actions, overcome self-doubt, and navigate challenges with resilience. Self-confidence is also crucial for building their credibility and influencing others.
10. **Problem-Solving Orientation:** Entrepreneurs have a natural inclination towards problem-solving. They view problems as opportunities and are adept at identifying, analyzing, and finding effective solutions. This trait helps them to address challenges creatively, adapt to changing circumstances, and continuously improve their businesses.
11. **Goal Setting:** Entrepreneurs set clear and specific goals for themselves and their ventures. They define milestones, targets, and objectives that align with their vision. By setting goals, entrepreneurs provide direction, focus their efforts, and measure progress while also motivating themselves and their team members.
12. **Faith in Planning:** Entrepreneurs understand the importance of strategic planning. They develop comprehensive business plans that outline their vision, mission, target market, competitive analysis, and growth strategies. Confidence in planning allows them to make informed decisions, allocate resources effectively, and navigate their entrepreneurial journey with clarity.
13. **Persuasive and Influencing Quality:** Entrepreneurs possess strong communication and interpersonal skills. They can persuasively articulate their ideas, vision, and value proposition to various stakeholders, such as investors, partners, employees, and customers. Effective persuasion and influence help them build partnerships, secure funding, attract customers, and foster collaborations.
14. **Long-Term Commitment:** Entrepreneurship requires long-term commitment and dedication. Successful entrepreneurs are willing to invest the time, effort, and sacrifices necessary to build and grow their ventures. They understand that entrepreneurial success often takes time and patience, and they remain committed to their vision even during challenging periods.

**INTEXT QUESTIONS 23.2**

1. Which trait of an entrepreneur involves being proactive and self-motivated?
 - a. Initiative and drive
 - b. Information seeking
 - c. Self-confidence
 - d. Long-term commitment
2. Which trait of an entrepreneur involves the ability to bounce back from challenges and setbacks?
 - a. Persistence
 - b. Opportunity seeking
 - c. Faith in planning
 - d. Problem-solving orientation

*Notes***23.4 DIFFERENT STAGES OF ENTREPRENEURSHIP**

The entrepreneurial journey is not always linear, and entrepreneurs may experience challenges, pivots, and adjustments at each stage. The duration and specific activities within each stage can vary depending on the nature of the business, industry, and individual circumstances. Typically, the entrepreneurial journey consists of several stages that entrepreneurs go through as they start, develop, and grow their ventures. Here are the key stages of entrepreneurship:

1. ***Idea Generation and Opportunity Recognition:*** This is the initial stage where entrepreneurs generate ideas and identify opportunities in the market. They explore various industries, trends, and customer needs to develop innovative business ideas.
2. ***Feasibility Analysis and Market Research:*** Once an idea is generated, entrepreneurs conduct feasibility analysis and market research to assess the viability and potential of their business concept. They analyze the target market, competitors, and customer preferences to determine if their idea is feasible and viable.

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3. **Business Planning and Development:** At this stage, entrepreneurs create a comprehensive business plan that outlines their vision, mission, goals, strategies, and financial projections. They refine their business concept, define their value proposition, and establish a roadmap for their venture.
4. **Startup and Launch:** Entrepreneurs begin executing their business plan and officially launch their venture. They set up the necessary infrastructure, acquire resources, and begin operations. This stage involves securing funding, establishing legal structures, and building initial customer relationships.
5. **Growth and Scaling:** In the growth stage, entrepreneurs focus on expanding their customer base, increasing sales, and achieving sustainable profitability. They refine their products or services, optimize operations, and explore opportunities for scalability. This stage may involve hiring additional employees, entering new markets, or introducing new product lines.
6. **Adaptation and Innovation:** As the business grows, entrepreneurs must continuously adapt to changes in the market and industry shifts. They embrace innovation and explore new technologies, in order to stay ahead of their competitors. This stage involves ongoing monitoring of customer feedback, market trends, and industry developments.
7. **Consolidation and Expansion:** At this stage, successful entrepreneurs consolidate their position in the market and explore opportunities for further expansion. They may consider diversification, partnerships, mergers, acquisitions, or international expansion to reach new markets and achieve sustained growth.
8. **Exit or Succession:** Entrepreneurs may choose to exit their ventures by selling the business or transferring ownership. This stage involves careful planning and execution to ensure a smooth transition. Alternatively, they may plan for succession to pass the business on to the next generation or a chosen successor.



INTEXT QUESTIONS 23.3

1. During which stage of entrepreneurship do entrepreneurs conduct the market research and assess the viability of their business idea?
 - a. Growth and scaling
 - b. Adaptation and innovation



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- c. Business planning and development
 - d. Feasibility analysis and market research
2. What is the main focus of the startup and launch stage of entrepreneurship?
- a. Consolidation and expansion
 - b. Growth and scaling
 - c. Feasibility analysis and market research
 - d. Setting up operations and officially launching the venture
3. In which stage of entrepreneurship do entrepreneurs refine their products or services and optimize their operations?
- a. Startup and launch
 - b. Growth and scaling
 - c. Adaptation and innovation
 - d. Exit or succession

23.5 TYPES OF ENTERPRISES

When categorizing entrepreneurs based on the size of their enterprises, we typically refer to micro, small, medium (MSMEs), and large enterprises. These classifications are generally based on factors such as the number of employees, annual turnover, or assets.

The different types of enterprises are outlined below:

23.5.1 Micro Enterprises:

Micro enterprises are the smallest in size and typically have fewer than 10 employees. They are often started by individual entrepreneurs or self-employed individuals and usually operate on a small scale, serving local or niche markets. Examples include individual retail shops, small-scale artisans, freelancers, or home-based businesses.

23.5.2 Small Enterprises:

Small enterprises have slightly larger operations compared to micro enterprises. The specific criteria for defining small enterprises may vary by country or industry, but they

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generally include 10 to 50 employees. Small enterprises typically have a higher level of organization and may require additional resources and infrastructure. Examples include small restaurants, boutique stores, local manufacturing units, or specialized service providers.

23.5.3 Medium Enterprises:

Medium enterprises are larger than small enterprises and have a more significant scale of operations. Generally, medium enterprises employ 50 to 250 people. Medium enterprises often have well-established processes, systems, and structures in place. They often serve regional or national markets and have higher annual turnover and assets. Examples include regional distributors, medium-sized manufacturing firms, or professional service firms.

The Ministry of Micro, Small and Medium Enterprises (MSME), Government of India, has proposed classifying micro, small and medium enterprises based on composite criteria: investment in plant & machinery/equipment and annual turnover (<https://msme.gov.in/know-about-msme>).

	Micro Enterprises	Small Enterprises	Medium Enterprises
Investment in plant and machinery or equipment	Not more than Rs.1 crore	Not more than Rs.10 crores	Not more than Rs.50 crores
Annual turnover	Not more than Rs. 5 crores	Not more than Rs. 50 crores	Not more than Rs. 250 crores

23.5.4 Large Enterprises

Large enterprises are the largest in terms of size and often have a substantial market presence. They employ more than 250 employees and typically possess significant assets and annual turnover. Large enterprises have well-developed organizational structures, extensive resources, and often operate across multiple regions or internationally. Examples include multinational corporations, conglomerates, or industry leaders across various sectors.



It's important to note that specific criteria and definitions for micro, small, medium, and large enterprises can vary between countries and industries. Governments and organizations frequently establish guidelines and classifications to provide support, incentives, and regulatory frameworks tailored to the needs of different-sized enterprises. These classifications help policymakers, researchers, and entrepreneurs better understand and address the specific challenges and opportunities faced by businesses of different scales.



INTEXT QUESTIONS 23.4

1. What is the defining characteristic of a large enterprise?
 - a. Small scale of operations
 - b. Less than 10 employees
 - c. 50 to 250 employees
 - d. More than 250 employees
2. Which type of enterprise is typically started by individual entrepreneurs or self-employed individuals?
 - a. Micro enterprise
 - b. Small enterprise
 - c. Medium enterprise
 - d. Large enterprise

23.6 ENTREPRENEURSHIP AS A CAREER

Entrepreneurship as a career offers unique opportunities and challenges for individuals who are passionate about creating their own path and making a meaningful impact. Entrepreneurship comes with risks and uncertainties and therefore requires resilience, adaptability, and a willingness to embrace failure as a learning opportunity. However, for those who are driven, passionate, and determined, entrepreneurship can be an incredibly fulfilling and rewarding career choice. Here are some key aspects of pursuing entrepreneurship as a career:

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1. ***Independence and autonomy:*** As an entrepreneur, you have the freedom to shape your own destiny. You have the autonomy to make decisions, set your own goals, and determine the direction of your business. This level of independence allows you to pursue your passions and build a career around what truly matters to you.
2. ***Innovation and creativity:*** Entrepreneurship provides a platform for you to unleash your creativity and innovation. It allows you to identify problems, develop unique solutions, and create products or services that have the potential to improve the industrial productivity and meet market demands in new ways. As an entrepreneur, you have the freedom to experiment, iterate, and bring your ideas to life.
3. ***Impact and fulfillment:*** Building a business and seeing it grow can be immensely rewarding. As an entrepreneur, you have the opportunity to make a positive impact on society by solving problems, creating jobs, driving economic growth, or contributing to social causes. The sense of fulfillment that comes from building something meaningful and leaving a lasting legacy can be deeply satisfying.
4. ***Financial potential:*** While entrepreneurship involves risks, it also offers the potential for financial rewards. As a successful entrepreneur, you have the opportunity to create wealth and achieve financial independence. By building a scalable and profitable business, you can generate income and create value for yourself and your stakeholders.
5. ***Continuous learning and personal growth:*** Entrepreneurship is a journey of constant learning and personal growth. You'll face various challenges and obstacles along the way, which will push you to acquire new skills, develop resilience, and adapt to changing circumstances. The entrepreneurial journey offers opportunities for self-improvement and acquiring a diverse set of skills that can benefit you in all aspects of life.
6. ***Flexibility and work-life balance:*** As an entrepreneur, you have the flexibility to design your work-life balance according to your preferences. While starting a business requires hard work and dedication, it also provides the flexibility to set your own schedule, prioritize family or personal commitments, and create a lifestyle that aligns with your values.
7. ***Networking and collaboration:*** Entrepreneurship allows you to connect with like-minded individuals, mentors, investors, and industry experts. Building a network of supportive contacts can provide valuable guidance, open doors to

opportunities, and help you overcome challenges. Collaboration and partnerships with other entrepreneurs can lead to synergistic growth and shared success.

Case Studies:

1. Rikin Gandhi - Digital Green

Rikin Gandhi is the co-founder of Digital Green, a nonprofit organization that leverages technology to empower smallholder farmers in India. Digital Green uses videos and community-based interventions to disseminate agricultural information and best practices. The organization trains local farmers to create and share videos showcasing their successful farming techniques. These videos are shared within communities, allowing farmers to learn from their peers and adopt improved agricultural practices. Digital Green has reached thousands of farmers across India, improving their agricultural productivity and livelihoods.

You can access Digital Green by following this link: <https://www.digitalgreen.org/>

2. Naveen Jain - FarmersFZ

Naveen Jain is the founder of Farmers Fresh Zone (FarmersFZ), an agritech startup that connects farmers directly with consumers in urban areas. FarmersFZ operates an online platform where farmers can sell their produce directly to consumers, eliminating intermediaries and ensuring fair prices for both farmers and consumers. The platform also provides logistics and delivery support, enabling farmers to reach a wider market. FarmersFZ has successfully bridged the gap between farmers and consumers, promoting transparency in the supply chain and providing a sustainable market for farmers' produce.

You can explore various services offered by FarmersFZ to the crop producers through their website (<https://farmersfz.com/>).

3. Kiran Patil - Organic Mandya

Kiran Patil is the founder of Organic Mandya, an organization promoting organic farming practices in the Mandya district of Karnataka, India. Organic Mandya works closely with farmers and provides them with training, organic inputs, and market linkages for their produce. The organization also helps farmers obtain organic certifications, enabling them to access premium markets. Through these efforts, Organic Mandya has transformed numerous conventional farmers into successful organic farmers, promoting sustainable agriculture and improving farmers' incomes.



Notes

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These case studies demonstrate the diverse entrepreneurial endeavors in the agricultural sector of India. These entrepreneurs have leveraged technology, created innovative business models, and established platforms to address the challenges faced by farmers and promote sustainable agriculture. Their efforts have not only created successful ventures but also positively impacted farmers' lives, agricultural practices, and the overall agricultural ecosystem.

**INTEXT QUESTIONS 23.5**

1. Entrepreneurship encourages:
 - a. Following conventional paths
 - b. Minimal innovation and creativity
 - c. Risk-taking and problem-solving
 - d. Reliance on others for direction
2. The entrepreneurial journey involves:
 - a. No learning or personal growth
 - b. Fixed work schedules and limited networking
 - c. Financial instability and no potential for wealth creation
 - d. Constant learning and adaptation
3. Networking and collaboration are important for entrepreneurs because they:
 - a. Limit exposure to diverse perspectives and ideas
 - b. Stifle innovation and creativity
 - c. Provide guidance and open doors to opportunities
 - d. Impede personal growth and development

**ACTIVITY 2**

Visit the websites of Digital Green (<https://www.digitalgreen.org/>) and FarmersFZ (<https://farmersfz.com/>). Explore the services available for farmers in these websites.

