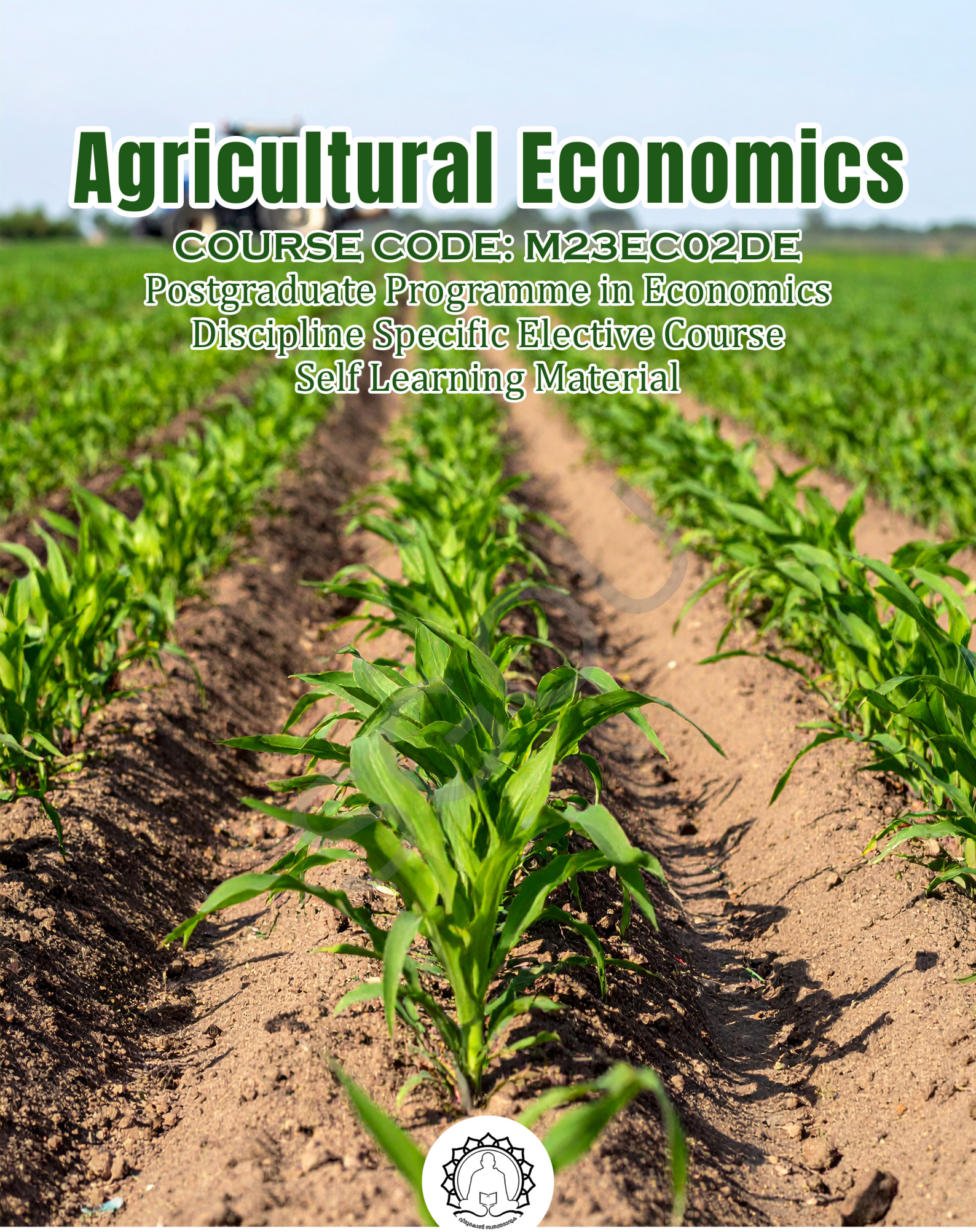
Agricultural Economics

COURSE CODE: M23EC02DE

Postgraduate Programme in Economics

Discipline Specific Elective Course

Self Learning Material



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Mission

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Pathway

Access and Quality define Equity.

Agricultural Economics

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Semester - III

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MESSAGE FROM VICE CHANCELLOR

Dear learner,

I extend my heartfelt greetings and profound enthusiasm as I warmly welcome you to Sreenarayanaguru Open University. Established in September 2020 as a state-led endeavour to promote higher education through open and distance learning modes, our institution was shaped by the guiding principle that access and quality are the cornerstones of equity. We have firmly resolved to uphold the highest standards of education, setting the benchmark and charting the course.

The courses offered by the Sreenarayanaguru Open University aim to strike a quality balance, ensuring students are equipped for both personal growth and professional excellence. The University embraces the widely acclaimed "blended format," a practical framework that harmoniously integrates Self-Learning Materials, Classroom Counseling, and Virtual modes, fostering a dynamic and enriching experience for both learners and instructors.

The University aims to offer you an engaging and thought-provoking educational journey. The postgraduate programme in Economics builds on the undergraduate programme by covering more advanced theories and practical applications. The course material aims to spark learners' interest by using real-life examples and combining academic content with empirical evidence, making it relevant and unique. The Self-Learning Material has been meticulously crafted, incorporating relevant examples to facilitate better comprehension.

Rest assured, the university's student support services will be at your disposal throughout your academic journey, readily available to address any concerns or grievances you may encounter. We encourage you to reach out to us freely regarding any matter about your academic programme. It is our sincere wish that you achieve the utmost success.

Regards,
Dr. Jagathy Raj V.P.

01-01-2025

Contents

BLOCK 1

Introduction to Agricultural Economics

UNIT 1

Agricultural Economics

Learning Outcomes

After learning this unit, the learner will be able to:

- understand the nature of agricultural and rural economics
- know about traditional agriculture and its modernisation
- identify the interdependence between agriculture and industry

Background

Agricultural economics and rural economics are two branches of economics that examine the vital role of agriculture and rural areas in economic development. Agricultural economics focuses on the allocation of resources in farming, and exploring the production, distribution, and consumption of agricultural products. It encompasses various components such as crop production, livestock farming, forestry, marketing, and farm input supplies like fertilisers and machinery. Rural economics, on the other hand, looks beyond farming and addresses broader issues within rural areas, including poverty, migration, infrastructure development, and policies aimed at promoting rural growth and sustainability. The agricultural practices have transitioned from traditional methods based on local culture and ecological balance to modern techniques that seek to maximise efficiency. Innovations like high-yielding varieties (HYVs), modern irrigation systems, and biotechnology have revolutionised farming. Organic farming has emerged as a response to the harmful effects of chemical fertilisers and pesticides, promoting sustainability and long-term soil health. Agriculture remains fundamental to the economies of many developing countries, driving poverty reduction, food security, industrial growth, and job creation. The symbiotic relationship between agriculture and industry ensures continued economic prosperity, especially in regions where both sectors are integral to national development. In this context, this unit focuses on the role of agriculture in economics, specifically agricultural economics and its significance.

Keywords

Agricultural Economics, Rural Economics, Organic Farming, Modernisation

Discussion

1.1.1 Nature and Scope of Agricultural and Rural Economics

- Agricultural and rural economies are directly or indirectly connected

Agricultural economics and rural economics are two specialised branches of economics. Agricultural economics focuses on the application of economic principles to the agricultural sector. It studies how scarce resources in agriculture are allocated, the production, distribution, and consumption of agricultural products, and the impact of policies and market forces on agriculture. On the other hand, rural economics examines the economic conditions and development of rural areas, focusing on the livelihood and well-being of rural populations. It is concerned with the economic activities that take place outside urban areas, including agriculture, rural industries, and services. Both fields are directly or indirectly connected.

1.1.1.1 Nature of Agricultural Economics

- Economic aspects of agriculture

Agricultural economics is the branch of economics that studies the economic aspects of agriculture. It combines principles of economics with the agricultural sector and focuses on the production, distribution, and consumption of agricultural goods and services. In the past, agriculture was primarily based on the production of basic food crops and was often associated with subsistence farming. However, with the commercialisation of agriculture, the scope of the field has been expanded significantly. Today, agricultural economics encompasses various sectors beyond crop production, including forestry, animal husbandry, marketing, processing, and distribution of agricultural products. It also involves businesses that provide necessary inputs to farmers, such as fertilisers, machinery, and seeds, and those that convert raw farm products into food and fibre for consumption. Thus, agricultural economics covers a wide range of activities, many of which extend beyond farms and are not managed directly by farmers.

- Agricultural economics is an applied science

According to A.W. Ashby, "Agricultural economics is an applied science, that is, it is a methodical pursuit of knowledge of economic processes and organisation in agriculture and of their results, for the process of stabilising adaptations or modifying and, if necessary, changing their results." This means agricultural economics is an applied social science that aims to solve problems related to agriculture through economic analysis, contributing to the improvement of the agricultural sector and its related industries.

1.1.1.2 Scope of Agricultural Economics

- Agricultural economics is not different from general economics

Agricultural economics borrows many principles from general economics. Like general economics, the core issue in agricultural economics is the problem of scarcity of resources and the selection of how to employ those resources. Agricultural economics is not entirely different from general economics; it shares many of the same analytical tools and areas of focus to solve these issues. These areas include production economics, which deals with understanding how crops and livestock are produced and the decisions behind resource allocation; consumption economics, which explains how agricultural products are consumed by households and industries; and distribution, which refers to how agricultural goods move through the economy, from production to consumption. Additionally, agricultural economics covers financing, which shows how farmers finance their activities and investments, and planning and policy, which relate to agricultural policy decisions and strategic planning aimed at guiding the development of agriculture.

- Agricultural economics examines both the micro and macro aspects of the agricultural sector

Agricultural economics uses both microeconomic and macroeconomic analysis to understand the behaviour of individual agricultural units and the broader sector. In microeconomic analysis within agricultural economics, the focus is mainly on individual farmers or specific agricultural enterprises. It examines decisions related to production choices, such as which crops to grow or which livestock to raise, how to minimise costs, and how to allocate resources efficiently for maximum productivity. This type of analysis helps to understand the behaviours of individual agricultural units and the factors that influence their decisions regarding input-output combinations, land use, labour, and capital. At the macro level, agricultural economics looks at the agricultural sector as a whole. It examines broader areas like national agricultural policies, overall agricultural growth, and the

role of agriculture in the economy. Macroeconomic analysis studies the impact of agricultural decisions and policies on national economic growth, food security, rural development, and overall economic stability.

Agricultural economics involves both static and dynamic analysis. Static analysis deals with the economic situation at a particular point in time. It explains the state of agriculture, providing policymakers and researchers with a snapshot to assess current agricultural conditions, resource allocation, and the efficiency of agricultural systems without considering the effects of time or external changes. On the other hand, dynamic analysis examines changes in the economic situation over a period of time. It focuses on how agricultural decisions and policies impact the economy in the long run, helping to understand the long-term effects of agricultural investments, technology adoption, land reforms, or changes in market conditions. It also aids in predicting the future trajectory of the agricultural sector and its implications for national economic growth.

- Agricultural economics involves both the static and dynamic analysis of the agricultural sector

Agricultural economics encompasses the decision-making processes involved in farming and agricultural enterprises. It specifically focuses on how farmers make key choices that affect production and profitability. For example, when farmers make decisions about crop selection, they must consider factors such as market demand, climate, and available resources. Agricultural economics studies how farmers determine the most cost-effective methods of production, including strategies to minimise costs and maximise efficiency. It also explores how farmers allocate their limited resources (labour, capital, and land) to achieve the most productive combination of inputs for specific agricultural activities. Further, agricultural economics examines the business relationships farmers have with suppliers (for inputs such as seeds, fertilisers, and machinery) and buyers (for outputs like crops and livestock), with a focus on pricing, contracts, and market conditions.

- Agricultural economics encompasses the decision-making processes

1.1.1.3 Nature and Scope of Rural Economics

Rural economics is the study of economic activities in areas beyond urban centers such as farms and small towns. It looks at both farming and other businesses that happen in these areas. Rural economics is different from agricultural economics because it includes more than just food production, it also looks at industries and services in rural places. Rural areas

- Study of how the economy works in rural area

face some big problems, like poverty, few job opportunities, and people moving to cities for work. Many rural areas also do not have things like electricity, good roads, or easy access to healthcare, which makes it harder to grow the economy there. These problems can lead to people leaving rural areas, which creates a big gap between incomes in cities and the countryside.