Make a list of these services. Do you think these are sufficient for good crop production? If not, mention your suggestions.

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WHAT YOU HAVE LEARNT

- Entrepreneurship involves the process of identifying, creating, and pursuing opportunities to develop and manage a business venture. Entrepreneurs are individuals who take risks and organize resources to transform innovative ideas into viable businesses. The lesson discusses the motivations behind choosing entrepreneurship as a career, such as the joy of being self-employed, the desire for independence and autonomy, the opportunity for financial success, and the ability to make a positive impact on society.
- Successful entrepreneurs typically possess certain traits that contribute to their effectiveness. These include creativity and innovativeness, risk-taking ability, initiative, initiative persistence, opportunity-seeking, information-seeking, the ability to seek and use feedback, a concern for standards/quality of work, self-confidence, problem-solving orientation, goal-setting, faith in planning, persuasive and influencing qualities, and long-term commitment.
- The entrepreneurial journey consists of distinct stages, including opportunity identification and evaluation, business planning and launch, growth and expansion, and maturity or exit. Each stage presents unique challenges and opportunities. Enterprises can be categorized based on their size, such as micro, small, medium, and large enterprises. Each category has specific characteristics, including employee count, annual turnover, and investment criteria. Entrepreneurship as a career offers individuals opportunities for independence, autonomy, creativity, and a profound impact on society. Although it involves risks and uncertainties, it also provides financial potential, personal growth, flexibility, networking, and collaboration.



Notes

Enterprises in
Agriculture**Notes****TERMINAL QUESTIONS**

1. Entrepreneurship is the process of starting and managing one's own business. Comment.
2. How does the joy of being self-employed and catering to the societal benefits intersect to create a mutually beneficial relationship in sustaining entrepreneurship?
3. Can you provide examples of successful entrepreneurs who have made significant contributions to society?
4. Explain the traits that collectively contribute to the entrepreneurial mindset and success.
5. What are the different stages of entrepreneurship? Explain in detail.
6. What are the primary differences between micro, small, medium and large enterprises?

**ANSWERS TO INTEXT QUESTIONS****23.1**

1. b) Autonomy and independence
2. b) By aligning personal passions and interests with business pursuits
3. d) Job creation
4. c) By addressing societal needs and developing new solutions
5. c) By attracting investment and fostering competition

23.2

1. a) Initiative and drive
2. a) Persistence

23.3

1. d) Feasibility analysis and market research
2. d) Setting up operations and officially launching the venture
3. b) Growth and scaling

23.4

1. d) More than 250 employees
2. a) Micro enterprise

23.5

1. c) Risk-taking and problem-solving
2. d) Constant learning and adaptation
3. c) Provide guidance and open doors to opportunities



Notes

GLOSSARY

Entrepreneur: An entrepreneur is someone who organizes, manages and assumes the risks of a business or enterprise.

Entrepreneurship: Entrepreneurship is the practice of starting new enterprises, generally in response to identified opportunities.

Large enterprises: These are the largest enterprises in terms of size and often have a substantial market presence. They employ more than 250 employees and typically possess significant assets and annual turnover.

MSMEs: MSMEs (Micro, Small and Medium enterprises) are engaged in the manufacture, processing, and production of commodities and goods. The concept of MSMEs was first introduced by the Government of India and classified based on investment and annual turnover.

SUGGESTED READINGS

1. *Entrepreneurship Developments*, e-KrishiShiksha, Agricultural Education Division, Indian Council of Agricultural Research, New Delhi (<https://ecourses.icar.gov.in/>).
2. Desai, V. (2014). *Entrepreneurship Development in India*, Himalaya Publishing House, New Delhi.
3. Khanka, S. S. and Gupta, C. B. (2022). *Entrepreneurship and Small Business Management*, Sultan Chand & Sons, New Delhi.
4. Haldhar, S. M., Sharma, P. T., Sarangthem, I. and Singh, S. B. (2022). *Entrepreneurship Opportunities in Agriculture*, Bhavya Books, India.

WHAT YOU HAVE LEARNT

Autonomy and Independence

Personal Fulfillment

Financial Potential

Joy of being self employed

Job Creation

Innovation and Progress

Economic Development

Benefits to the Society

Entrepreneurship as a Career

Reasons to Become Entrepreneur

Entrepreneurship

(Ability and readiness to understand the risk of setting a new enterprise)

Types of Enterprise

Micro Enterprises

Small Enterprises

Medium Enterprises

Large Enterprises

Traits of Good Entrepreneur

Creativity and Innovation

Risk Taking Ability

Persistence

Opportunity Seeking

Information Seeking

Self Confidence

Planning

Long-term Commitment

Stages of Entrepreneurship

Opportunity Recognition

Idea Generation

Market Research

Business Planning

Start up and Launch

Succession Exit

Consolidation & Expansion

Adaptation & Innovation

Growth and Scaling

*Notes*

IMPORTANCE OF SELF-HELP GROUPS IN AGRICULTURE AND VILLAGE ECONOMY

In the previous lesson, you learnt about the concept and meaning of entrepreneurship. You have also seen the important characteristics of a successful entrepreneur. However, it's obvious that a single individual alone may not possess the full spectrum of skills necessary to establish a successful and thriving enterprise. The real strength lies in the synergistic efforts and collectivisation of like-minded individuals with a strong drive and high achievement motivation. In this context, self-help groups play a crucial role in fostering entrepreneurship. SHGs serve as catalysts by providing a supportive environment, facilitating skill development, promoting financial inclusion, and creating a platform for collaboration and resource sharing among aspiring and seasoned entrepreneurs. In this scenario, Self-help Groups (SHGs) have emerged as promising avenues for enhancing farmers' income.



LEARNING OUTCOMES

After studying this lesson, the learner:

- explains the concept and meaning of self-help groups;
- appraises the merits of forming self-help groups among local people;
- describes the evolution of SHGs over time; and
- persuades the local youth and women to form self-help groups for their socio-economic development.

24.1 WHAT IS SELF-HELP GROUPS (SHGS)?

Self-Help Groups (SHGs) represent collectives or community-based organisations, wherein individuals unite voluntarily with the aim of addressing common socio-economic

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issues, improving their livelihoods and enhancing their quality of life. Typically originating as small assemblies of rural individuals, SHGs emerge when community members, recognizing shared challenges, opt to unite voluntarily to uplift their socio-economic circumstances. These groups may take on either a formal, registered structure or remain informal. As defined by NABARD, SHGs consist of 20 or fewer individuals from similar socio-economic backgrounds who converge to tackle common issues by forming their own support networks. Presently, India boasts approximately 83 lakh SHGs, primarily comprising members from local villages.

The idea encompasses the values of saving, lending, and mutual assistance, with SHGs typically operating under self-regulation and peer oversight, promoting financial inclusivity. These groups play a significant role in institutionalizing women's economic autonomy. Typically, SHGs operate informally and voluntarily. In the early 1990s, banks were authorized to establish savings accounts for SHGs, facilitating economic empowerment.

24.2 NEED OF SELF-HELP GROUPS

Self-Help Groups are voluntary assemblies aimed at achieving shared objectives, uniting individuals of similar social and economic backgrounds, or traditional occupations to pool and administer resources for mutual benefit. The existence of robust community networks within Indian villages is a key factor in facilitating credit connections in rural regions, fostering the growth of SHGs. These groups serve as pivotal avenues for providing financial access to impoverished communities, thus significantly contributing to poverty reduction efforts. Additionally, SHGs play a pivotal role in empowering women from financially disadvantaged backgrounds by facilitating the development of social capital. Enhancing financial freedom through self-employment arenas not only contributes to economic empowerment but also leads to advancements in other developmental aspects, including literacy rates, healthcare quality, and family planning initiatives.

**INTEXT QUESTIONS 24.1**

1. What is the objective of formation of SHGs?
2. What role can SHG play in curbing the activities of money lenders in villages?
3. Which one is 'not true' from the following?
 - a. SHGs are a model for imparting education.

- b. SHGs play an important role in empowering women.
- c. SHG is a voluntary association of people, formed to attain a collective goal.
- d. Usually, SHGs are voluntary groups, with informal structure.

**ACTIVITY 1**

Visit a SHG in your nearby village. Enquire about the different activities being performed by the SHG.

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24.3 CHARACTERISTICS OF SELF-HELP GROUPS

Self-help groups help to improve the quality of the lives of the impoverished and poor sections of society. The common characteristics of these SHGs are as follows:

- **Shared Goals:** Individuals sharing similar social and economic backgrounds within a village come together, often with the help of non-governmental organizations (NGOs) or government agencies, to address local challenges, conflicts, and enhance living standards. SHG members commit to regular savings and collectively contribute to a shared fund, thereby reducing reliance on village moneylenders for emergency loans.
- **Voluntary Participation:** People join voluntarily in SHGs based on their common cause and interest. No one is pressurised for participation in these groups.
- **Peer Support:** Members consent to utilize the pooled resources, including grants and loans from banks, to undertake self-help initiatives or provide small loans to members in need, based on group consensus. Popular activities for SHGs include producing value-added goods such as flours, pulses, ground spices (chilly, turmeric, coriander powder), *papad*, pickles, jams, squash, etc; packaging and branding of gur, ghee, honey, etc.; creation of decorative bamboo items, etc., which are then sold under the SHG's banner.

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- **Skill Development:** SHGs facilitate their members to adopt new skill, expertise and experiences for capturing new opportunities in market.
- **Empowerment of Members:** The dissemination of technology through SHGs benefits both farming and non-farming communities on a significant scale. Members learn the recommended and standardized ways of production, packaging, drying, storage technique, selling and keeping accounts. These groups include members from economically disadvantaged backgrounds, and have the potential to enhance their income-earning capacity.

**ACTIVITY 2**

Collect SHG products and give their brief discussion in your own language.

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24.4 THE RISE OF SHGS: EMERGENCE AND EVOLUTION IN INDIA

- Since their inception, SHGs have been operating in villages where essential services such as banks, businesses, and retail outlets are scarce. The inception of Self-Help Groups (SHGs) in India can be linked to the establishment of the **Self-Employed Women's Association (SEWA)** in Gujarat in **1972**.
- Prior to the formal establishment of SHGs, there were early initiatives towards establishment of self-help organisations. An instance of this occurred in **1954** when the **Textile Labour Association (TLA)** in Ahmedabad established its **women's wing**. The aim was to provide training to women from mill workers' families in various skills like sewing and knitting.
- **Ms. Ela Bhatt, the founder of SEWA**, mobilised impoverished and self-employed female workers including weavers, potters, craftsmen, hawkers, etc. from the unorganised sector for the formation of SHGs. Her goal was to uplift their economic status by increasing their incomes.
- In **1992**, NABARD (National Bank for Agriculture and Rural Development) initiated the **SHG-Bank Linkage Project**, now recognized as the world's largest microfinance project. NABARD pioneered an innovative approach to this

movement with a pilot project introduced in 1991. Subsequently, starting from 1993, NABARD collaborated with the Reserve Bank of India to provide savings bank accounts to SHGs.



INTEXT QUESTIONS 24.4

1. The organization which supports mostly the development of SHGs in the country is:
 - a. NGO (Non-Governmental Organization)
 - b. NABARD (National Bank for Agriculture and Rural Development)
 - c. ICAR (Indian Council of Agricultural Research)
 - d. Ministry of Education
2. Who was the founder of Self-Employed Women's Association (SEWA)?
3. Formation of SHGs was started from state.
4. Other than agriculture, which are the other sectors in which SHGs are active?



Notes

24.5 DEVELOPMENTAL STAGES OF SELF-HELP GROUPS IN INDIA

Each SHG generally follows these steps of evolution:

1. Formation of group
2. Capacity building of the group members
3. Savings and credit activities
4. Linkage with formal institutionalised financial institutions
5. Livelihood promotion and generating income through collective action
6. Networking, mobilisation, expansion and formation of federation

Several groups are formed with the help of self-help promoting organisations. Due to its benefit towards local institution building, Government launches campaign to mobilize women for SHGs as a social movement in different states and union territories of India.

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The different types of Self-help promoting organisations are:

1. Non-governmental Organisations (NGOs)
2. Government projects
3. Poverty management programmes
4. State & commercial banks
5. Microfinance institutions
6. SHG Federations
7. SHG leaders/Entrepreneurs
8. International donor projects

**ACTIVITY 3**

Discuss the schedule of monthly activities of any self-help group located in your area.

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24.6 FUNCTIONS OF SELF-HELP GROUPS

SHGs deliver important functions for betterment of society. Some of the functions are enlisted, as below:

- SHGs play a significant role in fostering and developing small-scale micro-enterprises aimed at generating income.
- They aim to enhance the functional capacity of economically disadvantaged and marginalised segments of society in areas of employment and income-generation. Besides contributing towards the economic development, these groups are important for social networking.
- They provide loans without requiring collateral security from individuals who typically face challenges in securing loans at high interest rates from traditional money-lenders.



- **Financial Inclusion-** SHGs incentivize banks to lend poor and marginalized sections of society due to the assurance of returns and the collective responsibility maintained within the group.
- They introduce the habit of money saving and its best possible utilisation by prioritisation of needs and wants.
- They also play a role in conflict-resolution through collective leadership and mutual discussions. They provide a platform to share experiences and provide mutual support.
- They conduct vocational training programmes for competency building and entrepreneurship development, which aim to provide livelihood opportunities for their members.
- They encourage the development of potential micro-enterprises at the village or block level by facilitating access to financial services such as savings, credit and insurance.
- **Empowering the Marginalised**– SHGs have provided a platform for the empowerment of marginalized and voiceless segments of society, granting them a voice that was previously unheard.
- **Social Integrity**– SHGs contribute to the eradication of various social ills, including dowry, alcoholism, and early marriage, by fostering community support and empowerment among their members.
- **Gender Equality** – SHGs focus on providing employment opportunities through training, thereby generating income and employment. By empowering women, SHGs contribute to advancing true gender equality in the nation.
- **Pressure Groups** – SHGs serve as pressure groups capable of exerting influence on the government to address significant issues.
- **Effective Implementation of Government schemes**– SHGs contribute to the effective implementation of government schemes and enhance their efficiency. Additionally, they play a pivotal role in combating corruption through the conduct of social audits.

**INTEXT QUESTIONS 24.3**

1. In what ways do Self-Help Groups (SHGs) provide support to their members for social causes?
2. How do Self-Help Groups (SHGs) derive financial benefits from their operations?
3. SHG supports in setting up of level enterprises.

24.7 CONSTRAINTS OF SELF-HELP GROUPS (SHGS)

Although self help groups have huge potential for socio-economic improvement of farmers in India, presently they are not performing as per the expectations. The probable reasons for this are:

- The idea of SHG has not yet reached to the poorest families of our country.
- Prevalence of patriarchal mindset in society prevents many women from coming forward to join self-help groups.
- Expanding banking facilities is crucial, given the disparity between the number of bank branches and villages in rural India.
- The sustainability and operational quality of these groups have raised concerns.
- SHGs sometimes encounter internal conflicts stemming from power struggles. Establishing monitoring bodies for SHGs nationwide could help mitigate such issues.
- SHGs operate on mutual trust, but if this trust is compromised, members may perceive their deposits as insecure or feel cheated, if not adequately informed about critical decisions. This could lead to the collapse of the SHG system.

24.8 FUTURE COURSE FOR EFFECTIVE SELF-HELP GROUPS

Currently through the active efforts of **Ministry of Rural Development** under the **Deendayal Antyodaya Yojana (DAY)** and **National Rural Livelihoods Mission (NRLM)**, approximately 9 crore households have been mobilized into SHGs. Following measures may be adopted for efficient management and proper administration of SHGs:

1. The government ought to enhance its efforts to foster the expansion and advancement of the SHG movement nationwide, assuming the facilitator and advocacy roles.



2. The SHG movement needs to extend its reach to credit-deficient regions across the country, including areas like Madhya Pradesh, Uttarakhand, Rajasthan, and the states of North-East India. The Government of India is envisaging an expansion of the SHG initiative to encompass 1 crore groups, involving approximately 10 million women in the near future. The concept of SHG federation has started in different states of India to function for networking, coordination, capacity building and supporting the SHG movement as apex organization.
3. There is a pressing need to strengthen the financial infrastructure, including institutions like NABARD, Commercial Banks, and also leveraging the information technology (IT) structure for establishing improved communication network.
4. There is a crucial need to extend the reach of Self-help Groups to urban and peri-urban areas, considering the rapid pace of urbanization and the prevalent financial exclusion among the urban poor.
5. Establish SHG monitoring cells in each state for better oversight and evaluation of SHG activities.



INTEXT QUESTIONS 24.4

1. Which Government schemes target the formation of SHGs?
2. What is the function of SHG federation?

24.9 SELF HELP GROUPS IN INDIA

24.9.1 Self-help groups in remote forested villages in India

There are more than 1.2 lakhs of Joint Forest Management Committees (JFMC) in different states of India. In all the JFMCs, the respective State Governments have started SHG formation through local women to support villages located in and around the forest areas. Such SHGs deal with the processing, value addition and marketing of Non-timber Forest Products (NTFPs) including the medicinal plants. Such JFMC related SHGs have been active in the states of Chhattisgarh, Madhya Pradesh, Telangana, Uttar Pradesh, Rajasthan, West Bengal and Uttarakhand.

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24.9.2 Watershed Management Committees in India

At the village level, watershed management committees establish SHGs to foster agricultural development, embracing principles of organic cultivation and vermi-composting. These groups, comprising micro-entrepreneurs with similar backgrounds, voluntarily pool funds for mutual assistance.

24.9.3 Kudumbashree in Kerala

Initiated in 1998 in Kerala, the Kudumbashree project aims to combat poverty through community action. It stands as India's largest women-empowerment endeavour, overseen by the government. The project encompasses three pillars: microcredit, entrepreneurship, and empowerment.

24.9.4 Mahila Aarthik Vikas Mahamandal (MAVIM) in Maharashtra

In Maharashtra, SHGs faced challenges managing increasing transactions, prompting the establishment of Community Managed Resource Centre (CMRC) under MAVIM. CMRC offers sustainable financial and livelihood support tailored to SHG needs. The mission of MAVIM is to enhance women's access to education and boost their involvement in decision-making and governance to bring social equity.

It also plays crucial role in strengthening women's entrepreneurship skills and improving their access to credit and markets.

**ACTIVITY 4**

Visit a cooperative or nationalized bank to inquire about the presence of Self-Help Groups and their initiatives.

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WHAT YOU HAVE LEARNT

- Self-Help Groups (SHGs) are informal collectives where individuals unite to address their common concerns/issues and enhance their living standards. They operate autonomously and are governed by members.
- Self-help Groups (SHGs) are driving force for women unity, solidarity and promotion of local level enterprises.
- Self help groups are characterized by their shared goals, voluntary participation, informal organizational structure, peer support, skill development initiative and empowerment of members.
- Key functions of SHGs are encouragement of saving among the poor, supply of collateral-free loans, and financial inclusion.



TERMINAL QUESTIONS

1. Discuss the key functions of Self-Help Groups.
2. What are the unique characteristics of SHGs?
3. How SHGs can help in the social development process?
4. Why SHGs are more active and have larger spread in rural areas?
5. What are the constraints plaguing the SHG programme in our country?



ANSWERS TO INTEXT QUESTIONS

24.1

1. SHGs are formed for economic empowerment of the members and to overcome the common issues and challenges.
2. SHG members save their money on regular basis through which they set up small business at local level. From the saved amount, they can provide interest free loan to their members, which protects them from the high interest rates of money lenders.



Notes

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Notes

3. Option a

24.2

1. NABARD
2. Ms. Ela Bhatt
3. Gujarat
4. Weaving, pottery, forest product processing, craft manufacturing

24.3

1. They play a role in conflict resolution through collective leadership, mutual discussions and empowerment.
2. SHGs support individuals in earning a livelihood by providing vocational training and facilitating access to tools and resources. They provide loans without requiring collateral to individuals who typically face challenges in securing loans from traditional banking institutions.
3. Micro

23.4

1. Deendayal Antyodaya Yojana (DAY) and National Rural Livelihoods Mission (NRLM)
2. SHG federation acts as apex organisation of self-help groups. Its function is networking and coordination among SHGs, capacity building and supporting the SHG movement.

GLOSSARY

Empowerment: An act or process of enabling individuals to give authority and power to perform and achieve the results they desire.

Microcredit: It is a small loan facility provided to the low-income individuals or groups without collateral, to motivate them to start their business and become self-employed. It is offered by microfinance institutions (MFIs), non-governmental organizations (NGOs), or banks that cater to needs of marginalized populations.

Unorganized sector: The segment of economy where economic activities are undertaken by individuals or private enterprises without formal registration. They are

characterized by low levels of organization, limited access to social security benefits, and operate outside the purview of government regulations.

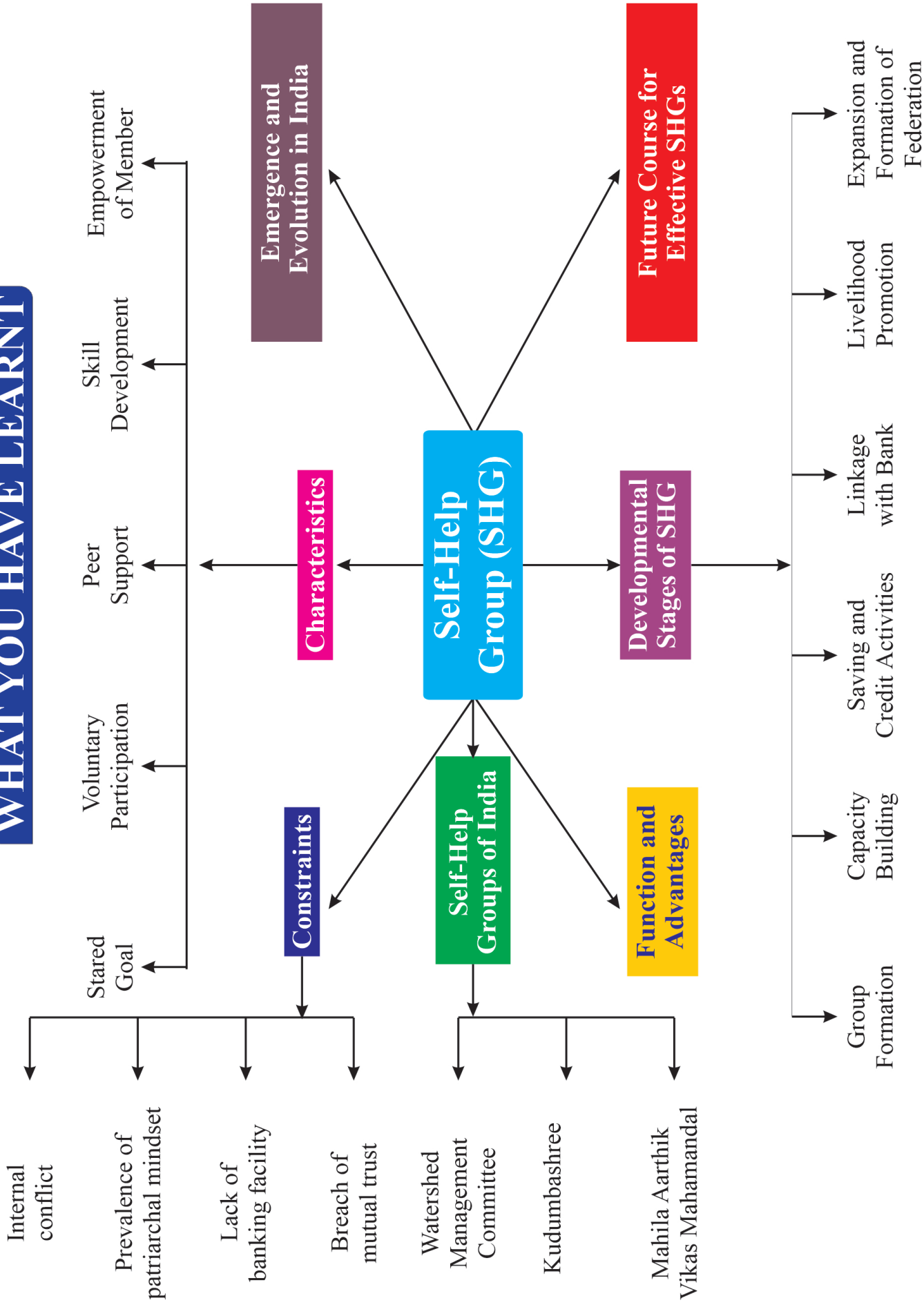
SUGGESTED READINGS

1. Non-government organisation (NGO) and self-help group, TNAU Agritech Portal, Tamil Nadu Agricultural University, Coimbatore, India.
(https://agritech.tnau.ac.in/ngo_shg/shg_intro.html)
2. A Handbook on Forming Self-Help Groups (SHGs), National Bank for Agriculture and Rural Development (NABARD), Mumbai.



Notes

WHAT YOU HAVE LEARNT





CAREER OPPORTUNITIES IN AGRICULTURE SECTOR



Notes

In the previous lessons, you learned about the importance of agriculture in the growth and development of our country. You also explored how new technologies can help address some of the major challenges faced by this sector. Trained professionals in these emerging technologies are required to transform the farming sector. The field of agriculture is vast, offering professionals various opportunities to work in sectors such as crop production, crop protection, marketing and sales, farm engineering, farm management, academia and research, or entrepreneurship. After graduation, you may choose from a wide range of career opportunities within agriculture and allied sectors.



LEARNING OUTCOMES

After studying this lesson, the learner:

- recognizes the employment opportunities in the field of agriculture;
- identifies agriculture related educational programmes available in India; and
- explains the roles and responsibilities of popular professions of the agriculture field.

25.1 AGRICULTURE: AS A PROFESSION

When India gained independence, the then Prime Minister of India Pandit Jawaharlal Nehru, stated, “**Everything else can wait, but not agriculture**”. This statement was reaffirmed during the Covid-19 pandemic in 2019-2020, while all other sectors of the economy halted, but agriculture continued at its pace, as food is a necessity and we rely on it daily.