- Rural economics also focuses on ways to improve life in these areas

Rural economics also focuses on ways to improve life in these areas. For example, providing electricity to homes, starting rural tourism, or encouraging new businesses can help create jobs and boost the economy. These changes can make living in rural areas better, and can help people who are living in poverty to have a better chance at success. A big challenge in rural areas is that they don't have as many people as cities, which can make it harder to build things like schools or hospitals. Governments have to make special rules and policies to help these areas. For example, they may invest in better transportation, offer financial support to farmers, or make it easier for people to get loans to start businesses. In short, rural economics looks at how to make rural areas better places to live by creating jobs, improving infrastructure like roads and electricity, and making sure the government supports these areas. It is about finding ways to help rural areas grow and reduce the gap between city and country life.

1.1.2 Traditional Agriculture and its Modernisation

Traditional agriculture is deeply connected to the environment and local culture, forming a balanced and sustainable way of life. Traditional agriculture involves not only farming but also the overall harmony between the land, animals, trees, and people. The farming practices passed down through generations are deeply rooted in local knowledge, culture, and the natural environment. Therefore, they are adaptive, using methods that suit local conditions and ensure sustainable production. Let us discuss the features of traditional farming.

- **Sustainability Focus:** Traditional agriculture emphasises sustainability. It focuses on maintaining ecological balance, conserving soil fertility, and using natural resources wisely to avoid depletion.
- **Diversity of Crops:** One of the hallmarks of traditional agriculture is the cultivation of a wide variety of crops.

These crops are indigenous varieties that are well-suited to the local environment. Such biodiversity improves strength against pests, diseases, and climate variation.

- **Soil Fertility Management:** In traditional agriculture, soil fertility is maintained through the use of organic matter like compost, animal manure, and crop residues. Crop rotation and intercropping practices also prevent soil depletion and improve long-term soil health.
- **Water Conservation:** Traditional agriculture adopts indigenous irrigation methods, such as the use of wells, canals, and rainwater harvesting, to help use water efficiently, particularly in areas with irregular rainfall. These methods are often designed to conserve water.
- **Agroforestry Integration:** Traditional agricultural systems integrate trees with crops, forming an agroforestry system. Trees provide shade, prevent soil erosion, offer fruits, timber, and fuel, and improve water retention, all contributing to the overall health of the land.
- **Low External Input Dependence:** Traditional farmers depend on local resources rather than on external chemical inputs such as synthetic fertilizers and pesticides. This reduces costs and dependence on global markets while promoting the health of the local ecosystem.
- **Adaptation to Local Conditions:** Traditional agricultural systems are highly adaptable to local environments. They are shaped by centuries of knowledge about local climate, soil types, and ecosystems, allowing them to thrive even in diverse and challenging conditions.
- **Global Relevance:** As the world faces challenges like climate change, food security, and biodiversity loss, traditional agricultural methods are gaining recognition for their potential to offer sustainable solutions. Many advocates argue that blending traditional wisdom with modern technologies can lead to a more sustainable agricultural future.

- Traditional agriculture is deeply connected to the environment and local culture

1.1.2.1 Modernisation of Traditional Farming

Traditional farming has many advantages. Modernisation incorporates new technologies, practices, and inputs into traditional systems to improve efficiency, sustainability, and yields. Let us discuss how traditional agriculture adopts modern farming practices.

1. **Introduction of Modern Equipment:** Tractors, harvesters, and other machinery can increase efficiency and reduce labour requirements. These machines help farmers cultivate larger areas of land and increase crop yields. For instance, in many parts of India, traditional ploughing methods with oxen are being replaced by tractors to save time and increase the efficiency of farming operations.
2. **Use of High-Yielding Varieties (HYVs):** High-yielding varieties of crops have been developed to resist diseases, pests, and extreme weather conditions. They also produce higher yields compared to traditional varieties. For example, the Green Revolution introduced high-yielding wheat and rice varieties in India, leading to significant increases in food production and self-sufficiency.
3. **Modern Irrigation Techniques:** Modern irrigation methods, such as drip irrigation and sprinkler systems, are water-efficient and can be used in areas where water scarcity is a major concern. These systems help optimise water usage while improving crop yields. For instance, drip irrigation systems are widely used in Israel and parts of India for crops like tomatoes, providing water directly to the roots, reducing waste, and ensuring more effective water use.
4. **Genetic Modification and Biotechnology:** Genetic engineering and biotechnology can create crops that are resistant to pests, diseases, and adverse weather conditions. Genetically modified (GM) crops can also be engineered to have enhanced nutritional content. For example, Bt cotton, a genetically modified cotton variety resistant to certain pests, has been adopted by many farmers in the U.S. and India, reducing the need for chemical pesticides.

- Modernisation incorporates new technologies and practices into the agricultural system

5. **Integrated Pest Management (IPM):** Modern techniques such as Integrated Pest Management (IPM) combine traditional and scientific methods to manage pests. This reduces the dependency on chemical pesticides while maintaining crop health. For example, in China, IPM combines crop rotation, biological control agents (like ladybugs), and selective pesticide use to control pests without damaging the environment.
6. **Soil Health Management Using Technology:** Precision agriculture uses technology such as soil sensors and GPS (Global Positioning System,) mapping to assess soil health and manage fertilisers and water usage precisely. This

minimises resource wastage and increases agricultural efficiency. For example, in the U.S., precision farming technology is used to apply the right amount of fertiliser and water to specific parts of a field, optimising resources and minimising waste.

1.1.3 Organic Farming

For thousands of years, agriculture was practiced without the use of artificial chemicals. During the mid-19th century, artificial fertilisers were developed. They were cheap, effective, and easy to transport, which revolutionised farming. In the 1940s, chemical pesticides were introduced, greatly improving crop yields in the short term but causing long-term environmental and health issues (e.g., soil compaction, erosion, and health concerns over toxic chemicals).In the early 1900s, scientists began researching ways to maintain high agricultural production without the harmful effects of artificial chemicals. In 1921, Albert Howard and his wife Gabrielle Howard established the Institute of Plant Industry in India. They studied traditional farming methods, introducing crop rotation, composting, and animal husbandry techniques. Upon returning to Britain in the 1930s, Howard became a strong advocate for organic agriculture. The term 'organic' was popularised by Albert Howard and J.I. Rodale to refer to the use of organic matter (compost and manure) to improve soil quality. This concept is rooted in early soil science, known as 'humus farming.'

- Howard is considered a pioneer of organic farming

Organic farming is an agricultural method that prioritises natural processes and resources for food production. It uses natural fertilisers and pest control methods derived from plant and animal waste, rather than relying on chemical pesticides and synthetic fertilisers. This approach was developed as a response to the environmental damage caused by conventional farming practices that use these chemicals. The aim of organic farming is to create a balanced, sustainable farming ecosystem that promotes healthier food, maintains soil fertility, and helps preserve biodiversity.

- Agricultural system based on natural resources

The organic agriculture system is based on ecological processes, biodiversity, and local adaptation, as opposed to using inputs that might have harmful effects on soils, ecosystems, and people. It blends tradition, innovation, and science to foster a sustainable environment. Let us discuss some of the benefits of organic farming.

1.1.3.1 Benefits of Organic Farming

1. **Crop Diversity in Organic Farming:** Organic farming encourages polyculture, which means planting a variety of crops in the same space. This approach attracts beneficial insects, enhances soil health by promoting helpful microorganisms, and helps balance the ecosystem. By planting different types of crops, it also prevents species from becoming endangered or extinct. Through crop diversity, soil fertility can be increased as different crops support the growth of microorganisms that maintain soil health. Additionally, it can reduce pest and disease pressures, as the variety of crops makes it harder for harmful insects to thrive. Furthermore, crop diversity can improve the nutritional quality of food, as a broader range of crops provides a variety of nutrients for people to consume. Overall, crop diversity in organic farming benefits the health of the farm, the environment, and human nutrition. It also helps preserve biodiversity and maintain ecological balance.

- Planting a variety of crops in the same space

2. **Soil Management:** In organic farming, soil fertility is primarily maintained through natural processes, such as the breakdown of organic matter, including green manure and composting. Microorganisms, such as mycorrhiza (fungi) and earthworms, play a crucial role in breaking down organic material, releasing nutrients into the soil, and making them available to plants throughout the growing season. Farmers use various techniques to maintain soil fertility, including crop rotation, cover cropping, reduced tillage, and composting. Reduced tillage helps retain more organic matter in the soil and offers the added benefit of carbon sequestration, which refers to storing carbon in the soil. This process helps reduce greenhouse gases and combat climate change. Additionally, reduced tillage can improve soil structure and reduce erosion. When farmers use crop rotation and incorporate legumes, such as beans or peas, these crops help fix nitrogen from the air into the soil through a process involving beneficial bacteria. Organic farmers may also add animal manure, seed meals, and mineral fertilisers like rock phosphate to improve soil quality. However, some adjustments, such as changing the soil's pH (acidity or alkalinity), may be necessary. Organic farming permits the use of certain substances to correct pHs, such as lime or sulphur.

- Soil fertility is primarily maintained through natural processes

3. **Weed Management in Organic Farming:** Organic farming focuses on weed suppression, not elimination.

Weed growth is reduced through phytotoxic substances. Phytotoxins refer to naturally occurring or synthetic substances that affect plant growth. These substances can be a result of human activity (such as herbicides), or they can be produced by plants, microorganisms, or naturally occurring chemical reactions. Organic farming involves planting different crops in the same area each season and also includes planting weed-suppressive cover crops and choosing crops with varying life cycles to make it harder for weeds to grow. This helps prevent weed proliferation. Organic farmers use several practices to increase crop competitiveness and reduce weed pressure. These practices include:

- Selecting competitive crop varieties
- Planting crops densely (high-density planting)
- Using tight row spacing to shade out weeds
- Delaying planting until the soil is warm enough to encourage rapid germination

Additionally, several non-chemical techniques are used to control weeds, such as:

- Physically removing weeds by cutting off their top growth
- Using heat (e.g., flame weeding) to kill weeds
- Employing materials like organic matter, plastic films, or landscape fabric to block weed growth.

- Organic farming focuses on weed suppression, not elimination

Grazing animals, such as geese, can help control weeds by eating them. This practice, which was once common in the southern U.S., is being revived to help control weeds in organic crops like cotton, strawberries, tobacco, and corn. Additionally, some rice farmers use ducks and fish in paddy fields to eat both weeds and insects.

- Organic pest management practices are adopted to control harmful organisms

4. **Pest Management:** In organic farming, organic pest management practices are adopted to control harmful organisms such as insects, mites, nematodes, fungi, and bacteria, which are essential for maintaining healthy crops. Organic pest management practices include biological controls, predatory insects, and naturally derived insecticides and fungicides. Biological control involves using natural predators to manage pests.

- Organic farming provides animals with natural living conditions and feed

5. **Livestock in Organic farming :** In organic farming, raising animals like livestock and poultry for meat, dairy, and eggs is a traditional part of the farm. These farms aim to provide animals with natural living conditions and feed. While animals can receive medicine if they are sick, they cannot be given drugs to help them grow faster. Their feed must be organic, and they must have access to pasture. In the past, horses and cattle were important for helping with farm work, providing manure for soil fertility, and even supplying food for other animals. Today, these animals are still valued in organic farming for their role in maintaining a sustainable, self-sufficient farm system.

- Organic farming does not allow genetically engineered plants and animals

6. **Genetically Modified (GM) Crops :** One of the main principles of organic farming is that genetically engineered plants and animals are not allowed. This was officially agreed upon by over 600 delegates from more than 60 countries at IFOAM's (International Federation of Organic Agriculture Movements)12th Scientific Conference on October 19, 1998. However, there are concerns that pollen from genetically modified (GM) crops is contaminating organic and heirloom seeds, making it hard to keep GMOs out of organic food. Additionally, different rules in different countries make it difficult to control the spread of GMOs into organic farming systems.

1.1.3.2 Effects of Organic Farming

1. Organic farming often requires more land to produce the same amount of food as conventional farming due to lower per-hectare yields and space requirements for crop rotation. Some studies suggest organic farming can generate more greenhouse gas emissions, mainly due to nitrogen leaching and nitrous oxide emissions. However, organic farming typically uses less energy compared to conventional methods. Certain organic practices, like using grass cover and cover crops, can help store carbon in the soil, but the need for more land could contribute to deforestation. One advantage of organic farming is its ability to reduce soil erosion, especially when manure is applied.

2. Organic farming avoids synthetic pesticides and instead uses natural alternatives like neem oil and pyrethrin (Pyrethrins are pesticides found naturally in some

chrysanthemum flowers). However, these natural pesticides can still be toxic in high amounts. Some of the approved organic pesticides can have lethal effects on insects or plants if not used carefully.