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In addition to final consumption, agricultural outputs serve as raw materials for various industries. The commercialization of agriculture calls for specialized production, post-harvest management, and the expansion of processing, storage, transportation, packaging, and marketing operations, both domestically and internationally. However, in India, about 20-30% of crops are wasted annually due to improper handling, spoilage, floods, droughts, pests, diseases, and lack of knowledge of post-harvest technology. Certain sectors, such as floriculture, aquaculture, poultry, fruits and vegetables are especially vulnerable to these problems. Therefore, professionals with advanced scientific knowledge and management skills are in high demand throughout the world.

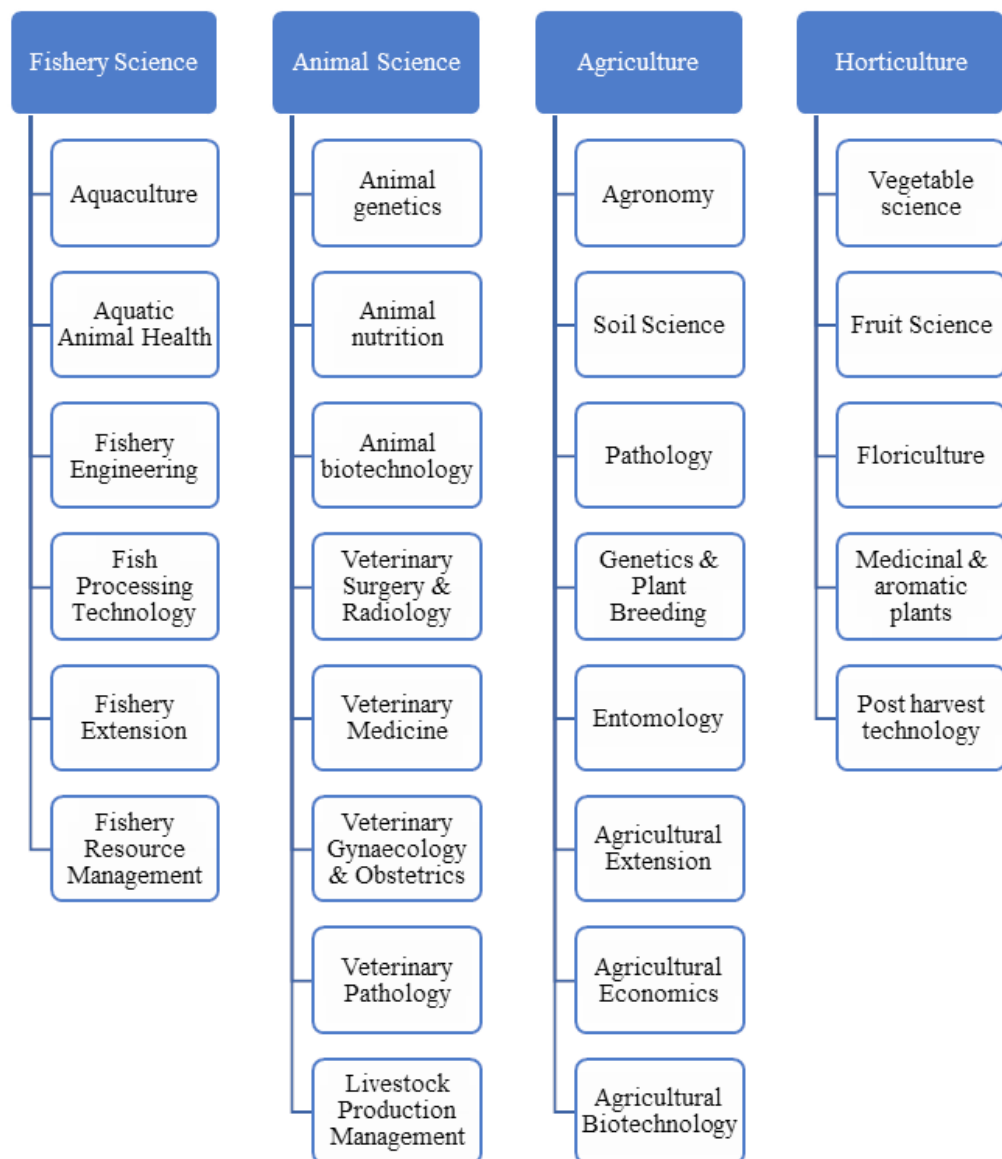


Fig. 25.1: Major divisions of agricultural and allied sciences



If you are interested in a career in agriculture, you may explore the various lines of employment in agriculture and the skills needed to succeed in these roles. Career paths may involve activities ranging from crop production to large scale plantations, manufacturing bio-fertilizers and bio-pesticides, or raising livestock like cattle, pigs, poultry and fish. There are several branches of agricultural science, like crop science, horticulture, biotechnology, water management, economics and marketing, agronomy, soil science, pathology and entomology, etc. Similarly, allied fields like animal sciences cover disciplines such as dairying, animal husbandry, rearing of sheep and goat, animal diseases, animal feed and fodder, animal biotechnology, poultry, fisheries, apiculture and sericulture.

New avenues are emerging through innovations and reforms in agriculture, leading to increased production and optimized benefits. Our country needs professionally qualified individuals who understand technological advancements to tackle the challenges in this sector.

25.2 EDUCATIONAL PROGRAMMES AVAILABLE IN AGRICULTURE SCIENCE

Formal education in agriculture can provide you a fulfilling career in agriculture. In India, there are numerous government and private universities offering undergraduate, post-graduate, and doctoral degrees in agriculture. After completing school education, you can pursue a bachelor's degree in agriculture or related disciplines. Some of the educational programmes available at the undergraduate level are mentioned in the table below.

Table 25.1: Undergraduate courses offered in agriculture and allied disciplines

Bachelor of Science (B.Sc.) in Agriculture	B.Sc. in Horticulture	B.Sc. in Forestry
B.Sc. in Animal Husbandry	B. V. Sc. (Bachelor in Fishery Science)	B.F.Sc. (Bachelor in Veterinary Science)
Bachelor of Technology (B.Tech.) in Agricultural Engineering	Bachelor of Technology (B.Tech.) in Dairy Technology	Bachelor of Technology (B.Tech.) in Food Technology
Bachelor of Technology (B.Tech.) in Plant Biotechnology	B.Sc. in Tea Husbandry and Technology	B.Sc. in Community Science

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B.Sc. in Sericulture	B.Sc. in Food Nutrition & Dietetics	Bachelor in Agribusiness Management
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Most of the professional courses listed are of four year duration (except B.V.Sc.) are offered by agricultural universities across India. Currently, there are 63 state agricultural universities accredited by the Indian Council of Agricultural Research (ICAR) (<https://www.icar.org.in/state-agricultural-universities>). In addition to state agricultural universities (SAUs), several other universities run by Government of India offer agricultural programs. These can be categorised as deemed universities, central agricultural universities, and central universities with agriculture departments.

Deemed Universities:

1. ICAR-Central Institute of Fisheries Education, Mumbai
2. ICAR-Indian Agricultural Research Institute, New Delhi
3. ICAR-Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh
4. ICAR-National Dairy Research Institute, Karnal, Haryana

Central Agricultural Universities:

1. Central Agricultural University, Imphal, Manipur
2. Dr. Rajendra Prasad Central Agricultural University, Samastipur, Bihar
3. Rani Laxami Bai Central Agricultural University, Jhansi, Uttar Pradesh

Central Universities with Agriculture Departments:

1. Aligarh Muslim University, Aligarh, Uttar Pradesh
2. Banaras Hindu University, Varanasi, Uttar Pradesh
3. Nagaland University, Lumami, Nagaland
4. Vishwa Bharti University, Shantiniketan, West Bengal

After completing an undergraduate degree (B.Sc./B.Tech./B.V.Sc./B.F.Sc.), students can pursue postgraduate degrees (M.Sc./M.Tech./M.V.Sc./M.F.Sc.), and a PhD (Doctor of Philosophy) in various sub-disciplines. These advanced degrees can lead to teaching and research-oriented careers. Candidates with higher academic qualifications and relevant work experience may find employment with reputed national and international institutions.

**DO YOU KNOW**

Indian Institute of Technology, Kharagpur is the only IIT in the country that offers a B.Tech. degree in agricultural engineering.

**ACTIVITY-1**

You can explore the list of agricultural universities in India by following this link: <https://icar.org.in/state-agricultural-universities>. Check whether there are any agricultural universities located in your state.

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*Notes***National and International Recruiting Agency**

Several national and international organizations recruit agriculture graduates and post-graduates in various roles for leveraging their diverse skill sets in the field of food production, environmental sustainability, and rural development. These national organizations include

- Indian Council of Agricultural Research (ICAR)
- Indian Council of Forestry Research and Education (ICFRE)
- Indian Space Research Organization (ISRO)
- Defence Research & Development Organisation (DRDO)
- Food Corporation of India (FCI)
- Agricultural & Processed Food Products Export Development Authority (APEDA)
- Food Safety and Standards Authority of India (FSSAI)
- Ministry of Agriculture and Farmers' Welfare
- Ministry of Fisheries, Animal Husbandry and Dairying

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- Ministry of Rural Development
- Commercial banks
- National Bank for Agriculture and Rural Development (NABARD)
- Central Silk Board
- Tea Board of India
- Coffee Board of India and others

Some prominent international agriculture organizations which provide opportunities to work for sustainable agricultural practices, food security, and rural development are:

- Food and Agricultural Organization (FAO), Rome, Italy
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India
- International Rice Research Institute (IRRI), Los Baños, Philippines
- International Maize and Wheat Improvement Center (CIMMYT), Mexico
- International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria
- International Water Management Institute (IWMI), Colombo, Sri Lanka
- International Livestock Research Institute (ILRI), Nairobi, Kenya
- The International Center for Agricultural Research in the Dry Areas (ICARDA), Beirut, Lebanon
- International Potato Center (CIP), Lima, Peru
- The World Vegetable Center, Taiwan

Management Programmes in Agriculture Sectors

After graduating in agricultural and allied sciences, you can also pursue an MBA (Master of Business Administration) or PGDM (Post-Graduate Diploma in Management) with a specialization in Agribusiness Management to build capacity for managing the agribusiness sector. These are two-year courses, offered by many agricultural universities, as well as autonomous public and private business schools. Some of the renowned institutes in India offering degrees in agribusiness management are:



1. Indian Institute of Management (IIM), Ahmedabad
2. Indian Institute of Management (IIM), Lucknow
3. National Institute of Agricultural Extension Management (MANAGE), Hyderabad
4. National Institute of Agricultural Marketing (NIAM), Jaipur
5. National Academy of Agricultural Research Management (NAARM), Hyderabad
6. Institute of Rural Management (IRMA), Anand, Gujarat

Short Term Courses

If formal education in agriculture sector is not feasible for you, you may consider opting for various short term courses, workshops, or training programmes offered by agricultural universities, open universities, Krishi Vigyan Kendras (KVKs) or the Department of Agriculture under the state or central government. These courses can be especially useful for those interested in pursuing agri start-ups or agri enterprises. The National Institute of Open Schooling (NIOS) also offers several vocational courses in different disciplines of agriculture, aimed at building practical competencies, knowledge, and values among students from a young age. Below is a list of short term courses offered by NIOS:

List of offered courses (<https://www.nios.ac.in/>)

- | | |
|------------------------|-----------------------------------|
| 1. Mushroom Production | 2. Vermicomposting |
| 3. Bee Keeping | 4. Paddy Farming |
| 5. Poultry Farming | 6. Bamboo Cultivation |
| 7. Plant Protection | 8. Soil and Fertilizer Management |



INTEXT QUESTIONS 25.1

1. Give examples of any three undergraduate programmes for pursuing a career in the agriculture sector.

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2. If you want to become a veterinary doctor, the preferable undergraduate degree would be:
 - a. B.Sc. in Agriculture
 - b. B.Sc. in Sericulture
 - c. B.Tech. in Dairy Technology
 - d. Bachelor in Veterinary Science
3. In India, the duration of the 'Bachelor in Agricultural Science' course is

25.3 POPULAR JOB OPPORTUNITIES IN AGRICULTURE SECTOR

A. Agri-entrepreneur

Entrepreneurs are individuals who develop and manage their businesses to earn profits. In the agriculture sector, they can venture into various fields such as apiculture, fishery, mushroom cultivation, vermi-composting, and the cultivation of medicinal and aromatic plants. Selling vermi-compost products is also a viable option. Additionally, the nursery business in urban areas has become a profitable avenue for agriculture professionals. Agri-entrepreneurs design new tools, equipment, technologies, and strategies for agricultural applications in alignment with government policies, schemes, and focus areas.

Success story of an agri-entrepreneur:

Mr. Srikant Singh is a farmer from Khakhra village in Aurangabad, Bihar. His family has been involved in agriculture for several generations. He manages approximately 3 hectares of land, equipped with modern irrigation systems like drip and sprinkler, and earns a modest income from his agricultural activities.

To increase his income, Mr. Singh decided to venture into vermicompost production. This process involves the decomposition of organic material by earthworms. While cow dung is commonly used as the primary input, other agricultural wastes can also be utilized. For this purpose, specialized pits are created and the earthworms take around 45-50 days to decompose the material and produce vermicompost.

Mr. Singh attended a training program at the Krishi Vigyan Kendra (KVK) in

*Notes*

Aurangabad district, where he learned the techniques for producing high-quality vermicompost.

After completing the training, he actively engaged in vermi-compost production, digging 135 pits and filling them with cattle dung. The expenditure for creating these pits was approximately ₹2,53,800/-. He earned ₹3,94,200/- from selling vermi-compost to the state agricultural department.

Generally, the production cost for 1 kg of vermi-compost is around ₹4-5, and it is sold in the market at ₹10-12/kg. In the year 2022, he supplied 400 quintals of vermi-compost and has provided employment to 4-5 rural men and women in his village.



Fig. 25.2: Vermicomposting unit of Mr. Srikant Singh

Success story of an inspired Tassar silk cocoon grower of Bihar:

Mr. Dhanu Singh, a resident of South Bhorsar village in the Katoria block of Banka district, Bihar, has been involved in his family's Tassar silk cocoon production business for generations. The rearing of the cocoons occurs biannually, from July to September and from September to December, each cycle lasting approximately 45 days. During this period, the silk larvae undergo five moulting stages. The first and second moulting stages occur on one plant within 5-6 days, while the larvae are moved to another plant for the third and fourth moulting stages, which occur within 3-4 days. The fifth moulting stage takes place within 12 days.

PRADAN and NGOs at the district level provide assistance for plantation and Tassar seed procurement. They offer a Tassar seed packet (200 grams) priced at Rs. 1,600/-, containing approximately 20,000-22,000 eggs, from which approximately 9000-10000 cocoons can be reared. Typically, 2-3 packets of seeds are required annually for cultivation. The Tassar plants are spaced approximately 5 meters apart for commercial purposes and 10 meters apart in forest areas, with each plant capable of rearing 250-300 cocoons. A total of 2,000-3,000 Tassar

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plants are used for cocoon production. A single packet of seed can produce about 4000 high grade cocoons and 5000-6000 low grade cocoons .

The market price of higher-grade cocoons varies between 7-8 rupees per piece, whereas lower-grade cocoons fetch Rs. 4-5 per piece. Additionally, the price for cocoon compost is set at Rs. 1.5 per unit. He makes an annual profit of approximately Rs. 80,000 to Rs. 100,000, from the sales of both cocoons and cocoon compost. He markets his products in local markets and nearby areas, including Bihar Sarif, Nawada, Bhagalpur, and West Bengal. He stays updated on the latest techniques and addresses production related issues by consulting with experts and extension personnel.

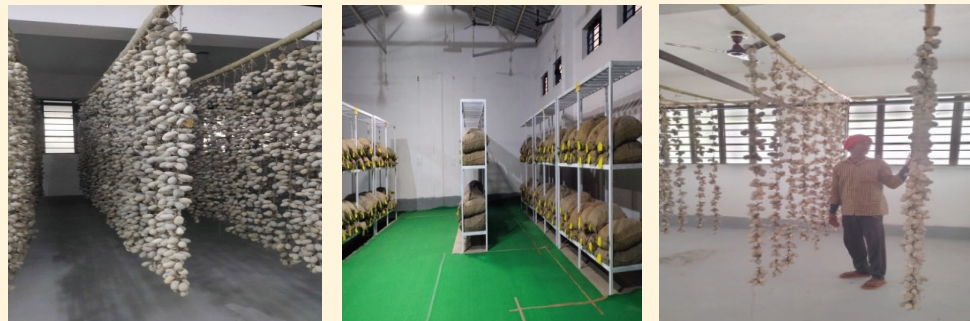


Fig. 25.3: Sericulture unit of Mr. Dhanu Singh

Success story of an inspirational mushroom grower of Punjab:

Mr. S. Sukhdev Singh, a resident of Meeranpur village in the district of Patiala, has been successfully engaged in mushroom production since 2014 . Through his hard work and dedication, he has become a source of inspiration for rural youth by developing his mushroom farm over an area of two acres. Mr. Singh initially began mushroom cultivation as a subsidiary occupation by preparing compost from 100 quintals of wheat straw. Over the subsequent years, he gained valuable experience in the field of mushroom production and transitioned to the short method of composting, by obtaining a 40% subsidy on his composting unit from the Department of Horticulture, Government of Punjab.

Mr. Singh constructed a bunker and a pasteurization chamber/tunnel with a capacity of 30 tonnes for preparing compost for button mushroom production. The compost produced through this method is of superior quality and free of diseases, resulting in greater yields compared to the long composting method. Initially, he used the compost solely for his own farm but later began preparing and selling compost to small and medium-scale growers as well as urban dwellers. This approach effectively promotes

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mushroom cultivation throughout the state. To cultivate mushrooms, the farmer constructed 35 mushroom huts using paddy straw and bamboo, each with dimensions of 30' x 60' and a capacity to accommodate 2,200-2,400 bags. He effectively utilized agricultural residue from his own fields as well as from adjacent fields. Approximately one acre of paddy straw from fields is used to construct a single mushroom hut. Following recommendations from the Punjab Agricultural University in Ludhiana, the farmer prepared compost using a 1:1 ratio of wheat and paddy straw, resulting in better yields. He also provides employment to 20-30 individuals for compost making, watering, harvesting, and post-harvest care. To market his fresh produce, he sells in local markets and Ludhiana Mandi. Additionally, he cultivates summer varieties such as milky and paddy straw mushrooms on a small scale. To stay updated on current knowledge and address any mushroom-related problems, he remains in touch with experts from the Punjab Agricultural University in Ludhiana.



Fig. 25.4: Few glimpses of Mr. Sukhdev Singh's Milky mushroom cultivation

B. Agronomist

The agronomists are professionals specialized in crop production, pest control, and soil management. Several government organizations and agribusiness companies, like seed and agro-chemical companies, recruit agronomists for their research labs or field experiment stations. Their primary goal is to enhance the well-being and health of crops.

Responsibilities of an agronomist:

1. Develop better cultivation, planting and harvesting techniques:

Agronomists seek innovative methods to improve farming practices, including

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experimenting with new planting methods, optimizing irrigation techniques, and implementing sustainable farming practices to enhance crop growth and yield.

2. **Improve crop yield:** They work to maximize the productivity of crops by identifying factors that limit growth and implementing strategies to address these issues. This may involve selecting high-yielding crop varieties, managing nutrient levels in the soil, and controlling pests and diseases that affect crop health and yield.
3. **Maintaining the quality of seed and nutritional value of crops:** Agronomists evaluate seed varieties for traits such as disease resistance, drought tolerance, and nutritional content to improve crop performance and meet consumer demands for nutritious food.
4. **Improve soil productivity:** They assess soil health, fertility, and quality to develop strategies for enhancing soil productivity and sustainability. This may involve soil testing, implementing conservation practices, and recommending appropriate fertilization and crop rotation methods to maintain soil fertility over time.

C. Soil Scientist

Such scientists conduct research both in field and laboratory to improve fertility and productivity of soil. They collect soil samples from farms to analyze nutritional needs and fertilizer requirements. A soil and plant scientist's job focuses on

- ❖ Testing soil and plant to obtain the information about nutrient status
- ❖ Improving soil health and understanding how it affects plant growth
- ❖ Researching alternative methods of growing crops to maximize crop yield
- ❖ Protecting the soil from erosion and degradation.

D. Plant Breeder

Plant breeder is a professional who specializes in the art and science of breeding plants. Plant breeding involves the controlled manipulation of plant species to produce plants with desired traits and characteristics. This process is essential for developing new and improved varieties of crops, ornamental plants, and other cultivated species.

**E. Farm Manager**

In this occupation, the individual is responsible for overseeing farm operations and making strategic business decisions within budgetary constraints. Duties include managing the maintenance and repair of farm buildings and equipment, as well as marketing the farm's products. Previous experience in farming is essential, along with technical knowledge encompassing compliance with government regulations and adherence to health and safety standards. Farm managers are generally recruited by Krishi Vigyan Kendras (KVKs), agricultural universities, research institutes, and seed companies.

F. Academic /Lecturer Jobs

India has a network of 70+ agricultural universities and 100+ research institutes under the Indian Council of Agricultural Research (ICAR). These organizations recruit young scholars as assistant professors or junior scientists after completion of a Master's or PhD degree in a specialized discipline. Lecturers provide basic knowledge of agriculture and allied disciplines to students and conduct experimental research in agricultural colleges and universities.

G. Agricultural Economist

In this role, an agricultural economist applies principles of micro and macroeconomics to understand economic decisions such as

- I. Determining the rationale behind producing a specific combination of food crops in a given year.
- II. Strategizing resource optimization in both production and post-production stages.
- III. Analyzing how government support for farmers is determined.

They collect and analyze economic data to find and determine trends in economic activity. They also develop future possible scenario through simulations based on past data, which help the policy makers in developing strategies for future.

H. Commercial Horticulturalist

A horticulturalist focuses on day-to-day activities for vegetable and fruit production process - overseeing the cultivation, harvesting, packaging, distribution and sale of fruits, vegetable flowers and plants.

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A landscape horticulturist may work with planners, architects and designers to create parks, gardens and recreational areas. They are also engaged in the maintenance of public gardens, managing fruit orchards, overseeing the production of organic fruits and vegetables.

Success story of a flower entrepreneur:

Ms. Vinod Kumari Shah is a woman entrepreneur from the village Maili, District Hoshiarpur, Punjab. She started farming with her parents after completing her higher secondary studies. Initially serving as a president of the Sandhya Self Help Group (SHG), she underwent training at KVK Bahawal with other members and was involved in activities like stitching, painting, making pickles (Achar) and chutneys. However, the returns from these endeavors were not satisfactory, prompting her to explore alternative avenues.

In 2014, an expert team from Punjab Agricultural University visited Maili village to conduct an awareness programme for a Government of India project. They interacted with Ms. Vinod Kumari Shah and encouraged her to undergo training in value-added products from vegetables and flowers. Subsequently, Ms. Shah attended hands-on training at village Maili and PAU, Ludhiana on value addition techniques for vegetables and flowers, including mixed pickles of cauliflower and carrot, black carrot Murraba, black carrot Kanji, tomato sauce and puree, Ghia chutney, rose Sharbat, and Gulkand. This marked a turning point in her life. She started producing 100% natural Rose sharbat using fresh desi rose petals sourced from local farmers in the kandi region of district Hoshiarpur. The beauty of her product is that it contains no synthetic preservatives or colours. The shelf life of this rose sharbat is about two years at normal room temperature. Ms. Vinod Kumari has been awarded with Sardarni Jagbir Kaur Memorial Award 2016 by Chief Minister of Punjab during the PAU Kisan Mela at Ludhiana, for her achievements in agriculture and allied enterprises. Due to her consistent efforts, there has been a significant increase in the sales of rose sharbat bottles (4000-5000 bottles per year), as well as other value-added products. Currently, Sandhya's SHG has about 150 associated members and generates an annual revenue of approximately Rs. 18-20 lakhs.

I. Agricultural Engineer

Various farm machineries, tools, and equipments are required in the agriculture sector. Individuals with technical knowledge of agricultural engineering oversee the design, manufacturing and maintenance processes of machineries like tractors and harvesters. Other important roles they fulfil include:

SENIOR SECONDARY

- Planning, designing, and overseeing the construction of irrigation projects for the distribution and application of water to agricultural lands
- Developing strategies to conserve soil and water resources
- Enhancing the processing and storage of agricultural products
- Supervising the production of machinery



INTEXT QUESTIONS 25.2

1. The person who develops their own agricultural businesses and manages its operation is called
 - a. Agronomist
 - b. Agri-entrepreneur
 - c. Farm manager
 - d. Agricultural engineer
2. An agronomist works for
 - a. Overall well being of crops
 - b. Construction of irrigation projects
 - c. Conservation of forest
 - d. None of these
3. Farm managers can be recruited at
4. Design, manufacture, and maintenance of farm machineries are done by agricultural engineers (True/False).
5. Which professionals area engaged in the creation of parks, gardens and recreational areas?

J. Administrative Jobs

There are separate agriculture departments in both the central and state governments. Individuals with an agriculture background are often recruited as agriculture development officers, horticulture development officers, fishery



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inspectors, or livestock officers within these departments. Their primary responsibilities include:

- ❖ Enforcing government policies pertaining to agriculture
- ❖ Promoting integrated development of the rural economy through agricultural initiatives
- ❖ Developing an effective extension plan to disseminate proven and viable production technologies to the farming community
- ❖ Supervising the agricultural activities of the area under their respective jurisdictions
- ❖ Performing tasks such as book-keeping, project implementation, and accounting

K. Technical Assistant/Lab Technician

Monitoring the nutrient content of soil and plants, as well as the quality of seeds, fertilizers, pesticides, and food, is necessary for successful crop production, marketing, and human consumption. To ensure this, various government and private organizations recruit technical assistants or lab technicians who help in analyzing, examining and evaluating the quality of agricultural produce in laboratories. Their primary responsibilities include:

- ❖ Collecting field samples from different sites and assisting in the management of field and glasshouse trials
- ❖ Accurately recording data and information from research trials to ensure uniformity and quality in samples
- ❖ Conducting laboratory experiments in accordance with designated protocols
- ❖ Operating and maintaining field equipment and laboratory instruments as per the required standards

L. Agricultural Marketing and Salespersons

The agribusiness industry needs to sell its products like seeds, fertilizers, agro-chemicals, animal feed, and machinery to farmers. For this, the sellers are also required to provide advice related to product features and the benefits to be realized. Therefore, companies hire individuals with technical knowledge of agriculture for such positions. The recruits listen to the needs of the farmers and then recommend suitable products to meet their requirements.