3. Organic farming can improve soil quality and enhance water retention, making it more resilient during droughts. It also supports biodiversity, as organic farms tend to have a greater variety of plant, animal, and insect species. The reduced use of harmful chemicals benefits soil organisms like earthworms and beneficial microbes, which, in turn, helps increase soil fertility.
4. Organic farming is often seen as providing better working conditions for farmworkers due to its reliance on more manual labour, but there is limited research to confirm this. While it is labour-intensive and workers may experience musculoskeletal issues from physical tasks, they are generally less exposed to harmful chemicals compared to conventional farming. Although organic farming is viewed as more ethical, labour standards are not always strictly enforced, and there is little consensus within the industry about how to improve these conditions.

- Organiz farming provides a better working conditin for farmworkers

1.1.4 Role of Agriculture in Economic Development

Economic development is the process of creating wealth and improving the quality of life for a society. It involves growing a nation's economy, increasing employment, and improving living standards. However, many nations are still in the underdeveloped stage, meaning a significant portion of the world's population lives in poverty. In these countries, most people primarily depend on agriculture for their livelihood, earning only subsistence wages, with a large portion of their income spent on basic necessities. In many developing countries, people face the problems of poverty and hunger. A key solution to these challenges is the development of the agricultural sector, as it can directly impact the reduction of rural poverty. Not only does it reduce poverty, but it also enhances the nation's foreign exchange through exports and serves as a foundation for industrial growth by supplying raw materials. Strengthening agricultural productivity has become essential for the development of less-developed countries. Let us now discuss the role of agriculture in economic development in detail.

- Strengthening the agricultural sector has become essential for the growth of less-developed countries.

- The agriculture sector ensures food security

The agriculture sector plays a crucial role in ensuring food security. Food security refers to the availability, accessibility, and affordability of food for all citizens at all times. When a nation adopts modern farming techniques, utilises high-yielding varieties of crops, and employs advanced irrigation methods, it can produce more food to meet increasing demand. Additionally, the agriculture sector ensures that different types of food are available throughout the year by cultivating various crops. Promoting the adoption of sustainable farming practices, such as organic farming, agroforestry, and soil conservation, ensures that food production remains viable in the long term, contributing to both food security and environmental protection. In this way food security plays a key role in raising the economic development of a nation. By ensuring that all citizens have access to nutritious and sufficient food, the agricultural sector contributes to a healthier, more productive workforce, which in turn boosts economic growth. Stable food supplies also enable industries to thrive, reduce poverty, and support overall social development, creating a positive cycle for the economy.

- The agricultural sector supplies raw materials

The agricultural sector ensures a steady supply of raw materials for agro-based industries, particularly in developing countries. A shortage of agricultural goods negatively impacts industrial production, leading to a rise in the general price level. This inflationary pressure can affect economic growth. Several industries, such as flour mills, oil mills, dal mills, dairy products, sugar factories, jute mills, textile mills, and others, rely heavily on agricultural products as raw materials for production. Therefore, maintaining a stable and sufficient supply of agricultural goods is essential for the overall health of the economy and the growth of these industries.

- Reduce the income disparity between rural and urban areas

The agricultural sector reduces income inequality between rural and urban areas. When the agricultural sector develops, it increases the income of the rural population, as a large number of labourers are engaged in agriculture. Any development in the agricultural sector that enhances the standard of living for rural people helps bridge the gap. As a result, the disparity in income between rural areas and urban areas can be reduced.

Agricultural development raises the purchasing power of farmers and also effective aggregate demand in the economy. This enables them to buy more products from the non-agricultural sector. As a result, the increased purchasing power

- The agricultural sector also creates effective demand in the economy

supports the growth of industries outside agriculture, fostering overall economic development. When agricultural production increases, it helps lower food prices. This makes food more affordable, which means the non-agricultural sector (such as manufacturing or services) needs to spend less of its income on food. Consequently, more disposable income is available, which in turn boosts demand for goods and services in the non-agricultural sector.

- The agricultural sector is one of the major sources of capital for a government

The agricultural sector provides a significant source of capital, particularly in underdeveloped and developing countries. The government can generate capital by taxing agricultural activities, which provides revenue that can be invested in other sectors of the economy. Additionally, by exporting agricultural products, these countries can earn foreign exchange, which can then be invested in infrastructure and other development projects. Furthermore, the government purchases agricultural products from farmers at lower prices and sells them at higher prices, generating revenue that can be used for further economic development.

- Agriculture sector enhances the labour mobility

The agricultural sector aids labour mobility, which in turn promotes economic development. In underdeveloped economies, disguised unemployment is a common issue. Disguised unemployment refers to a It occurs when more individuals are employed in a sector, typically agriculture, than are actually needed to produce the existing output excess labour can be considered a source of capital, as it can be redirected toward productive investments in other sectors. In this context, labour and capital can be transferred from the agricultural sector to non-agricultural sectors such as manufacturing and services, leading to capital formation and economic growth.

- Agricultural productivity improves and enlarges the market size

Increased agricultural productivity raises rural income levels, thereby creating an effective market for a wider range of industrial goods. As agricultural productivity improves, it enlarges the size of the market. In the case of surplus production, these goods can be exported to other countries, further expanding the market. Therefore, the agricultural sector helps to broaden the market both at the national and international levels.

In underdeveloped countries, the rural economy heavily depends on agriculture and related activities. As agricultural production and productivity increase, it leads to a surplus of

agricultural goods, which helps improve the well-being of the rural population. This surplus raises the standard of living for rural communities, enabling them to afford a better diet, including nutritious items such as eggs, milk, ghee, and fruits. As a result, the overall quality of life and health of the rural population improve.

1.1.5 Interdependence between Agriculture and Industry

The interdependence between agriculture and industry plays a crucial role in the development of both sectors. This interdependence is a key feature of a healthy economy, promoting growth, stability, and prosperity. By maintaining a balanced relationship between agriculture and industry, countries can ensure a reliable food supply, support job creation, foster innovation, and enhance resilience to external challenges. Let us discuss the details of the interdependence between agriculture and industry below.

1.1.5.1 Contributions of Agriculture to Industry

1. Supply of raw materials to Industries

- Agriculture products are used as raw materials in the industrial sector

The industrial sector depends on the agricultural sector for raw materials. Industries such as food processing, textiles, pharmaceuticals, and chemicals rely heavily on agriculture. For example, cotton supplied by agriculture is essential for the textile industry, sugarcane is a key raw material for the sugar industry, and crops like corn, wheat, and soybeans form the basis for food processing and biofuel industries. The agricultural sector ensures a consistent supply of these raw materials, which is critical for maintaining production levels, meeting market demands, and driving industrial growth. In turn, industries provide value-added products, which help diversify the economy.

2. Agriculture and Foreign Trade

Agriculture plays a crucial role in foreign trade by earning foreign exchange, and supporting the industrial growth of a nation. In the case of India, the country exports a wide variety of agricultural products, including cotton. India is also a major exporter of jute, a natural fibre used to make bags, ropes, and other items. Additionally, India is one of the largest producers and exporters of tea, with regions like Assam, Darjeeling, and Nilgiris being globally recognised for their tea. Besides these, India exports other agricultural products such as

rice, spices, fruits, vegetables, and oilseeds, which generate substantial revenue and contribute to the country's foreign exchange reserves. The export of agricultural goods supports rural employment in India by creating job opportunities in farming, processing, packaging, and distribution. This reduces migration to urban centres and promotes rural development. Increasing agricultural exports strengthens India's position in international trade, enhances global trade relations, and supports economic growth. As these sectors grow, they contribute to India's GDP and overall economic development.

- Export of agricultural products increases the foreign exchange reserves

3. Increasing demand for industrial goods in rural areas

The increasing income in the agricultural sector creates a growing demand for consumer goods produced by the industrial sector. As farmers and rural workers earn more, they have more disposable income to spend on goods such as clothing, household items, electronics, and other industrially produced products. This growing demand helps expand the market for industrial goods, allowing industries to grow and reach new consumer bases. The growth of industrial goods consumption in rural areas contributes to the overall development of the rural economy. It supports local businesses, promotes better standards of living, and facilitates the spread of modern goods and technologies to rural households. This, in turn, has long-term benefits, such as improved education, healthcare, and an overall better quality of life in rural regions. As the rural population becomes more connected to industrial goods and services, it leads to a more diversified economy and enhanced social welfare.

- Agricultural sector creates a growing demand for consumer goods produced by the industrial sector

4. Provide Capital and Labour to the industrial sector

Agriculture supplies surplus labour and, in early development stages, contributes to capital accumulation. The agricultural sector provides crucial resources, such as capital and labour, to the industrial sector, especially during the early stages of economic development in many countries. In England, during the industrial revolution, agriculture contributed capital through savings and investment, and labour from rural workers to the growth of industries. Similarly, in India, the agricultural sector helps provide both labour and resources for the textile industry and other industries, as workers from rural areas migrate to urban centres in search of jobs. Thus, agriculture is a vital source of both capital and labour in all stages of industrial development, with rural areas serving as the primary suppliers of these resources.

- Agriculture acts as a custodian of capital and labour

1.1.5.2 Contributions of Industry to Agriculture

1. Provides Inputs to the agriculture sector

The industrial sector provides modern inputs to the agricultural sector, which are essential for improving agricultural productivity and efficiency. Fertilisers, pesticides, machinery, and equipment are key inputs in agriculture. The industrial sector manufactures various types of fertilisers, such as nitrogenous, phosphatic, and potassic fertilisers, which help improve soil fertility, boost crop production, and increase food security. The use of these fertilisers allows farmers to grow more crops on the same land, leading to higher agricultural output. Pesticides are used to control pests, diseases, and weeds that affect crops. The industrial sector manufactures a wide range of pesticides, including insecticides, herbicides, fungicides, and rodenticides, which help farmers protect their crops from damaging pests and diseases. This results in healthier crops, higher yields, and reduced losses, ensuring that farmers have a stable and profitable harvest. The agricultural sector also relies heavily on machineries and modern equipments, such as tractors and harvesters.. These machines help automate various farming tasks, such as planting, ploughing, irrigation, and harvesting. They also reduce the amount of manual labour required, save time, and increase the efficiency of agricultural operations. The industrial sector provides hybrid seeds, which help increase crop productivity and ensure more reliable food production. The development and provision of modern irrigation systems by the industrial sector - such as drip irrigation, sprinkler systems, and subsurface irrigation - are crucial for ensuring efficient water usage in agriculture. In this way, the industrial sector plays an indispensable role in providing modern inputs to the agricultural sector.

- Agricultural sector takes modern inputs form industrial inputs

2. Provides infrastructure facilities to Agriculture

The provision of infrastructure is a critical component for the development of both the agricultural and industrial sectors. The industrial sector plays a central role in the development and maintenance of transportation systems such as roads, railways, ports, and airports. Efficient transport networks are crucial for the movement of agricultural goods, machinery, and raw materials to and from markets, storage facilities, and processing units. These networks also allow farmers to access necessary inputs, such as fertilisers and pesticides.

- Electricity is an essential input for agricultural sector

Electricity is essential for agriculture, as it is needed for irrigation, cooling, and processing crops. At the same time, industrial growth depends on a consistent power supply for factories and machinery. The industrial sector supports the establishment of financial institutions like banks, microfinance organizations, and credit facilities. These institutions provide farmers with access to loans for purchasing seeds, fertilisers, and machinery, while industries receive capital for expansion, research, and development. Furthermore, the industrial sector drives the development of telecommunication networks and information technology infrastructure, which play an important role in modernising agriculture. The industrial sector also invests in water supply systems for irrigation and sanitation infrastructure, ensuring safe water for agricultural activities and improving living conditions in rural areas. In this way, the industrial sector plays a crucial role in supporting the agricultural sector.

Summarised Overview

Agricultural economics and rural economics are specialised branches of economics that focus on the agricultural sector and the economic conditions of rural areas, respectively. Agricultural economics studies how resources are allocated in farming, concentrating on the production, distribution, and consumption of agricultural products. It covers various aspects, such as crop production, livestock, forestry, marketing, and the supply of farm inputs like fertilisers and machinery. Rural economics, on the other hand, examines the economic activities in rural areas, including both farming and other industries and services. It addresses issues such as poverty, migration, lack of infrastructure, and the need for policies that support rural development. Traditional agriculture is deeply rooted in local culture and the environment, emphasising sustainability, biodiversity, and ecological balance. Modernisation seeks to improve farming efficiency and food production through the introduction of modern equipment, high-yielding varieties (HYVs), advanced irrigation techniques, genetic modification, and biotechnology.