*Notes***M. Agricultural Extension Specialists**

Agricultural extension specialists are village-level extension workers who serve as a conduit to transfer improved farming practices and knowledge of scientific innovations to the last-mile farmers. They act as a bridge between the laboratory and the land. They provide advice, support, and training to farmers and help improve the efficiency and productivity of farming operations. Their primary responsibilities include:

1. To monitor the production and productivity of crops in their area to maintain the base records for comparison
2. To conduct, organize and supervise demonstrations, seed village programmes, diversified cropping programmes, and introduction of new crops/varieties along with group discussions
3. To prepare situation-specific crop production plans for each farmer and assess their input requirements realistically
4. To advise on and prepare long term action plans for encouraging sustainable agricultural practices, optimal fertilizer consumption, use of bio-fertilizers, use of improved farm implements and machinery, and increasing irrigation potential through dug wells, deep/shallow tube wells, etc.

N. Plant Protection/Quarantine Specialist

It is common for plants or agricultural products to be infested with fungus, virus, bacteria, insects, weeds, mites or nematodes in field as well as in storage. A Plant Protection Specialist, also known as a Plant Health Specialist or Plant Pathologist, is a professional who specializes in safeguarding crops and plants from pests, diseases, and other environmental threats. To become an expert in plant protection, one must specialize in weed science, entomology, plant pathology or nematology. Key job aspects of plant protection specialists include:

- To direct or monitor the quarantine, treatment, or destruction of plants or plant products
- To promote integrated pest management
- To ensure the availability of safe and quality pesticides
- To streamline quarantine measures

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O. Animal Doctor/Veterinarian

A veterinarian, sometimes referred to as a vet, is an animal doctor who is responsible for diagnosing and treating animals those are sick, injured, or need routine care. To be a veterinarian, one must complete a B.V.Sc. (Bachelor in Veterinary Science) degree, which is a 5.5 year course. After completing this degree, a person can be recruited in both the government and private sectors. A veterinarian can also start a veterinary pet clinic, as the number of pets is growing steadily along with the demand for their healthcare.



Fig. 25.5: Veterinarian

Success story of backyard poultry farming

Sania Tuddu, a college student from Burudih village in Saraikela, Jharkhand, faced numerous challenges during her school years. She comes from a financially struggling family that could only afford two basic meals a day. Completion of education was a great challenge for her. To finance her college education, she began working as a farm labourer. During a visit to a Kisan Mela organized in the district, she learned about backyard poultry farming, which she found to be a lucrative means to support both her family and educational expenses.

Attending training programs helped Sania to gain the necessary knowledge and skills related to improved techniques for backyard poultry farming, covering aspects like breeds, feeding, disease control, vaccination, and marketing.

In 2015, she began poultry farming with 20 Jharsim breed poultry birds provided by the agricultural university. While studying in college, she scheduled her poultry farming activities in the morning and evening. After six months, the birds started laying eggs and gained weight, with an average body weight of 3 to 3.5 kg. She collected approximately 130 eggs and sold them for ₹10 each, while the birds were sold for ₹280 per kg. With a profit of ₹12,000, she expanded her backyard poultry farming business and increased her flock size to 135 birds over the next two years.

She now earns an average annual income of ₹30,000 to ₹35,000 by selling birds and eggs. Recognizing her entrepreneurial spirit, she was invited to share her success story on the regional Doordarshan channel and radio, and was honored by the Hon'ble Governor of Jharkhand with an award.



Fig. 25.6: Ms. Sania Tudu with her poultry birds



Notes

P. Fish Hatchery Manager

A fish hatchery is a place where young fishes are produced and reared commercially for distribution and selling to fish farms at a later period. A fish hatchery manager oversees the daily operations of a fish hatchery. A person with technical knowledge in fishery is preferred over others. Their work includes:

- ❖ Overseeing egg incubation, fish spawning, and fish rearing
- ❖ Performing hatchery operations
- ❖ Coordinating with employees
- ❖ Preparing the budget

Success story of a progressive fish farmer:

Sh. Manvender Singh, a resident of Bhurewala village in Ambala district, Haryana ventured into the fisheries sector in 2018. He received valuable advice and encouragement after consulting with District Fisheries Officer, Ambala. Later, he underwent training from the Fisheries Department, Haryana. In November 2018, he constructed a fish pond on two hectares of his own land. Over the time, he dug three more small ponds for nursery. For the construction of fisheries farm (digging of ponds, construction of office and store room, seed, medicine, equipment, aerators and feed), he spent a total of Rs. 15 Lakhs. He received a financial subsidy of Rs. 5.37 lakhs towards pond excavation and inputs assistance from the Fisheries Department, Haryana.

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In year 2020, Mr. Singh procured one lakh fish seeds from the Fisheries Department and stocked them in the nursery pond. After a couple of weeks, the fingerlings were transferred to the main pond. By the end of the same year, he sold 20 tonnes of fish. In that year, his earnings from fish farming were Rs. 20 lakhs, with a net profit of approximately Rs. 12 Lakhs. He plans to develop more ponds to boost fish production in the coming years.



Fig. 25.7: Fisheries farm of Mr. Manvender Singh

Q. Forest Conservationist

A person with training in preservation, protection, and management of forests and other natural areas is a forest conservationist or forester. Another vital aspect of a forester's role is the conservation of wildlife habitats within forests. Therefore, knowledge and capacities for management of forest, the environment, and wildlife are crucial for a forester. They work in partnership with government agencies, landowners, and environmental groups. After graduation, you can appear for Indian Forest Service (IFS) or State Forest Service (SFS) exams to become a forester in central and state forest departments.

R. Food Inspector/Food Safety Officer

Food inspectors are experts in public health who verify that food items adhere to safety and labelling regulations. They also guarantee the cleanliness and safety of the food supply. Generally persons with degrees in biological sciences such as agriculture, food science/food technology, botany, zoology, microbiology or biochemistry are preferred as food inspectors. Their main duties include:

- ❖ To take samples of any food or substance which appears to have been sold for human consumption
- ❖ To inspect any place where the food is manufactured or stored for sale

- ❖ To check for the manufacturing or storage of any adulterants and take samples of such food or adulterants for analysis

S. Dairy Manager

Depending on the size and kind of dairy farm, a dairy manager's duties can vary, but in general, they are in charge of managing the daily operations of the dairy. To become a dairy manager, one must complete training in dairy technology. Some common responsibilities associated with a dairy manager include:

- ❖ Animal care
- ❖ Managing the milking operation
- ❖ Quality control of milk
- ❖ Staff management
- ❖ Maintaining records of animal health, production and breeding
- ❖ Maintenance of dairy instruments



Notes

Success story of a dairy farm:

Located just a few kilometers from the National Dairy Research Institute (NDRI) in Karnal, Haryana, lies the quaint village of Nalvikhurd, surrounded by lush green wheat and berseem fields. Among the several commercial dairy farms in the area, Arvind Dairy Farm stands out. Owned by Mr. Parmod Khokhar and his brother Mr. Ravi Khokhar, the farm has a rich history of traditional farming.



Fig. 25.8: Arvind Dairy Farm of village Nalvikhurd

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Although the family has traditionally pursued farming, it was only five years ago that Mr. Khokhar decided to diversify the farm by rearing crossbred dairy animals. The farm currently houses 80 crossbred cattle (Holstein Friesian cross) along with an automated milk collection system and a meticulously maintained cattle shed and feeding area. The animals are fed high quality forages like a mixture of green and dry fodder (berseem, oats, and wheat straw), homemade concentrate (maize/wheat/barley + deoiled cake + neem) and mineral mixtures to ensure good health and high-quality milk production. Proper and timely vaccination is administered to maintain the sound health of the animals. Mr. Khokhar reports milk yields of 35-53 liters per day and average annual profit of 47 lakhs from his farm.

Currently, the farm supplies milk to big companies like Nestle, nearby villages, local sweet shops, and community functions as needed. The farm has also sold around 50-60 animals and provides advice on dairy farming to other farmers in the region. Due to its outstanding success in dairy sector, the farm was awarded the title of "Milk Champion" in 2015 at the Dairy Mela organized by the National Dairy Research Institute, Karnal. Mr. Khokhar attributes the success of Arvind Dairy Farm to NDRI, other research and development organizations, and private companies. The family envisions expanding the farm with a greater number of high-quality pure H.F. breeds.

A. Banker

Commercial banks in India recruit graduates in agriculture and related fields as Agricultural Field Officers (AFOs) for promoting the banks' financial products and services like crop loans, insurance, or Kisan Credit Cards (KCC), to farmers and landlords in rural areas. Additionally, They are also employed by NABARD (National Bank for Agriculture and Rural Development), which is the apex bank for providing finance in rural development and regulating rural banks operating in India.

Success Story of Honey Production:

Mr. Jatinder Jeet Pal is a young honey entrepreneur of M/s Maghi Ram and Sons, located at Doraha, Ludhiana, Punjab. The brand name of his honey is "Samanyu Honey". Mr. Jatinder began his business in 2001 with 200 honey boxes after receiving comprehensive training in honey production from Punjab Agricultural University, Ludhiana. He has expanded his business beyond pure honey production (raw honey and blend honey) to include manufacturing of beekeeping equipments, such as honey processing plants, bee hives, honey extractors, pollen traps, and

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grafting needles. Mr. Jatinder has been awarded with National level awards like Krishi Bhushan award from the Maharashtra Government and Parman Patra from the Punjab Government. 'Samanyu Honey' from Maghi Ram & Sons is being exported to USA, Middle East, and Japan with an annual turnover of Rs.15-20 crores.

U. Organic Farmer

Excessive use of agro-chemicals like fertilizers or pesticides can damage human health and the environment. As a result, consumers today prefer to buy organic products, which are free from harmful chemicals. Organic products are sold at higher prices than conventional ones, making organic farming a lucrative career choice in present times. An organic farmer performs agricultural operations similarly to a traditional farmer but focuses on minimizing the use of synthetic agrochemicals as much as possible.

*Notes***Success story of a organic farmer:**

Atinderpal Singh started turmeric cultivation in 2019 with the primary aim of processing and catering to local demand. Having completed his Master's in Agronomy from PAU, Ludhiana, Singh began growing, processing, and selling his produce directly in the local market, following a direct farm to kitchen model. Instead of relying on the chemicals for pest and weed management, Mr. Singh employs cultural as well as biological methods. In Punjab, where breaking away from the wheat-paddy cycle is difficult, he has successfully adopted crop diversification and moved away from water intensive paddy. He noted that after shifting away from paddy, beneficial animals like wild rabbits, quails, pheasants, red-wattled lapwings etc. had returned to the fields, a sign he sees as restoring ecological balance. The crop is grown, processed, and packaged on the farm and is sold at the farm gate. Starting with 2 acres of turmeric cultivation, he now cultivates 10 acres and sells it directly to end consumers. The farmer takes great pride in stating that his crop is pesticide and adulterant-free. Recounting his experience, he states that after initial difficulties in selling his crop, all his produce now sells directly from the farm gate itself. Economically, the initial cost of setting up the processing plant was 12 lakh rupees. In the first year, he generated a gross income of 3-4 lakhs, which has now increased to 20-22 lakhs. The farmer has been awarded several times for his crop diversification efforts by the Department of Agriculture and Farmers Welfare, Punjab.

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Success story of Fox Nut/Makhana production:

Sumitra Foods was co-founded in 2019 by Er. Ruchi Mandal and Er. Shravan Kr. Roy. They are driven by three strong objectives: empowering underprivileged women through training and employment, fostering an entrepreneurial mindset, and revolutionizing the Makhana processing industry. Shravan's interest in Makhana processing during his B.Tech in Food Process Engineering at the Indian Institute of Food Processing Technology sparked his vision for its global market potential. In 2019, Shravan left his corporate job and returned to Darbhanga, Bihar, to establish a Makhana processing unit. He convinced Ruchi, who was working with Samsung India Limited, to join him. With their personal savings, they launched Sumitra Foods, specializing in high-quality customized Makhana products. The enterprise's process involves handpicking raw Makhana seeds from ponds and processing them to meet clients' specific requirements. Sumitra Foods operates on a pan-India level, serving both B2B (Business to Business) and B2C (Business to Consumer) markets.

Sumitra Foods actively empowers women by providing employment opportunities and training in various aspects of food processing. The enterprise utilizes social media platforms such as WhatsApp, Facebook, and LinkedIn for effective marketing. The primary objective of Sumitra Foods is to cultivate an entrepreneurial mindset among daily wage workers, particularly women from financially disadvantaged backgrounds. They extend their support on a national scale by providing comprehensive training and supplying raw Makhana to women who express interest in establishing their own processing units. In 2020, Sumitra Foods had the honor of representing Bihar at the prestigious Organic Food Festival held in New Delhi. Their commendable efforts were recognized, and the enterprise was honored with the Tally MSME Honours in 2021.