Organic farming, which avoids the use of artificial chemicals, has evolved as a response to the negative environmental and health impacts of synthetic fertilisers and pesticides. Agriculture is essential for both economic and social development, particularly in rural and underdeveloped regions, providing food security, raw materials, income equality, and a foundation for industrial growth. The symbiotic relationship between agriculture and industry supports the overall economy. Agriculture provides raw materials, labour, and foreign exchange, while industry supplies essential inputs, infrastructure, and capital. This interdependence is vital for sustained economic growth, especially in developing countries, where both sectors are crucial for creating jobs, reducing poverty, and enhancing food security.

Assignments

1. What are the main differences between agricultural economics and rural economics?
2. How has modernisation in agriculture, including the introduction of high-yielding varieties (HYVs) and biotechnology, impacted farming efficiency and food production?
3. What is organic farming, and how does it contribute to sustainable agricultural practices?
4. What role does agriculture play in poverty reduction and food security, particularly in developing countries?
5. How does the interdependence between agriculture and industry contribute to overall economic growth?

Suggested Reading

1. Hanumantha Rao C.H., (1994): *Agricultural Growth, Rural Poverty and Environmental Degradation,* Oxford University Press, New Delhi.
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2. Soni. R.N. (2004) *Leading Issues in agricultural Economics,* Vishal Publishing Co.Jalandhar.

Space for Learner Engagement for Objective Questions

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UNIT 2

Farm Management

Learning Outcomes

After completing this unit, the learner will be able to:

- understand the nature of the farming system
- learn about types of farming
- know the one-straw revolution in agriculture

Background

Farming is an essential part of agriculture. It refers to the practice of cultivating the soil, growing crops, and raising animals for food, fiber, medicinal plants, and other products used to sustain and improve human life. In the modern era, a significant portion of the population in underdeveloped countries lives in poverty. To address this issue, farming in the modern world plays a key role. Farming is the primary source of food production, ensuring that people around the world have access to sufficient, nutritious food, which is essential for survival and health. Not only does the farming sector produce food, but it also ensures the economic growth of a nation. Farming remains a significant contributor to the economies of many countries, especially in developing regions. It provides employment, boosts rural economies, and is often a major sector for exports.

Additionally, farming supplies raw materials for various industries, such as textiles (cotton, wool), pharmaceuticals (herbs, plants), and biofuels. Agricultural exports are essential in the global trade system. Crops and livestock are traded internationally, helping countries build international relations and maintain economic stability. These industries rely on agriculture for their production. Farming is a foundational aspect of human life and the global economy. It ensures environmental awareness, stabilises food supply, and addresses global challenges, such as food security and climate change, through innovative and sustainable farming practices.

Keywords

Subsistence, Industrial, Intensive and Extensive, Commercial, Plantation, Mixed Farming, Organic Farming, Zero Budget Natural Farming, One-Straw Revolution

Discussion

1.2.1 Farming System

- Method of organising agricultural activities that ensure the efficient utilisation of resources

A farming system refers to the method of organising agricultural activities that effectively utilises available resources by integrating crop cultivation and livestock rearing. Under the farming system, the inputs include seeds, fertilisers, machinery, and labour. These inputs are utilised for operations such as ploughing, sowing, irrigation, weeding, and harvesting. Through these processes, outputs are obtained from specific agricultural activities. However, the level of output may vary depending on the climatic and economic conditions of an economy.

- A Farming system promotes the efficient utilisation of resources

A farming system aims to meet the diverse needs of farm households, optimise productivity, ensure food security, and maintain environmental quality while preserving the resource base for future generations. A farming system emphasises soil health, pest control, and nutrient cycling, ensuring the sustainable use of biodiversity. It also promotes the efficient utilisation of resources, such as conserving water and energy through practices like rainwater harvesting and drip irrigation. Furthermore, a well-designed farming system aids in adapting to local conditions, including climate, soil, and socio-cultural factors. Additionally, it supports farmers by improving their access to markets, credit, and extension services. An efficient farming system enhances the productivity of crops and livestock through the optimal utilisation of resources such as land, water, and agricultural inputs. It also reduces costs, manages resources efficiently, and diversifies income sources through multiple agricultural activities, ensuring financial stability and profitability. By adopting adaptive farming techniques, it minimises the risks of crop failures or market fluctuations. Additionally, it protects and improves the environment by reducing soil erosion, conserving water, and promoting biodiversity. In the agricultural system, various types of farming systems exist. Let us discuss the major ones

1.2.1.1 Types of Farming System

- Different types of farming are employed worldwide

Farming is a practice that varies across regions and adapts to different environmental conditions and economic needs. Different types of farming are employed worldwide, each with its unique approach and purpose. From traditional subsistence farming to modern, technology-driven methods like precision farming, these practices aim to meet the growing demands for food, sustainability, and profit. Each type of farming plays a key role in shaping global food systems and addressing environmental challenges. The major types of farming are:

1. Subsistence Farming

- Produced goods are primarily used for their own consumption

Subsistence farming refers to the practice of growing enough food and raising livestock to meet the needs of the farmer and their family, rather than producing crops or animals for sale or profit. The primary goal of this system is to grow a variety of crops and sometimes raise animals to provide food, clothing, and other essentials for household use. Subsistence farming is also known as traditional agriculture. Subsistence farming methods typically do not incorporate the use of fertilizers or high-yielding variety (HYV) seeds. It is based on a labour-intensive method of farming, primarily using small land holdings, household labour, and low levels of technology. In India, many farmers engage in subsistence farming.. The produce they generate is primarily used for their own consumption, benefiting the farmer and their family.

2. Industrial Farming

- Industrial farming using large scale resources for production

Industrial farming is a way of growing crops and raising animals on a large scale using machines, chemicals, and advanced techniques to produce a lot of food quickly. This type of farming often focuses on growing one type of crop or raising many animals in one place to make everything more efficient. While it helps provide a lot of food for people, it can harm the environment by damaging the soil, polluting water, and reducing the variety of plants and animals. It also raises concerns about how animals are treated and the long-term impact on the Earth.

3. Intensive and Extensive Farming

Intensive farming is a method of agriculture that aims to maximise output (crops or livestock) from a given area of land by using high levels of inputs like labour, capital, fertilizers, pesticides, and machinery. Intensive farming is a method of

agriculture that aims to maximize output (crops or livestock) from a given area of land by using high levels of inputs like labor, capital, fertilizers, pesticides, and machinery This type of farming is practiced in densely populated areas where land availability is limited, and it often involves growing multiple crops per year. Intensive farming requires a high level of investment in labour and resources, such as fertilizers and machinery, to ensure high productivity per unit of land. Extensive farming refers to farming that involves large areas of land with lower inputs of labour and resources. This method covers a larger area but results in a lower yield per unit of land. Extensive farming primarily focuses on growing one crop per year and relies on machinery to improve efficiency. This approach requires less capital and labour compared to intensive farming, making it suitable for larger land holdings.

- Intensive and extensive farming aims to maximise output

4. Natural Farming

Masanobu Fukuoka was a Japanese farmer, philosopher, and agricultural scientist. He is well-known for developing a unique approach to farming called natural farming. Born in 1913, he spent much of his life working on a small farm in Japan. Fukuoka became famous for challenging the industrialised, chemical-based farming practices that were becoming widespread in the 20th century. His farming methods focused on working with nature and creating more sustainable and harmonious agricultural practices, rather than relying on machines, pesticides, and fertilizers.

- The natural farming concept developed by Masanobu Fukuoka

5. Mixed Farming

Mixed farming is a type of farming where both crops are grown and animals are raised. It's practiced in many countries like India, China, Russia, and parts of Europe and Africa. Initially, it was mostly for local consumption, but now places like the United States and Japan also use it for commercial purposes. In mixed farming, crops like wheat or rye are grown, and animals such as cows, sheep, pigs, or chickens are raised for meat, milk, or eggs. The manure from animals is often used to fertilize crops, and some crops are fed to the animals. In the past, male cattle were castrated and used as draft animals (to pull carts or plows) instead of being slaughtered for meat.

- Mixed farming where both crops are grown and animals are raised

6. Zero Budget Natural Farming (ZBNF)

Zero Budget Natural Farming was introduced by Subash Palekar, an Indian agriculturist and Padma Shri awardee. He introduced this concept in the mid-1990s as an alternative

- ZBNF focuses on growing crops without the use of fertilizers or pesticides

to the conventional Green Revolution practices. ZBNF is a sustainable farming method that focuses on growing crops without relying on chemical fertilizers or pesticides. The term "zero budget" refers to that farmers can reduce their input costs to zero by using natural, locally available resources. His vision was to create a farming system that is both economically viable and ecologically sustainable, without requiring farmers to take on heavy debts for purchasing expensive chemical inputs.

Zero Budget Natural Farming (ZBNF) is an agricultural method that focuses on growing plants without the use of external chemical inputs like pesticides and fertilizers. The term "Zero Budget" refers to the idea that farmers rely on natural resources and techniques for farming instead of purchasing expensive chemicals. This results in zero cost of production for crops. The major principles of ZBNF are discussed below:

- **Zero External Inputs:** No use of chemical pesticides or fertilizers. All inputs come from nature.
- **Living Roots:** Crops should cover the soil all year round, preventing soil erosion and maintaining soil health.
- **Minimal Soil Disturbance:** Avoiding practices that harm or disturb the soil, like heavy tilling.
- **Bio stimulants:** Natural substances that help plants grow and resist disease.
- **Native Seeds:** Using seeds that are well-suited to the local environment and farming conditions.
- **Mixed Cropping:** Growing different crops together to reduce the risk of pests and diseases.
- **Incorporating Trees:** Including trees in farming systems to enhance biodiversity, conserve water, and improve soil quality.

- Growing plants without the use of external chemical inputs

- **Conservation of Moisture and Water:** Using methods that help retain water and moisture in the soil, such as mulching or proper irrigation practices.
- **Incorporating Animals:** Integrating animals into farming to help with pest control and provide natural manure for fertilization.
- **Increasing Organic Debris:** Adding more organic matter, like plant residues, to the soil to enhance its fertility.

- **Plant Extracts for Pest Control:** Using natural plant extracts to control pests instead of synthetic chemicals.
- **No Artificial Pesticides or Fertilisers:** The farm remains free from artificial chemicals, which could harm the environment and human health.

Components of Zero Budget Natural Farming (ZBNF)

The components of Zero Budget Natural Farming (ZBNF) refer to key natural inputs used in this agricultural method for growing crops. The main components of ZBNF are:

- natural inputs used in this agricultural method for growing crops

- **Bijamrita:** Bijamrita is used for natural seed treatment and is applied to treat seeds before sowing. It is a mixture made from cow dung, cow urine, and other natural ingredients like neem leaves, tobacco, and green chili extracts. Bijamrita protects seeds from fungal and other soil-borne infections. The treatment ensures that the seeds remain healthy and free from diseases.
- **Jeevamrutha (or Jiwamrita):** Jeevamrutha (or Jiwamrita) is a natural fertilizer made from cow dung, cow urine, jaggery, pulse flour, and uncontaminated soil. When applied, Jeevamrutha enriches the soil with microorganisms that help break down organic material into nutrients that plants can use. This natural fertilizer improves soil fertility, encourages the activity of earthworms, helps crops fight soil diseases, and also makes the farming system self-sustaining.

- Zero Budget Natural Farming using natural inputs for growing crops

- **Acchadana (Mulching):** Acchadana (Mulching) is the process of covering the soil with organic materials like crop residues, cover crops, or other organic matter. It helps improve moisture retention, enrich the soil, and prevent weed growth.
- **Waaphasa (Moisture/Soil Aeration):** Waaphasa (Moisture/Soil Aeration) refers to ensuring that plants have enough air and moisture to grow properly. This is achieved by using practices like Jeevamrutha and mulching, which ensure proper soil aeration and moisture retention. Proper aeration and moisture retention are essential for healthy plant growth.

Benefits of Zero Budget Natural Farming (ZBNF)

- **Lower Water and Energy Usage:** ZBNF techniques use 50-60% less water and electricity for crop production compared to conventional farming methods.

- **Reduced Methane Emissions:** ZBNF reduces methane emissions by using multiple aerations (soil management techniques that improve air circulation in the soil).
- **Prevents Residue Burning:** ZBNF promotes mulching, a practice where plant residues are used as a protective cover for the soil. This reduces the need to burn residues, which is harmful to the environment.
- **Lower Cultivation Costs:** ZBNF helps farmers cut down on costs because they don't have to purchase expensive chemical fertilizers, pesticides, or herbicides. This lowers the overall cost of farming.