Sumitra Foods is dedicated to establishing Makhana as a globally recognized agricultural product through their emphasis on women empowerment, transformative Makhana processing techniques, and promotion of entrepreneurship. The enterprise has emerged as a prominent player in the industry, driven by its unwavering commitment to quality, innovation, and social impact. By incorporating sustainable practices and fostering inclusive growth, Sumitra Foods not only contributes to the expansion of the Makhana industry but also uplifts underprivileged women and marginalized communities. This success is evidenced by their achievements in enhancing product value, creating employment opportunities, and fostering socio-economic development.



Fig. 25.9: Makhana packaging by local women and men



Notes



INTEXT QUESTIONS 25.3

1. The person who acts as a bridge between laboratory and land is known as
2. Plant protection specialists are also known as
3. Who undertakes the preservation, protection and management of forests?
4. What are the roles and responsibilities of a food inspector?



ACTIVITY 2

Visit nearby Krishi Vigyan Kendras (KVKs) or Block Agriculture Office to inquire about the types of crops generally grown in your locality. Additionally, collect agriculture related books or pamphlets written in your mother tongue.

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WHAT YOU HAVE LEARNT

- As agriculture is such a broad discipline, agricultural experts have many options where they might work, including academia, research, crop production, crop protection, marketing, sales, farm engineering, and farm management.

Enterprises in
Agriculture

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- In India, there are numerous public and private universities that offer undergraduate, post-graduate and Ph.D. degrees in agriculture and allied disciplines.
- Common undergraduate degrees offered in the field of agriculture include Bachelors in Agriculture, Horticulture, Veterinary Science, Fishery, Community Science, Agricultural Engineering, and Dairy Technology.
- There are plenty of jobs in the agriculture sector, including roles such as agronomist, commercial horticulturist, farm manager, agricultural chemist, veterinarian, agricultural economist, extension worker, hatchery manager.

**TERMINAL QUESTIONS**

1. Discuss the key skills and capabilities required for jobs in agriculture.
2. What entrepreneurial job opportunities exist in the agricultural sector?
3. What educational programmes are available to become an agricultural professional?
4. Explain the responsibilities of an agronomist. How do they contribute to the overall well-being and health of crops?
5. Discuss the role of agricultural extension specialists in improving the efficiency and productivity of farming operations. Provide examples of activities they undertake to support farmers.

**ANSWERS TO INTEXT QUESTIONS****25.1**

1. B.Sc. in Agriculture, B.Tech. in Agricultural Engineering, B.V.Sc. in Veterinary Science
2. Option d (Bachelor in Veterinary Science)
3. Four years

**25.2**

1. Option b (Agri-entrepreneur)
2. Option a (overall well being of crops)
3. Krishi Vigyan Kendras (KVKs), agricultural universities and research institutes, seed companies
4. True
5. Landscape horticulturists

25.3

1. Village level extension workers
2. Plant health specialist or plant pathologist
3. Forester
4. To assure the safety and quality of the food products

GLOSSARY

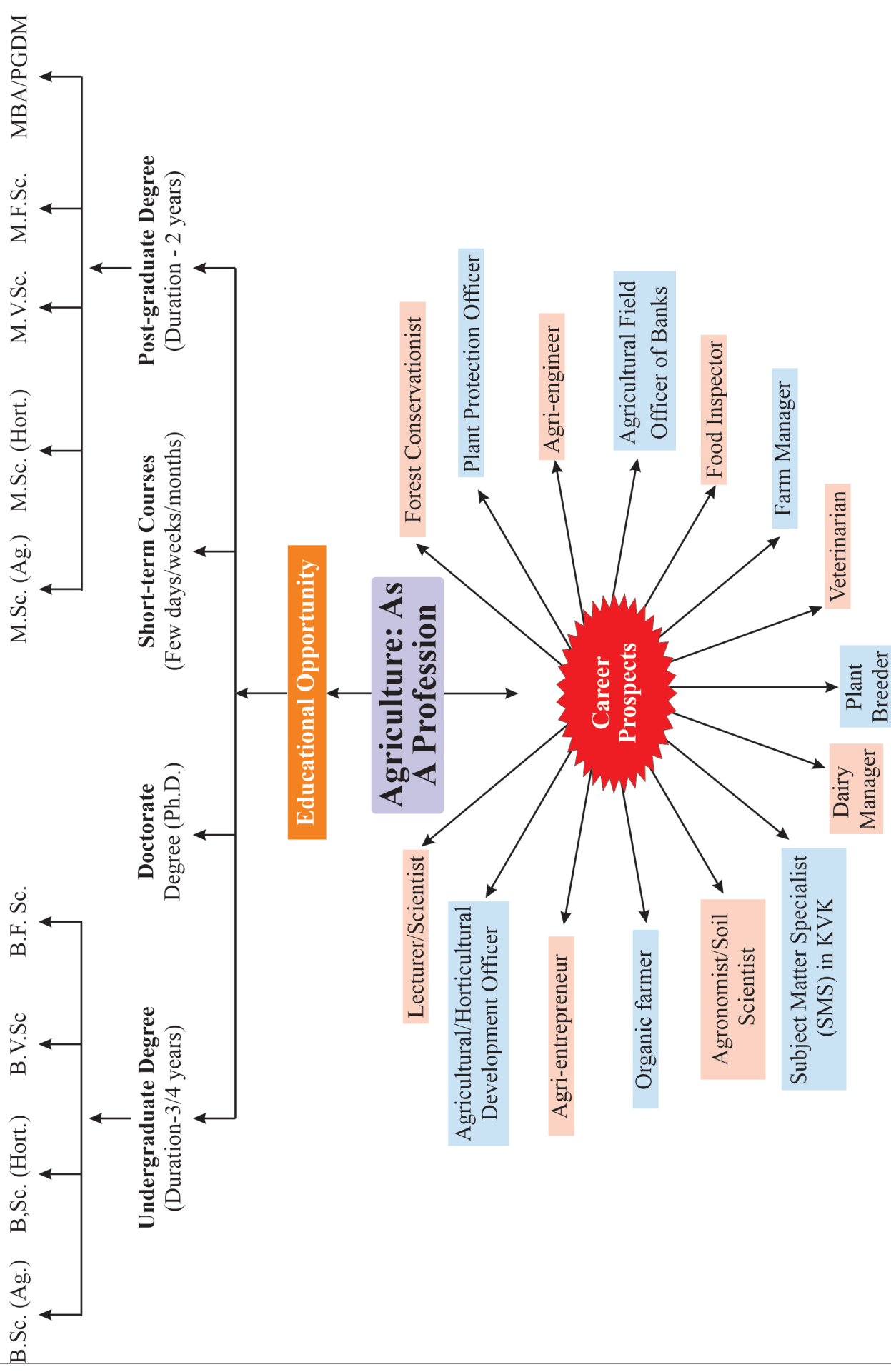
Agricultural Entomology: Agricultural entomology is a branch of agriculture that focuses on the study of insects and their interactions with agricultural crops.

Apiculture: Apiculture, commonly referred to as beekeeping, is the art of raising honey bees for the purpose of producing wax and honey.

Plant Pathology: Plant pathology is the sub-discipline of agricultural science that involves the scientific study of plant diseases caused by pathogens such as fungi, bacteria, viruses.

Vermicompost: Vermicompost is the type of compost created by the decomposition of biodegradable wastes in the presence of earthworms.

WHAT YOU HAVE LEARNT



National Institute of Open Schooling

Krishi: Production, Processing and Marketing at Senior Secondary Level (383) Curriculum

Rationale

Agriculture serves as foundation of human civilization and primary source of food production. It is fundamentally linked to the achievement of the sustainable development goals (sdgs), which aim to address global challenges such as poverty, hunger, and environmental sustainability. India is agrarian country where majority of population depend on agriculture for their livelihood generation. Therefore investing in sustainable agricultural practices is essential not only for achieving food security but also for fostering economic growth, promoting gender equality, sustaining water resources and addressing climate change. This course ‘krishi: production, processing and marketing’ has been designed for senior secondary level learners of nios in such a way that learners will be able to acquire the basic understanding of agriculture and its significance in day-to-day life. Special attention has been paid to incorporate eco-friendly farming practices of soil, crop and pest management so that learners become aware about the sustainable ways of food production. Further various case studies, success stories and real-life examples have been presented in order to educate the youths about promising employment opportunities in ‘krishi’. As the learners pursue their career paths in agriculture, this course is expected to provide meaningful and relevant learning experiences to them.

Course objectives

After completing this course, the learner will be able to:

- Recognize the significance of agriculture in indian as well as global society;
- Summarize how the farm products move from field to plate of the consumer;
- Familiarize with agricultural production practices and post-harvest technologies;
- Develop excellence and skills on the aspects of food production, its accessibility, food safety, and

nutrition as well as production economics;

- Outlines the basics of the food value chain viz. How farmers, food processors, exporters, retailers, and end consumers interact in the real world;
- Become aware about the marketing and export strategies for generating revenue through agriculture and its associated activities and
- Appraise entrepreneurship as a path to self-employment and income generation.

Course structure:

Sl. No.	Modules	Study hours	Marks
1.	Scope and importance of agriculture	25	12
2.	Crop production practices	45	25
3.	Post harvest management	20	10
4.	Food processing and value addition	35	15
5.	Agricultural economics, marketing and policy	35	13
6.	Enterprises in agriculture	20	5
7.	Practical	60	20
	Total	240 hrs.	100

Course Description**MODULE 1****(SCOPE AND IMPORTANCE OF AGRICULTURE)****Marks: 12****Study hours: 25****Approach**

This module aims at providing basic understanding of the subject Krishi (agriculture) to learners through the discussion of its evolution from ancient period to modern era, importance of agriculture in Indian economy, unique characteristics of Indian agriculture and modern technologies to hasten agricultural growth and productivity.

Lesson 1:**Evolution and development of agriculture****Topics:**

The lesson covers:

- Origin and evolution of agriculture
- Neolithic revolution (Domestication of plants and animals, technological achievements)
- History of agriculture in India (Pre-Vedic era, Vedic era, ancient dynasties, Mughal and British era)
- British agricultural revolution
- Green revolution (Basic elements and drawbacks, Evergreen revolution)
- Significant achievements of Indian agriculture in post independence era
- History of agricultural education & research in India

Learning Outcomes

The learner:

- recognizes how agriculture was gradually developed from ancient times to modern era;
- explains the reasons for backwardness of Indian agriculture during British period;
- identifies the role of 'Green Revolution' in alleviating hunger from India and
- distinguishes the achievement of India after independence in agriculture sector.

Lesson 2:

Importance of agriculture in Indian economy

Topics:

The lesson covers:

- Sectors of economy (Primary, secondary and tertiary sector)
- Indian agriculture at present scenario
- Role of agriculture in Indian economy
- Source of food, feed and fibre
- Source of income and employment
- Supplying raw material to industries
- Importance of agriculture in international trade
- Share in national income

Learning Outcomes

The learner:

- identifies different sectors of Indian economy;
- explains how agriculture acts as source of food, feed and fibre;

- analyzes role of agriculture in supplying raw material to industries and
- examines how agriculture contributes to employment generation and international trade of our country.

Lesson 3:

Characteristics of Indian agriculture

Topics:

The lesson covers:

- Concept of farm and farm size
- Land use pattern in India
- Challenges of Indian agriculture
- Agro climatic zones of India
- Different soil types of India
- Different farming systems in India
- Classification of crops
- Importance of allied sectors of agriculture
- Sources of irrigation in India

Learning Outcomes

The learner:

- defines the concept of farm and farm size;
- identifies the land use pattern in India;
- recognizes the different agro-ecological zones of India;
- explains the various systems of farming practiced in India and
- analyzes the importance of allied sectors in agriculture.

Lesson 4:**New developments in agriculture**

Topics:

The lesson covers:

- Evolution of agriculture technology (Agriculture 1.0, 2.0, 3.0, 4.0)
- Farm level modernization (Laser Land Leveling, Precision farming, Micro irrigation)
- Farm automation (Modern greenhouse, Artificial Intelligence, Mobile technology, Robotics, Remote sensing, Weather tracking, Drone, Farm management software)
- Modern practices in agriculture (Hydroponics & Aeroponics)
- Agritech startups and FPOs

Learning Outcomes

The learner:

- explains about the recent advancements in Indian agriculture;
- describes the role of emerging technologies and precision agriculture in crop production;
- defines the farm automation;
- discovers modern practices of crop production and
- states the role of Agritech startups and FPOs in agricultural revolution.

MODULE 2**(CROP PRODUCTION PRACTICES)****Marks: 25****Study hours: 45****Approach**

This module is designed to impart the technical knowledge about commonly cultivated crops, their specific climatic and soil requirement and the series of operations from land preparation, sowing, various intercultural practices to harvesting of crops. Additionally, it also discusses about different dimension of horticulture like Pomology, Olericulture, and Floriculture.