• Natural inputs used in agraicultural method for growing crops

- **Fighting Debt and Suicide:** A major issue among farmers is the increasing debt caused by high costs for external farming inputs like seeds, fertilizers, and pesticides. ZBNF reduces or eliminates these expenses, making farming more affordable. This could help alleviate financial pressures, reduce farmer suicides, and help small farmers escape the cycle of debt.
- **Increased Profitability for Farmers:** Since ZBNF is chemical-free, it produces organic crops that can fetch higher prices in the market. This leads to better income for farmers compared to conventional farming.
- **Health Benefits:** Organic foods produced through ZBNF are free from harmful chemicals, reducing health risks associated with consuming non-organic food. Over time, this can lead to better public health and reduce the burden on healthcare systems.
- **Adaptable to All Crops:** ZBNF can be used for any type of crop in various agro-climatic zones, making it a versatile and adaptable method for different farming environments.

1.2.2 The One-Straw Revolution

• A unique approach to farming

Masanobu Fukuoka was a Japanese farmer, philosopher, and agricultural scientist. He is well-known for developing a unique approach to farming called natural farming. Born in 1913, he spent much of his life working on a small farm in Japan. Fukuoka became famous for challenging the industrialised, chemical-based farming practices that were becoming widespread in the 20th century. His farming methods focused on working with nature and creating more sustainable and harmonious agricultural practices, rather than

relying on machines, pesticides, and fertilizers. 'The One-Straw Revolution' is the famous book authored by Fukuoka. This book explains his philosophy of farming and how he developed his methods. It was first published in Japanese in 1975 and later translated into English in 1978. The book combines Fukuoka's personal farming experiences with his thoughts on how modern agriculture encourages people to rethink the way farming is done and to consider simpler methods of food production.

- Fukuoka's famous work is The One-Straw Revolution

Fukuoka's approach to farming is based on the idea that farming should work with nature, not against it. This approach is called natural farming. The basic principles of natural farming are discussed below:

- **No Chemicals or Pesticides:** Fukuoka argued that chemical fertilizers and pesticides were harming the environment and creating unhealthy food. His methods avoid the use of these chemicals, relying instead on the natural balance of ecosystems to keep plants healthy.
- **No Tilling (Ploughing):** Fukuoka's approach opposes tilling the soil for planting. He argued that ploughing or tilling can damage the soil structure and harm the microorganisms that help plants grow. He advocated planting directly into the soil without disturbing it, allowing nature to take care of things.
- **No Mono-cropping:** Fukuoka's approach was against mono-cropping, which involves growing only one type of crop in large fields. He promoted growing a variety of plants together in a way that mimics the natural ecosystem. This encourages biodiversity, helps plants protect each other from pests, and creates healthier soil.

- Farming should work with nature, not against it

- **Working with Nature:** Fukuoka believed that humans should observe nature carefully and learn from it. He saw nature as perfect in its own way and believed that people should stop trying to control it and force it to follow unnatural methods.
- **Minimal Intervention:** One of the core ideas of his farming philosophy was the concept of "do nothing" farming. This does not mean doing absolutely nothing, but rather working in harmony with nature and not forcing the land to grow in a way that is unnatural. For example, Fukuoka would scatter seeds and let them grow without trying to control every part of the process.

Fukuoka's natural farming techniques have had a big impact on how people think about farming around the world. His ideas are important for a few reasons:

- **Environmental Sustainability:** Fukuoka's methods help protect the environment because they do not rely on harmful chemicals or intensive machinery. His farming practices help conserve soil health, protect water quality, and encourage biodiversity.
- **Inspiring a Global Movement:** Although Fukuoka's farming style was not immediately adopted by large commercial farms, his message spread worldwide. His book, The One-Straw Revolution, influenced people around the world who were interested in organic farming, permaculture, and sustainability. Many people who were concerned about the environment were inspired by his ideas.

- Fukuoka's natural farming techniques have had a big impact on how people think about farming around the world

- **Advocacy for Small-Scale Farming:** Fukuoka believed that small family-run farms were a better model for producing food sustainably. He argued that farming should not be about mass production for large corporations, but about growing healthy food that supports local communities.
- **Regreening the Desert:** Fukuoka even applied his ideas to areas suffering from desertification, like parts of Africa. He believed that degraded, barren land could be restored to productivity with his natural farming techniques. He proved this in places like Somalia and Ethiopia, where he worked with locals to help them grow food in dry, desert-like conditions.
- **Philosophy of "Nothingness":** Beyond farming, Fukuoka's teachings also have a spiritual side. He believed that modern people had lost their connection with nature and that this loss was contributing to a spiritual and emotional decline. His philosophy of farming was part of a larger idea of reconnecting with the natural world and living a simpler, more meaningful life.

- Fukuoka's ideas maintain environmental sustainability

Fukuoka's ideas are still very relevant today because many of the farming practices that dominate the world are causing environmental damage. These farming practices come with several problems, such as the use of chemical fertilizers and pesticides, the destruction of natural habitats, and the depletion of soil. Fukuoka's natural farming offers an alternative that is more sustainable and healthier for both the environment and people. For example, if we continue to use chemical fertilizers

and pesticides, we could harm our soil and water systems in the future. But by practicing natural farming, we can grow healthy, nutrient-rich food while taking care of the planet. It is a method that emphasises balance and harmony instead of control and exploitation.

Summarised Overview

A farming system refers to the method of organising agricultural activities to efficiently utilise available resources by integrating crop cultivation and livestock rearing. This system incorporates inputs such as seeds, fertilizers, machinery, and labour, which are used in processes like ploughing, sowing, irrigation, weeding, and harvesting. The output of these activities varies depending on factors such as climate and economic conditions. A well-designed farming system aims to meet the diverse needs of farm households, optimise productivity, ensure food security, and maintain environmental quality, all while preserving the resource base for future generations. There are various types of farming systems, each with distinct characteristics and practices. Subsistence farming focuses on growing food primarily for personal consumption, relying on small landholdings and minimal technological input. Industrial farming, in contrast, involves large-scale operations that use chemical fertilizers, pesticides, and machinery. Intensive farming aims to maximise yields from small areas of land through high inputs, while extensive farming covers larger areas with fewer inputs, resulting in lower yields per unit of land. Commercial farming is centred on producing crops for sale in markets, often involving specialised, large-scale operations. Mixed farming combines both crop production and livestock rearing, ensuring diversified income and efficient resource use. Zero Budget Natural Farming (ZBNF) is a sustainable method that avoids chemical inputs, relying instead on natural resources such as cow dung, urine, and other locally available materials, thus promoting eco-friendly and self-sustaining farming. The One-Straw Revolution, introduced by Masanobu Fukuoka, advocates for natural farming methods that avoid tilling, mono-cropping, and synthetic chemicals. Fukuoka's approach emphasizes working with nature, promoting soil health, conserving water, and improving biodiversity. Each of these farming systems offers unique solutions for optimising agricultural productivity while ensuring environmental sustainability and minimising ecological impact.

Assignments

1. Explain the concept of Zero Budget Natural Farming (ZBNF) and discuss its benefits.
2. What is the difference between intensive and extensive farming systems?
3. Describe the main principles of Masanobu Fukuoka's natural farming philosophy.
4. What are the key components of Zero Budget Natural Farming (ZBNF)?
5. Discuss the role of mixed farming in promoting sustainable agricultural practices.

Suggested Reading

1. HansraParumal and Chandrakarn - *Modernization of Indian Agriculture in 21st century challenges, opportunity and strategies,* Concept Publication Co.New Delhi.
2. Fukuoka, M. (1978). *The one-straw revolution: An introduction to natural farming.* New York Review of Books.

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2. Das Gupta, (1977): *The New Agrarian Technology and India,* Macmillan, New Delhi

Space for Learner Engagement for Objective Questions

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UNIT 3

Land Use Pattern in India

Learning Outcomes

After learning this unit, the learner will be able to:

- understand the land use pattern in India
- evaluate land size and productivity
- apply principles of land utilisation
- examine land tenures and features of small and large farmers

Background

Land is a vital resource that plays an essential role in shaping the economy, particularly in agricultural nations like India. The way land is distributed and managed has direct implications for agricultural productivity, income levels, and the overall economy. Historically, the distribution of land in India has been uneven, with a significant concentration of land in the hands of a few, while the majority of farmers own small or marginal holdings. This inequality in land ownership has led to several challenges, including poverty, underdevelopment, and limited access to essential resources like credit, technology, and markets. The land reforms introduced post-independence aimed to address these issues, but despite these efforts, challenges such as land fragmentation, inefficient land use, and the persistence of historical land tenure systems continue to affect the agricultural sector. In this units we explore the concept of land distribution and tenure, focusing on its structure, trends, and the challenges faced by both small and large farmers in India. Understanding the implications of land distribution and tenure is critical to formulating policies that can lead to more equitable land access, improved agricultural productivity, and sustainable economic growth.

Keywords

Land Use Pattern, Land Tenure, Land Size, Land Productivity

Discussion

1.3.1 Land Use Pattern in India

Land is a fundamental natural resource and a crucial factor of production in the economy. Its importance can be observed across various sectors. Land forms the basis for agricultural production, providing primary resources for cultivation, grazing, and forestry, which are essential for livelihood and sustenance. It also serves as a source of raw materials for industrial development, such as minerals and other resources. The forest resources of land contribute significantly to environmental sustainability by absorbing carbon dioxide and maintaining biodiversity, thereby ensuring ecological balance. Additionally, forests provide timber, medicinal plants, and other products that support industries, enhancing the economic value of land. Land plays a vital role in direct and indirect employment generation. Millions of people are employed in agriculture, forestry, and mining sectors, while industries dependent on land resources, such as food processing and tourism, generate additional indirect employment opportunities. Furthermore, land contributes revenue to the government through land taxes, property registration fees, and royalties from mining and other land-based activities. The effective utilisation of land creates a multiplier effect in the economy, leading to growth across multiple sectors and ensuring sustainable development.

- Effective land utilisation creates a multiplier effect on the economy

Effective land utilisation paves the way for development. To achieve this, it is essential to understand the land use pattern followed by a nation. Understanding the land use pattern helps in better planning of urban and rural areas, and also allows governments identify areas at risk of overuse, degradation, or deforestation. By monitoring these patterns, it becomes easier to implement sustainable agricultural, forestry, and conservation practices to prevent environmental damage. In the case of underdeveloped countries, the population often depends on the agricultural sector. Therefore, governments

- Understanding the land use pattern of a nation helps to efficient allocation of resources

can ensure that adequate resources are allocated to meet the food production needs of the population. The land use pattern helps identify regions where agricultural productivity can be increased or where land is being over-exploited and may need to be restored. Additionally, the land use pattern reflects how resources are allocated across different sectors, such as agriculture, industry, and services. It provides insights into the economic development of a country, enabling policymakers to make informed decisions on how to best allocate land for economic growth while ensuring the efficient use of resources.

In India, Land Use Statistics are issued by the Department of Agriculture and Farmers Welfare. These statistics provide data on how land is utilised or allocated for various purposes across the country. They include detailed classifications of land use, both at the All India and State-wise levels. The statistics cover important aspects such as gross and net irrigated area (source-wise), irrigated area under crops, and area under crops. Understanding these land use patterns is important for monitoring areas under crops, forests, fallow lands, and irrigation. Furthermore, these statistics play an essential role in various key areas, including resource allocation (such as agricultural land and infrastructure development), food security, land reforms, and environmental management. They are also vital for promoting sustainable land use and for policy formulation related to land use and development.

- Land data shows on how land is utilised or allocated for various purposes

For land use statistics, India follows the Nine-Fold Classification system, which categorises land into various types based on its use and potential for cultivation. This methodology was established based on the recommendations of a Technical Committee on Coordination of Agriculture Statistics set up in 1948. The classification helps to systematically analyse land use patterns across the country. Let us discuss the types of land that come under the Nine-Fold Classification system.

- India follows the Nine-Fold Classification system in land statistics

1. Forest Area

Forest area refers to all land classified or administered as a forest, regardless of whether it is owned by the government (State-owned) or private individuals. It includes both wooded areas, which are covered by trees and vegetation, and potential forest lands, which are not yet forested but have the potential to become forests in the future. This classification also includes crops raised within forested areas. For example, if farmers grow crops inside a forest, that land is still considered a 'forest area.'

- Forest area included both wooded areas and potential forest land

Additionally, it includes grazing lands or common grazing areas within forests, which are used for grazing livestock and are also considered part of the forest area.

2. Area under Non-agricultural Uses

The area under non-agricultural uses represents land utilised for non-agricultural activities and infrastructure development. This category includes all land used for buildings, roads, railways, and water bodies such as rivers and canals.

3. Barren and Un-cultivable Land

- Land that is not suitable for cultivation

Barren and un-cultivable land refers to land that is not suitable for cultivation, including mountainous regions, deserts, or areas where cultivation is prohibitively costly. For example, in mountainous regions, the land may have steep slopes or rugged terrain, making farming difficult or impossible. Similarly, in deserts, areas with very little rainfall or vegetation are unsuitable for cultivation. Even if the land is part of a larger cultivated area, it remains categorised as barren and uncultivable if it is unsuitable for agriculture.

4. Permanent Pasture and Grazing Land

- Land specifically used for grazing livestock

This category of land includes land specifically used for grazing livestock. It applies to both permanent pastures, which are lands intended for long-term grazing, and lands that may not be permanent but are still used for grazing. It also includes areas such as village common grazing lands, which are collectively used by villagers for grazing their livestock, meadows, which are grasslands or open fields used for grazing, and other areas used for grazing by livestock, which are any other lands used by farmers or communities for grazing animals.

5. Land Under Miscellaneous Tree Crops

- Land used for growing tree crops

This category includes land used for growing tree crops. Tree crops are cultivated for specific purposes, such as timber, fuel, or other non-fruit tree products, but they are not considered part of traditional orchards. Orchards refer to areas of land specifically cultivated with fruit-bearing or, in some cases, nut-bearing trees. Examples of tree crops include casuarina trees, which are used for timber or other purposes, and bamboo bushes, which may be used for construction, crafts, or fuel. These types of land fall under this category.

6. Cultivable Waste Land

This category refers to land that has the potential to be cultivated in the future but has not been used for cultivation for at least five years (including the current year). The land is not actively being farmed but still holds the possibility for future agricultural use. This land may be fallow, overgrown with shrubs, or abandoned but is still considered suitable for farming over time.

7. Fallow Lands Other than Current Fallows

- Land that temporarily left out of cultivation

Fallow lands other than current fallows refers to land that was previously cultivated but is temporarily left out of cultivation. The period of non-use is more than one year but not longer than five years. These lands were once farmed but are not being actively used for cultivation during this temporary period. The reason the land left fallow is to allow the soil to rest and recover, improving its fertility. After the fallow period, the land will be brought back into cultivation for agricultural use.

8. Current Fallow

- Land that was cultivated in the past but is currently kept fallow

Current fallows refer to land that was cultivated in the past but is currently kept fallow during the ongoing agricultural year. Although it was previously used for farming, it is temporarily not being farmed in the current year. The land may be left fallow for various reasons, such as allowing the soil to restore its fertility by resting it, or for other agricultural purposes like crop rotation, pest control, or preventing soil degradation.

9. Net Area Sown

- In India the nine-fold classification system is followed

Net area sown refers to the total area of land that is sown with crops or orchards during the agricultural year. If a field is sown multiple times in the same year, it is counted only once. This term represents the actual land area that has been used for crop cultivation or the growth of orchards. The Net Area Sown helps to measure the total land actively being used for agricultural production, indicating how much land is devoted to growing crops or orchards during a given period.

As per the 'Land Use Statistics at a Glance: 2022-23', the land use pattern in India can be explained with the help of a pie chart.

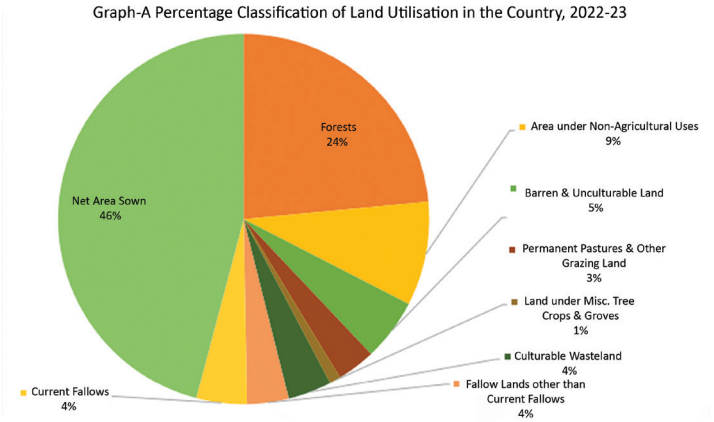

Fig:1:3:1 A Percentage Classification of Land ultimate in the country 2022-23

The above pie chart shows that nearly half of India's land area is used for agricultural activities. Forest is the second-largest segment at nearly 24%, highlighting the significant coverage of forests in the country. Area under Non-Agricultural Uses occupies around 9%, and Barren and Uncultivated Land accounts for nearly 5%,. Smaller segments represent Current Fallows at around 4%, Culturable Waste Land at 4%, and Fallow Lands Other Than Current Fallows at 4%, illustrating lands that are temporarily out of use or degraded. Permanent Pastures and Other Grazing Lands make up about 3%, and Land Under Miscellaneous Tree Crops and Groves cover approximately 1%, indicating a relatively smaller proportion of land dedicated to grazing and non-commercial tree crops.

- Half of India's land area is used for agricultural activities

It can be observed that the Nine-Fold Classification System plays a crucial role in systematic land use analysis in India. This classification supports informed decision-making, helping policymakers plan effective agricultural policies, allocate resources, and manage land sustainably. It also aids agricultural research and development by offering valuable insights into crop management, irrigation, and soil conservation. Additionally, it serves as a tool for monitoring changes in land use, such as urbanisation or land reclamation, and provides essential data for national policy formulation on food security, land conservation, and rural development.

- Land classification is helpful to resources allocation

1.3.2 Land Size, Productivity and Distribution

- Area of land owned or cultivated by a farmer

Land size refers to the total area of land owned or cultivated by a farmer, typically measured in hectares or acres. It can range from a very small plot to a large agricultural estate. On the other hand, productivity refers to the output or yield produced per unit of land. In farming, productivity is measured by how many crops or goods a farmer can grow or produce from a specific area of land, typically expressed as tons per hectare. Land productivity is important because it directly impacts food security, economic development, and environmental sustainability. When land productivity is high, farmers can grow more food on the same amount of land, helping to feed more people, especially in areas where farmland is limited. This is essential for ensuring that everyone has enough to eat. Efficient land use also boosts the economy because agriculture is a major part of many countries' economies.

Land productivity refers to how much output (like crops) is produced from a specific area of land. It helps us understand how efficiently land is being used to grow food, which is important for feeding people and supporting the economy. The formula for calculating land productivity is:

$$\textit{Land Productivity} = \frac{\textit{Total Output (e.g., crop yield in kilograms)}}{\textit{Land Area (in hectares)}}$$

Several factors can impact how productive is the the land.

- **Soil Quality:** Good soil is essential for growing crops. It should have the right texture, nutrients, and drainage to support plant growth. Fertile soil is typically better for farming and results in higher productivity.
- **Climate:** Temperature, rainfall, and the length of the growing season are all important factors. Some crops need specific weather conditions to grow well. For example, rice needs a lot of water, while wheat prefers a drier climate.
- **Irrigation:** Having access to water for crops is crucial. If there is not enough rainfall, farmers use irrigation systems to water their crops. Without sufficient water, productivity can be very low.
- **Technology:** Modern farming tools, new crop varieties, and improved techniques can increase productivity. For

example, using machinery for planting and harvesting crops makes farming faster and more efficient, leading to higher yields.

- **Land Management:** Practices like crop rotation (changing what crops are grown in a field each season), using fertilizers, and controlling pests can help maintain or increase land productivity over time.
- **Land Tenure:** This refers to the ownership of land. When farmers have secure rights to the land they work on, they are more likely to take good care of it, which increases their productivity.

- Land Productivity refers to how much output is produced from a specific area of land

The relationship between land size and productivity is complex, and both can affect the efficiency of farming. Various factors determine land use and its productivity. Let us discuss them in detail.

1. Efficiency of land use

- Land Productivity refers to how much output is produced from a specific area of land

Small farms often focus on intensive farming methods to use the most of the land they have. This includes using techniques like crop rotation, proper irrigation, and planting high-yield crops. Because the farmers usually manage the land directly, they can pay more attention to details, leading to high productivity per unit of land. On the other hand, large farms may benefit from economies of scale, using big machines and advanced techniques that increase total crop output. However, the productivity per unit of land can sometimes be lower if the farm is not carefully managed.

2. Diminishing returns on large land

As farms become larger, managing them effectively becomes more challenging. Large farms may have fewer workers, and it's harder to pay attention to every part of the land. This often leads to decreasing productivity per hectare. Small farms, however, are often managed by the owners themselves, who can focus on making the most of each square meter, which can result in higher productivity per unit of land.

3. Land size and specialisation

Large farms tend to specialise in one crop (like wheat or corn), which can lead to higher total output using efficient techniques and modern equipment. This allows the farm to maximise production. In contrast, small farms might grow a variety of

crops, such as vegetables, fruits, and grains, which can lead to higher productivity per hectare, even if the total size of the farm is small.

4. Resource availability

Large farms often have more resources, such as advanced machinery, more labour, and larger capital, which can increase productivity. For instance, they can afford modern irrigation systems and harvesting machines. Small farms may have limited access to such resources and rely on manual labour and traditional farming methods, which can make them less productive per hectare. However, small farms can still be highly productive if managed properly, even without advanced equipment.

5. Land Degradation and Overuse

Large-scale farming can sometimes lead to issues like soil erosion, nutrient depletion, or overuse of land, especially if not managed with sustainable practices. This can lower productivity over time. Small farms may also face challenges like land degradation, but their smaller size often makes it easier to manage soil health and resources more effectively, preventing overuse.

So, we can say that the larger land can result in greater total output while smaller land often leads to higher productivity per unit when managed effectively. The key to productivity lies in the efficiency of land use, management practices, and the availability of resources, rather than just the size of the land. Suppose a small organic farm that grows vegetables. The farm's small size allows it to be carefully managed, which results in high productivity per hectare. The farm may use sustainable farming practices like composting, crop rotation, and minimizing chemical use. In contrast, a large commercial farm may grow a single crop, like wheat or corn, on a much larger piece of land. While the total output may be high, the productivity per hectare may be lower than that of the small farm, especially if the farm is not managed sustainably.

- Land size and productivity are inversely related

1.3.3 Principles of Land Utilisation

The land is one of the most valuable resources for economic development, agricultural production, and human habitation. However, it is limited and often subject to competing demands. Therefore, its utilisation requires careful planning

and management. The principles of land utilisation provide a framework for the careful planning and management of land and also provide a framework for maximising the productive capacity of land while considering factors such as resource availability, environmental sustainability, and economic viability. These principles guide land users whether farmers, urban planners, or policymakers in making informed decisions to optimise land use. The major principles of land utilisation include:

- Careful planning is needed for land utilisation

1. The Principle of Maximisation
2. The Equi- marginal Principle
3. The Principle of Diminishing Marginal Rate of Substitution
4. The Principle of Diminishing Marginal Productivity
5. The Principle of Specialisation and Comparative Advantage
6. The Principle of First Choice and Others. Let us discuss each of them in detail.

1.3.3.1 The Principle of Maximisation

- Try to get the maximum profit from using all available resources efficiently

The Principle of Maximisation means that land users try to get the most value from their land by using all available resources efficiently. They aim to increase production and profits. The user works to make the best use of the land, considering the availability or lack of other resources like capital, labour, irrigation, and facilities. For example, in a densely populated area with a lot of savings, cheap labour, and irrigation, but limited land, the small available land would be used intensively to get the highest possible yield per hectare. On the other hand, in a less developed, sparsely populated area with limited resources like capital, labour, and irrigation, the larger land would be used extensively but with lower yields. In both cases, the goal is to maximise the return from the land.

1.3.3.2 The Equi Marginal Principle

The Equi marginal Principle is about making the best use of resources to maximise profit. This principle helps land users decide how to allocate their resources across different activities to achieve the highest possible return. It means that if you are using resources like land, labour, and capital for different activities, you should move them around so that the extra profit (marginal return) from each activity is equal.

Imagine you have a piece of land near Kolkata. You can use the land to grow jute, paddy, or ladies finger. Each crop has a different level of profit. Ladies' finger has a high market price and gives good profit, while jute and paddy yield less profit compared to ladies finger.

According to the Equi marginal Principle, to make the most profit from your land, the farmer will allocate more resources (like labour, water, and fertiliser) to growing ladies fingers because it gives the most profit. However, the farmer also needs to consider the crops they are giving up in favour of ladies fingers. If the farmer takes resources away from jute or paddy to grow more ladies' fingers, the extra profit from the ladies finger should equal the lost profit from growing less jute or paddy.