Lesson 5:**Soil health and plant nutrition**

Topics:

The lesson covers:

- Soil as a natural body for plant growth
- Components of soil (mineral matter, organic matter, air, water)
- Soil horizons and profile
- Weathering and soil formation
- Properties of soil (Physical, Chemical, Biological)
- Soil fertility and plant nutrition
- Sustainable soil management

Learning Outcomes

The learner:

- summarizes the importance of soil in agriculture and human life;

- explains how a soil is originated from parent rocks;
- supports the farmers to manage the soil sustainably for crop production and
- discusses the techniques for protection of soil from erosion and degradation.

Lesson 6:

Crops, cropping system and crop establishment

Topics:

The lesson covers:

- Concept of crop production practices
- Classification of crops (based on growing season and use)
- Cropping system
- Farming system
- Soil and climatic requirement of important field crops
- Field preparation (Conventional and conservation tillage)
- Seeds and varieties
- Sowing and transplanting

Learning Outcomes

The learner:

- classifies the crops growing in their surroundings according to their growing season and usage;
- develops integrated farming system plan for better farm productivity;

- recommends the crops for cultivation as per their specific soil and climatic requirement and
- prepares the field scientifically for sowing and transplanting of crops.

Lesson 7:

Nutrient, water and weed management

Topics:

The lesson covers:

- Type of plant nutrients, their function in plant body and characteristic deficiency symptoms
- Sources of plant nutrients: fertilizers and manures
- Fertilizer management in crops
- Water movement in soil
- Water requirement of various crops
- Scheduling and methods of irrigation
- Weeds, their classification and crop weed competition
- Weed control techniques

Learning Outcomes

The learner:

- defines the essential and beneficial plant nutrients;
- explains the role of proper nutrition in the plant's growth and development;
- identifies water requirement of various crops and the significance of supplying irrigation;
- discusses the different irrigation techniques; and
- describes the preventive and curative strategies of weed control.

Lesson 8:**Plant protection and harvesting**

Topics:

The lesson covers:

- Insect-pest; their life cycle and feeding habit
- Integrated pest management: physical, cultural, chemical, biological and behavioral control
- Disease pests: fungi, bacteria and virus
- Disease management
- Harvesting of crops (criteria and methods)

Learning Outcomes

The learner:

- defines the insects, pests, diseases and their life cycle;
- explains the importance of integrated pest management in managing ecological imbalance;
- distinguishes common disease symptoms of plants; and
- identifies the appropriate method and suitable time for harvesting of plant produces.

Lesson 9:**Fundamentals of horticulture and fruit production**

Topics:

The lesson covers:

- Concept & origin of horticulture
- Division of horticulture

- Importance of horticultural crop and factors affecting horticultural production
- Climatic zones for horticultural production in India
- Propagation of horticultural crops (asexual and sexual propagation)
- Types of fruits
- Orchard management
- Training and pruning
- Causes and remedies of fruit drop and barrenness in plants

Learning Outcomes

The learner:

- defines the concept and origin of horticulture;
- identifies the different horticultural zones of India;
- describes various plant propagation techniques;
- discusses about orchard for large scale production of fruits and
- explains the causes and remedies of fruit barrenness.

Lesson 10:**Vegetable crops**

Topics:

The lesson covers:

- Difference between vegetable and fruit crops
- Importance and scope of vegetable cultivation in India
- Classification of vegetables

- Types of vegetable gardens
- Nursery raising of vegetables
- Cultivation practices of important vegetable crops

Learning Outcomes

The learner:

- differentiates between vegetable and fruit crops;
- summarizes the scope of vegetable cultivation in India;
- explains various types of vegetable gardens;
- describes the method to develop a vegetable nursery and
- tabulates the cultivation techniques of common vegetables grown in India.

Lesson 11:

Flower crops

Topics:

The lesson covers:

- Importance of floriculture and Prospects of floriculture in India
- Cut and loose flowers
- Shrub & shrubby border
- Climber plants and Cut greens (fresh leaves and stems)
- Potted plants & annuals
- Flower seed production and bulbous ornamentals
- Nursery, lawn and arboriculture
- Perfumes, colouring pigments, dried flowers

- Bonsai and terrarium

Learning Outcomes

The learner:

- defines floriculture and its prospects of in India;
- describes the popular flower species cultivated in India;
- recommends suitable shrubs and climbers for specific purposes and
- discusses the different components of commercial floriculture.

MODULE 3

(POST HARVEST MANAGEMENT)

Marks: 10

Study hours: 20

Approach

This module aims at developing awareness about post-harvest losses occurring after harvesting and before consumption and proper post-harvest management techniques to minimize these losses. It also discusses about various traditional and modern practices by which learners can ensure quality, nutritional value, and safety of food products.

Lesson 12:

Need and importance of post harvest management

Topics:

The lesson covers:

- Causes and effects of post harvest loss
- Benefits of effective management of post-harvest systems

- Types of post-harvest loss (PHL)
- Important sites of post harvest losses
- Advanced technologies to minimize the losses

Learning Outcomes

The learner:

- explains the importance of post harvest management;
- identifies the reasons for post harvest loss;
- classifies the different types of post harvest loss; and
- indicates the advanced technologies to manage post harvest loss.

Lesson 13:

Processes in post-harvest management system

Topics:

The lesson covers:

- Steps involved in post harvest management system
- Processing of fruits and vegetables
- Processing of cereals

Learning Outcomes

The learner:

- identifies various processes of post-harvest management system;
- describes the methods of fruits and vegetables processing; and
- explains the cereal processing techniques.

Lesson 14:

Storage and warehousing

Topics:

The lesson covers:

- Importance of storage
- Factors of storage
- Precautions of fruit and vegetable storage
- Changes in the food during storage
- Storage techniques
- Warehouse

Learning Outcomes

The learner:

- defines the storage and its importance;
- explains the important factors of food storage;
- indicates several precautions for prolonged storage of foods;
- identifies the difference between traditional and modern storage structures and
- describes the warehousing system of food storage.

MODULE 4

(FOOD PROCESSING AND VALUE ADDITION)

Marks: 15

Study hours: 35

Approach

Food processing extends the shelf life of perishable products. This is crucial in reducing post-harvest

losses and improving farmer's income and resource utilization. As demand for easy to prepare and ready-to-eat food is growing, this module is designed to impart the knowledge of different food groups, their processing techniques and methods of value addition among learners for tapping employment opportunities in this sector. Apart from that, the learner will also understand the importance of maintaining food safety and quality during processing.

Lesson 15:

Food processing sector: opportunities and challenges

Topics:

The lesson covers:

- Importance of food
- Present status of Indian food processing industry
- Scope of food processing sector
- Challenges in food processing sectors
- Opportunities in food processing sector

Learning Outcomes

The learner:

- defines food processing and explains its importance;
- describes the current status of the food processing sector in our country;
- lists the various sub-sectors of the food processing industry;
- discusses the scope and opportunities available in the food processing sector;

- highlights the challenges and constraints faced by the food processing sector and
- outlines the various schemes and initiatives by the government to support the food processing industry.

Lesson 16:

Food groups and nutritional importance

Topics:

The lesson covers:

- Sources of food (plants and animals)
- Basic food groups and their classification
- Balanced diet
- Nutrients present in food

Learning Outcomes

The learner:

- states the different sources of food;
- classifies food into various food groups;
- explains the importance of a balanced diet;
- lists the nutrients present in food;
- describes the importance of nutrients in our food and
- identifies important food sources for these nutrients.

Lesson 17:

Types and methods of food processing

Topics:

The lesson covers:

- Types of food processing (primary and secondary)
- Principles of food preservation
- Methods of food processing (blanching, pasteurization, dehydration, freezing and fermentation)
- Emerging non-thermal technologies

Learning Outcomes

The learner:

- recognizes the common food spoilage factors;
- explains the principle of food preservation;
- describes different levels and important methods of food processing;
- lists the advantages and disadvantages of different techniques and
- enlists the emerging techniques in food processing.

Lesson 18:

Value added food products

Topics:

The lesson covers:

- Importance of value addition and range of value added food products
- Techniques opted for value addition of food products
- Value added products of fruits and vegetables
- Value added products from cereals
- Value added products from milk

Learning Outcomes

The learner:

- defines the value addition;
- lists the different methods used for value addition of foods;
- explains the value addition of fruits and vegetables and different value added products;
- describes the process of value addition of cereals and
- outlines the value addition of milk and different value added milk products.

Lesson 19:

Food safety and quality control

Topics:

The lesson covers:

- Attributes of food quality
- Methods of food quality control
- Food quality inspection and food quality control
- Quality control (QC) and quality assurance (QA)
- Food safety
- Food Safety Management Practices (FSMP)
- Food product certifying bodies

Learning Outcomes

The learner:

- identifies the characteristics of food quality;
- interprets the concept of food safety;

- differentiates between quality control and quality assurance;
- evaluates various Food Safety Management Practices like GMP, GHP, HACCP and
- discovers the features and functions of national and international food quality certifying bodies.

MODULE 5

(AGRICULTURAL ECONOMICS, MARKETING AND POLICY)

Marks: 13

Study hours: 35

Approach

The knowledge of economics is helpful for the allocation, distribution, and utilization of farming resources. This knowledge enables farmers to optimize their production processes, manage costs effectively, and enhance the overall efficiency of their operations. This module introduces various principles, concepts, and factors of agricultural economics as well as their potential applications in real market situation. Additionally the role various marketing institutions, functionaries, government policy initiatives are discussed to make the learners aware about scope of availing the credit and insurance facility in market.

Lesson 20:

Basics of agricultural economics

Topics:

The lesson covers:

- Principles of economics
- Agricultural economics: definition, nature and scope

- Characteristics of Indian agriculture as an industry, and its role in the national economy
- Concept of demand and supply
- Price determination
- Factors of production
- Elements of costs and benefits

Learning Outcomes

The learner:

- explains the importance of learning economics;
- describes agricultural economics in terms of definition, nature and scope;
- infers characteristics of Indian agriculture industry;
- identifies the factors of production;
- summarizes the concept of demand and supply as well as their factors;
- defines the cost and revenue concepts and
- demonstrates the practical applications and utility of demand, supply, price, and costs.

Lesson 21:

Agricultural marketing and policy

Topics:

The lesson covers:

- Concept of agricultural marketing
- Utility in marketing
- Marketing channels
- Marketing functionaries
- Marketing functions

- Marketing institutions
- Government policy support

Learning Outcomes

The learner:

- explains the concepts of agricultural marketing;
- identifies marketing channels;
- describes marketing functions;
- recognizes different marketing institutions and their role and
- discusses Government policies to facilitate the marketing of agricultural goods.

Lesson 22:

Agricultural finance and credit in India

Topics:

The lesson covers:

- Importance of credit and finance in agriculture
- Commercial banks
- Cooperative credit structure
- Major types of institutional credit
- Micro finance in India
- Crop insurance
- Kisan Credit Card (KCC)

Learning Outcomes

The learner:

- recalls the necessity of timely availability of credit in agriculture;

- identifies the various public and private agencies working in the field of agricultural finance;
- differentiates between a cooperative bank and commercial bank and describes their role in agriculture finance;
- explains the concept of microfinance and how the model works in India and
- assesses the significance of crop insurance and the Kisan Credit Card in supporting the farmers.

MODULE 6

(ENTERPRISES IN AGRICULTURE)

Marks: 05

Study hours: 20

Approach

This module aims to deliver the joy of self-employment among the learners through development of entrepreneurial capabilities. Also how the learners can benefit the society by forming self-help groups is also discussed. Further the learner will also be able to explore the diverse educational and occupational opportunities existing in agriculture and allied sectors.

Lesson 23:

Entrepreneurship: nature, types and levels

Topics:

The lesson covers:

- Meaning and definition of entrepreneurship
- Need to become an entrepreneur
- Traits of a good entrepreneur
- Different stages of entrepreneurship

- Types of enterprises
- Entrepreneurship as a career
- Case studies of successful entrepreneurs

Learning Outcomes

The learner:

- defines the concept of entrepreneur, entrepreneurship and enterprise;
- appraises entrepreneurship as a career option;
- plans to inculcate the skills of a successful entrepreneur;
- identifies the stages of enterprise development;
- differentiates between MSMEs and large enterprises and
- cites examples of successful entrepreneurial models in agriculture.

Lesson 24:

Importance of self-help groups in agriculture and village economy

Topics:

The lesson covers:

- Concept and definition of Self-Help Groups (SHGs)
- Need of self-help groups
- Characteristics of self-help groups
- The rise of SHGs: emergence and evolution in India
- Developmental stages of self-help groups in India
- Functions of self-help groups
- Constraints of self-help groups (SHGs)

- Future course for effective self-help groups
- Examples of self-help groups in India

Learning Outcomes

The learner:

- explains the concept and meaning of self-help groups;
- appraises the merits of forming self-help groups among local people;
- describes the evolution of SHGs over time and
- persuades the local youth and women to form self-help groups for their socio-economic development.

Lesson 25:

Career opportunities in agriculture

Topics:

The lesson covers:

- Scope of agriculture as a profession
- Educational programmes available in agriculture science
- Popular job opportunities in agriculture sector
- Success stories of agri-entrepreneurs

Learning Outcomes

The learner:

- recognizes the employment opportunities in the field of agriculture;
- identifies agriculture related educational programmes available in India and
- explains the roles and responsibilities of popular professions of the agriculture field.



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