- Use of best resources to maximise profit

1.3.3.3 Principle of Diminishing Marginal Rate of Substitution

The Principle of Diminishing Marginal Rate of Substitution suggests that when you replace one type of good or land use with another, the additional satisfaction or benefit you gain from the new use decreases as you increase its production. Imagine a farmer near Kolkata who is using their land to grow two types of crops: ladies finger (okra) and rice. The farmer decides to allocate more of his land to growing ladies finger instead of rice. Since ladies finger is a perishable crop, it must be harvested and sold daily. This creates a challenge because the farmer must continuously harvest and sell the crop, while rice, being less perishable, can be stored for longer periods.

As the farmer increases the amount of land dedicated to ladies finger, the additional benefit or satisfaction (such as profit or return) from growing more ladies finger decreases. Initially, the farmer might earn a good profit from the first few fields of ladies finger, but as more land is used for it, the extra return from each additional unit of land becomes smaller. Eventually, the farmer may find that the returns from growing more ladies finger are not worth the effort, especially when compared to growing rice, which requires less daily attention.

- Replace one type of good or land use with another

1.3.3.4 Principle of Diminishing Marginal Productivity

The Principle of Diminishing Marginal Productivity suggests that as more and more resources (like labour, land, or capital)

are added to the production process, the additional output (or returns) from each extra unit of input will eventually decrease, holding all else constant. This means that adding more workers or resources to the land does not continue to increase production at the same rate. Eventually, there will be less and less additional output from each new worker or resource added.

For example, imagine a farmer who owns a piece of land and is growing wheat. Initially, the farmer may start with just one worker on the land, and as more workers are added, production increases significantly. Here, the land is being utilised more effectively. However, if the farmer continues to add more workers, they may crowd the land and encounter problems such as limited space or workers getting in each other's way. As a result, the increase in wheat production per additional worker becomes smaller and smaller. Additionally, the cost of labour may rise as the farmer has to pay higher wages or provide more equipment, and inputs like water, fertilisers, and machinery may need to be increased.

- Additional output or returns from each extra unit of input will eventually decrease

1.3.3.5 The Principle of Specialisation and Comparative Advantage

The principle of specialisation and comparative advantage suggests that countries, regions, or individuals should focus on producing goods or services where they have a relative advantage in productivity, based on factors such as climate, geography, skills, or resources. This principle encourages specialisation in areas where production can be more efficient, ultimately benefiting trade and economic efficiency. For example, black soils under a semi-arid climate are suitable for cotton cultivation. Regions like Maharashtra, Gujarat, and parts of Madhya Pradesh, Andhra Pradesh, Tamil Nadu, and Karnataka have the right combination of soil and climate for high cotton yields. These regions can produce cotton most profitably. However, cotton cannot grow efficiently in humid climates or alluvial soils. Therefore, regions in north-eastern India and eastern India are not suited for cotton cultivation. The humid climate in these areas encourages the growth of insect pests, which damage the crop, reducing its yield and quality. Additionally, the extra costs required for pest control would increase the cost of production, making cotton farming less profitable in these regions

- Comparative Advantage focus on relative advantage in productivity

1.3.3.6 The Principle of First Choice

- Farmers choose the best land for growing specific crops

The principle of first choice means that farmers choose the best land for growing specific crops based on what those crops need. Different crops grow better in certain conditions, like soil type, texture, and drainage. By picking the right land, farmers can grow more crops and reduce production costs.

1.3.4 Land-Distribution - Structure and Trends

- Land is divided or allocated among farmers and regions

Land distribution refers to how land is divided or allocated among farmers and regions. On the other hand, land holding refers to the actual ownership of land.. In India, the size of land holdings varies, with categories such as

- Marginal holdings: Less than 1 hectare (2.5 acres). These make up a large percentage of farms in India.
- Smallholdings: Between 1 to 2 hectares (2.5 to 5 acres).
- Semi-medium holdings: Between 2 to 4 hectares (5 to 10 acres).
- Medium holdings: Between 4 to 10 hectares (10 to 25 acres).
- Large holdings: More than 10 hectares (25 acres).

- Landlords collected taxes from the peasants

The size of these holdings significantly affects farmers' ability to produce crops and earn income. Land distribution in India is a complicated issue because of historical, social, and economic factors. During British rule, landlords (called Zamindars) controlled large areas of land and collected taxes from the peasants who worked on it. After India gained independence in 1947, the government introduced land reforms to divide the land more fairly among farmers. This was meant to reduce the power of landlords and improve the lives of small farmers. However, even after these reforms, inequality in land distribution still exists, especially in rural areas. India's total land covers over 51.9 million acres, but the land is not shared evenly across the country. Uttar Pradesh has the most land holdings, but other states like Maharashtra, Bihar, and West Bengal also have large amounts of agricultural land. Most Indian farmers have small land holdings, with about 85% of them owning less than two hectares (5 acres) of land.

A big problem in India is the unequal distribution of land. Many farmers do not have enough land to farm, and some have none at all. This leads to poverty and difficulties in making a

living. The richest families or big businesses own the largest pieces of land, while most farmers only have a small amount. The average size of a farm in India is only about 1.15 hectares (which is quite small), making it hard for farmers to produce enough food. Another challenge is rapid urbanisation. As cities grow, more land is needed for housing and infrastructure. This means fertile farmland is being turned into urban areas, leaving less land for farming. Many farmers also move from rural areas to cities looking for better jobs, which creates even more pressure on the land available for farming.

- Unequal distribution of land leads to poverty

In India, land is often passed down from one generation to the next, but many farmers do not legally own the land they farm. To make land ownership fairer, the Indian government has introduced several laws and reforms. One such reform is land ceiling Laws, which limit the amount of land one person can own. This helps give land to landless farmers.. The government also tries to redistribute land from rich landowners to poor or small farmers. Another effort is to update land records, so that farmers have proper documents of land. Finally, land reform acts passed by state governments have worked to remove middlemen, secure rights for tenants, and improve farming productivity. These changes aim to make land ownership fairer and improve the situation for farmers in India.

- Make land ownership fairer through the Land Ceiling Laws

1.3.5 Land Tenures

The land tenure system in ancient India went through gradual changes, evolving from communal ownership to individual ownership. In the early stages, when human beings lived as tribal groups and practiced nomadic lifestyles, land was seen as a gift of nature. No one person owned it, and it was commonly used by all members of the tribe. As time passed, and people started settling down and practicing agriculture, the idea of individual land ownership developed. Agriculture at this stage was in transition, shifting from nomadic cultivation to settled farming.

- Land as a gift of god

In the Vedic period, land was still considered a common property, and the Vedas prohibited land grants. Since all property was shared, the idea of gifting land to someone was not considered. However, during the post-vedic period, land began to move away from being a communal property, and the concept of private ownership gradually emerged. Although land grants started to happen, the practice was not immediately accepted by everyone and was met with indecisiveness. As

- Evolution of land ownership form communal to individual

the Aryan society settled in the Gangetic plains and as the population grew, a shortage of cultivable land began to be felt, making land transfers more common. During the Mauryan period, agriculture had two types of landholdings: Rashtra landholding, which was largely independent of the state's administrative control, and Sita land, which was created by clearing forests with the help of tribal groups.

In the Gupta period, different land tenure systems were used, as shown in land grant inscriptions. These included:

- **Nivi dhams:** Land given as an endowment in perpetuity.
- **Nivi dharma aksayana:** Perpetual endowment that could not be alienated, but the recipient could enjoy the income forever.
- **Aprada dharma:** The recipient could enjoy the land's income but could not transfer it or give it away.
- **Bhumichchhidranyaya:** Ownership rights granted to a person who made barren land cultivable for the first time, and they were exempt from paying rent.

• Different tenure systems followed in the Gupta period

During the medieval period, the Delhi Sultans made significant changes to the land revenue system, focusing on agrarian exploitation and increasing land revenue. They classified land into three categories.

- **Iqta land:** Land assigned to officials as iqtas (military governors or administrative officers).
- **Khalisa land:** Crown land, controlled by the Sultan, whose revenues were used for the royal household's maintenance.
- **Inam land (madad-i-maash):** Land granted to religious leaders.

• In the medieval period land revenue system, focusing on agrarian exploitation

Under the Mughal Empire, during Akbar's reign, land was classified into four categories for revenue assessment.

- **Polaj:** Land that was cultivated every year and never left fallow.
- **Parati/Parauti:** Land that had to be left fallow for some time to regain fertility.
- **Chuchar:** Land that was left fallow for two or three years.

• British made money in India through the land revenue

- **Banjar:** Land that remained uncultivated for five or more years.

Land revenue was a major way the British made money in India, and there were three main systems used to collect it: the Zamindari system, the Ryotwari system, and the Mahalwari system.

Zamindari system

- Collect tax from farmers

The Zamindari system was introduced by Lord Cornwallis in 1793. In this system, Zamindars (landlords) were made permanent owners of the land. They collected taxes from farmers and gave most of it (89%) to the British government, keeping 11% for themselves. This system was used in places like West Bengal, Bihar, Uttar Pradesh, and Madhya Pradesh. However, the system was harsh for farmers, who had to pay high rents and had no secure rights to the land. If they couldn't pay, they were kicked off the land. The Zamindars also faced problems because the tax rate was so high that many of them could not pay it, and the British didn't benefit from the increased farming and prices because the revenue was fixed.

Ryotwari system

- Tax directly paid to the government

The Ryotwari system was introduced in southern India by Sir Thomas Munro in the early 1800s. In this system, the farmers, called Ryots, paid taxes directly to the government. This meant there were no middlemen like Zamindars. The farmers had more control over their land and could sell or lease it. The system worked in areas like Tamil Nadu, Maharashtra, and Punjab. However, this system led to problems too, as moneylenders and local officials took advantage of the farmers. If the farmers took loans and couldn't repay them, they lost their land.

Mahalwari system

- The village headmen collected the taxes from villagers

The Mahalwari system was introduced in 1822 in parts of northern India, like Uttar Pradesh. In this system, instead of Zamindars, the village headmen collected the taxes for the whole village. The taxes were not fixed permanently and were revised over time. The system was also used in places like Madhya Pradesh and Punjab. However, the system had issues too. The surveys of land were often wrong, which led to corruption and inefficiency. Sometimes, the cost of collecting taxes was higher than the money collected.

Other systems like the Taluqdari system and Malguzari system were also in place. The Taluqdari system referred to large landowners, or Taluqdars, who were responsible for managing the land. The Malguzari system was used in parts of central India, where wealthy people called Malguzars collected taxes from farmers. All of these systems were set up by the British to get more money, but they caused a lot of problems for farmers. The taxes were often too high, and the farmers faced a lot of hardship. Although the British made money from these systems, the lives of the farmers became much harder.

1.3.5 Small and Big Farmers

In India, farmers are classified based on the size of the land they own. Small farmers are those who own less than 2 hectares (about 5 acres) of land, while marginal farmers have even smaller holdings, less than 1 hectare (about 2.5 acres). On the other hand, big farmers or lare farmers own 10 hectares (about 25 acres) or more of land. There are also medium farmers who own between 2 and 10 hectares (5 to 25 acres) of land. Small farmers typically face more challenges than larger farmers because they have less land and fewer resources.

- Farmers are classified based on the size of the land they own

1.3.5.1 Small and Marginal Farmers

According to the 2015-16 Agriculture Census, Small and Marginal Farmers (SMFs) in India make up 86.1% of the country's farmers, meaning they own landholdings smaller than 2 hectares. These farmers predominantly cultivate crops like paddy, wheat, cotton, maize, and gram. SMFs are primarily concentrated in five states: Uttar Pradesh, Bihar, Maharashtra, Madhya Pradesh, and Andhra Pradesh, with Uttar Pradesh alone accounting for 18% of India's SMF population. The agricultural land owned by small and marginal farmers represents nearly half of India's total agricultural land, with approximately 47.3% of operational land under their control. Despite the small size of their landholdings, these farmers play a crucial role in India's agricultural production. Most of their farming practices rely on traditional methods, although some use modern techniques such as irrigation systems. However, they still face challenges like land fragmentation and limited access to resources. Small and marginal farmers in India often grow more high-value crops like fruits and vegetables than large farmers, which helps them earn quicker profits. Even though they own less land, these farmers still contribute a lot to India's food production, especially in vegetables, fruits, cereals, and milk. Their contribution is higher in Eastern

- Small and Marginal Farmers own landholdings smaller than 2 hectares

states, but in some areas, medium and large farmers are still in charge. When it comes to productivity, small farmers usually get more value per hectare of land than large farmers, though this can vary in different regions. For example, in states like Kerala and Madhya Pradesh, large farms are more productive, but overall, small farms tend to be more productive in terms of value.

Small and marginal farmers in India often get more value from their land than large farmers, although this can change depending on the region. In some states like Kerala and Madhya Pradesh, large farms have higher productivity. However, overall, small farms tend to be more productive in terms of value. Small farmers have also seen improvements in access to important resources like irrigation, fertilizers, and high-yielding varieties (HYV) of crops. While they now have better access to irrigation, large farmers still get water from cheaper sources like canals. Small farmers use more fertilizers per hectare and plant a larger portion of their land with HYV crops. Additionally, small farmers grow more crops per year, which means they use their land more intensively than larger farmers.

- Small farms tend to be more productive in terms of value

According to the 2018-19 National Sample Survey (NSS) data, Small and Marginal Farmers (SMFs) in India predominantly cultivate cereals, with rice (paddy) and wheat being the most common crops. Small and marginal farmers in India often grow more high-value crops like fruits and vegetables than large farmers, which helps them earn quicker profits. Even though they own less land, these farmers still contribute a lot to India's food production, especially in vegetables, fruits, cereals, and milk. Their contribution is higher in Eastern states, but in some areas, medium and large farmers are still in charge. When it comes to productivity, small farmers usually get more value per hectare of land than large farmers, though this can vary in different regions. For example, in states like Kerala and Madhya Pradesh, large farms are more productive, but overall, small farms tend to be more productive in terms of value

- Small and Marginal Farmers (SMFs) are predominantly in India

1.3.5.2 Issues and Challenges for Small Farmers

Small farmers in India face several challenges. Let us discuss them in detail.

- One big problem is the lack of access to markets where

they can sell their products for fair prices. They also struggle to get loans from banks, leading to poor investment in their farms. Additionally, many small farmers do not have access to modern farming techniques or proper resources like irrigation systems, which makes farming harder.

- Women play an important role in farming, doing tasks like planting, harvesting, and taking care of animals. However, they are often denied the rights to own land and access other resources. This prevents them from getting loans and other support that could help them.
- Socially disadvantaged groups, such as Scheduled Castes (SCs) and Scheduled Tribes (STs), are more likely to be small farmers. Unfortunately, these groups often face discrimination when trying to access resources like credit and farming information.
- Another major issue for small farmers is land ownership. Many small farmers do not have clear land titles, which makes it difficult for them to get loans or support. There are also problems with land leasing and tenancy, meaning some farmers do not have land for farming. Reforms to protect land rights and make leasing easier are needed.
- Education is another challenge. Many small farmers are not well-educated, which limits their ability to learn about new farming methods and technologies. This lack of education also means they are less aware of helpful resources like government programs or new farming techniques.

- Small farmers have limited accessibility of resources

- Small farmers also face high levels of debt. Many rely on informal sources of credit, like money lenders, which charge high interest rates. This makes it even harder for them to succeed in farming.
- Globalisation is another challenge. As the world's economy becomes more connected, small farmers in India have to compete with large farms in other countries. The prices for some crops are lower because of cheap imports, making it harder for small farmers to earn a living.
- Climate change also affects small farmers. Changes in the weather can lead to crop failures, loss of livestock, and fewer resources like water. Since small farmers are more vulnerable, they need support to adapt to these changes.
- Water is a big issue for small farmers too. Many depend on groundwater for irrigation, but it is depleting in many

areas. This will make farming even harder in the future, especially if they don't have access to better irrigation systems.

- As people's diets change in India, there is more demand for high-value crops like fruits, vegetables, and meat. This could provide opportunities for small farmers to earn more money, but it also comes with risks. If small farmers are supported with the right infrastructure and marketing, they could benefit from this change.
- Finally, small farmers face many risks, such as health problems, job insecurity, and natural disasters like floods or droughts. These risks can damage their income and livelihoods. To help them, India needs to strengthen its social protection programs, like crop insurance and financial assistance, to ensure small farmers can cope with these challenges.

1.3.5.2 Big Farmers

Big farmers or Large farmers are individuals who own extensive amounts of agricultural land (often more than 10 hectares). They typically manage high-scale farming operations and may hire a significant number of agricultural labourers.

Large farmers often employ many workers to help with tasks like planting, cultivating, and harvesting crops, which makes their operations more efficient and productive. They also have enough money to lend to smaller farmers, helping them with resources and creating a support system within the farming community. Additionally, large farmers sometimes start other businesses like food processing or agricultural technology, which helps them make more money beyond just selling crops. These large farmers play an important role in food security by producing a lot of food, ensuring there is enough for everyone, especially in areas with large populations. Their businesses can also boost the local economy by creating jobs and advancing farming technology.

- Large farmers holding more than 10 hectares

Large farmers face several challenges. First, they have to manage the high costs of running large-scale operations, including buying equipment, paying labourers, and maintaining land. They also face market risks, such as fluctuating crop prices, which can affect their profits. Additionally, large farms require a lot of resources like water and fertilisers, and finding sustainable ways to manage these can be difficult.

- Large farmers face difficulties to maintain profitability

Large farmers also have to deal with competition from other large farms, which can make it hard to maintain profitability. Finally, the need for effective risk management, like handling extreme weather, is a big concern for large-scale operations.

Summarised Overview

Land is a fundamental resource with significant value in the economy, especially in agriculture and industrial production. Its importance extends across multiple sectors, ranging from food production and raw material extraction to supporting environmental sustainability through forestry. In India, the Nine-Fold Classification system categorises land into different types, which helps policymakers allocate resources efficiently. Land productivity refers to the output produced per unit of land and depends on various factors such as soil quality, climate, irrigation, technology, land management, and land tenure. Smaller farms, when efficiently managed, can achieve higher productivity per hectare, whereas larger farms benefit from economies of scale but may encounter challenges like diminishing returns or resource constraints. To optimise land use, several principles guide decision-making, including the Maximisation Principle, Equi-Marginal Principle, Diminishing Marginal Rate of Substitution, Specialisation and Comparative Advantage, and the First Choice Principle. In India, land distribution is marked by significant inequality. Farmers' landholdings are divided into categories: marginal (less than 1 hectare), small (1-2 hectares), semi-medium (2-4 hectares), medium (4-10 hectares), and large (more than 10 hectares). Marginal and small farmers, who make up the majority of the farming population, face numerous challenges such as limited access to resources, market opportunities, and modern agricultural techniques. Despite government reforms designed to improve land access and rights, issues like land fragmentation, lack of legal ownership, and difficulty accessing credit continue to persist. Historically, land tenure systems in India have evolved from communal ownership in ancient times to individual ownership. The British introduced exploitative land revenue systems like the Zamindari, Ryotwari, and Mahalwari systems, which imposed heavy taxes and resulted in insecure land tenure, causing severe hardship for farmers. Small and marginal farmers are crucial to India's food production, significantly contributing to crops like rice, wheat, and vegetables. However, these farmers face considerable challenges, including poor access to markets, loans, education, and exposure to environmental risks. On the other hand, large farmers, who own significant amounts of land, benefit from economies of scale but also face issues such as high operational costs and fluctuating market prices. Despite the challenges, both small and large farmers are integral to India's agricultural economy. The government has introduced reforms aimed at improving land distribution and ownership rights, but these efforts have yet to fully address the persistent issues surrounding land fragmentation, inadequate access to resources, and financial support for small farmers.

Assignments

1. Explain the different categories of land holdings in India and discuss their implications on the farmers' income and agricultural productivity.
2. Discuss the historical evolution of land tenure systems in India, highlighting key periods and their impact on land distribution.
3. Identify and elaborate on the major challenges faced by small and marginal farmers in India. How can these challenges be addressed?
4. Compare and contrast the role of small and large farmers in India's agricultural economy, highlighting their respective contributions and challenges.
5. What are the key reforms introduced by the Indian government to improve land distribution and ownership? How effective have these reforms been?

Suggested Reading

1. Various Economic Surveys, Govt. of India
2. Bharadwaj K, (1974): *Production conditions in Indian Agriculture-A study based Farm Management,* Cambridge University Press

Reference

1. HansraParumal and Chandrakarn - *Modernization of Indian Agriculture in 21st century challenges, opportunity and strategies,* Concept Publication Co.New Delhi.
2. Soni.R.N. (2004) *Leading Issues in agricultural Economics,* Vishal Publishing Co. Jalandhar.

Space for Learner Engagement for Objective Questions

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BLOCK 2

Production and Management in Agriculture

UNIT 1 Agricultural Production Function

Learning Outcomes

After completing this unit, the learner will be able to:

- analyse the relationship between inputs and outputs in agricultural production process
- identify the principles of efficient resource allocation in agricultural production
- understand the challenges in the agricultural sector

Background

Agriculture is the backbone of many economies, especially developing countries, and understanding its complex mechanism is key for improving productivity and sustainability. The production function is a foundational concept in agricultural economics that explains the relationship between factors of production and products. It serves as a tool to analyse how resources such as land, labour, capital, and technology contribute to agricultural output. An in-depth understanding of the relationship between factors and products helps to understand how input variations impact production levels. Similarly, examining the interaction between different products highlights opportunities for specialisation in agricultural practices. The interrelationship between factors of production also provides insights into achieving a balance between inputs, reducing wastage, and maximising efficiency. Efficient use of resources is important in agriculture, given the challenges caused by limited land, water scarcity, and the growing demand for food. Addressing these challenges requires strategies that ensure the sustainable use of inputs while maintaining productivity.

Keywords

Production Function, Isoquant, Iso Cost Line, Production Possibility Curve, Iso Revenue Line, Least Cost Combination

Discussion

2.1.1 Production Function

Agricultural production is a natural starting point for understanding agricultural economics. In the production process, firms, also known as producers, combine inputs to create outputs. Production refers to the creation of goods and services, which requires the use of scarce resources. As we know, inputs are also known as factors of production, and include land (A), labour (L), capital (K), and management (M). The production function describes the physical relationship between the quantity of inputs and the output produced. The production function can be expressed as:

$Y = f(A, L, K……)$

where Y is output, f represents the production function of, and A, L and K are inputs like land, labour, and capital. In real-world, production processes can be complex. To simplify this, focusing on one variable at a time is often helpful. For instance, agronomists may conduct controlled experiments to determine the optimal amount of nitrogen fertiliser for wheat production. By keeping other inputs constant and varying the amount of nitrogen, they can measure its effect on wheat yields. These experiments are typically done on adjacent test plots to ensure consistent weather, soil, and growing conditions. Here, nitrogen is the factor or input, and wheat is the product or output. This is known as the relationship between factors and products. The discussion on the factor-product relationship is limited to considering only one variable input and its corresponding output.

- Agriculture Production Process

2.1.2 Relation Between Factor and Product

We have already explained the production function. To study the relationship, we need to understand certain concepts such as:-

a. Total Physical Product (TPP)

TPP represents the total output produced by utilising varying quantities of input, measured in physical units such as quintals, kilograms, etc.

b. Average Physical Product (APP)

APP denotes the average output produced per unit of input. It is calculated by dividing the total output at a given level by the number of input units used.

$$APP = \frac{Total\ Physical\ Product}{Input\ Level} = \frac{Y}{X}$$

c. Marginal Physical Product (MPP)

MPP refers to the additional output generated by using one more unit of input, representing the change in total output resulting from a change in the quantity of the variable input.

$$MPP = \frac{Change\ in\ total\ physical\ product}{Change\ in\ input\ level} = \frac{\Delta y}{\Delta x}$$

d. Elasticity of Production (Ep)

It is the percentage change in output as a result of a percentage change in input.

$$EP = \frac{Percentage\ change\ in\ output}{percentage\ change\ in\ input}$$

2.1.2.1 Relationship between TPP, MPP, and APP

- TPP, MPP and APP behaviour

As long as the MPP is rising, TPP increases at an increasing rate. TPP continues to grow at this increasing pace until the MPP reaches its maximum. After MPP reaches its peak, TPP still increases but at a slower rate. When MPP becomes zero, TPP reaches its maximum value. If MPP becomes negative, TPP starts to decline. When TPP is increasing, MPP is positive; when TPP is at its maximum, MPP is zero; and when TPP decreases, MPP becomes negative. A tabular representation of the production function is given below. The below table shows various levels of the variable input (human labour) along with the corresponding Total Physical Product (TPP), Average Physical Product (APP), and Marginal Physical Product (MPP). Land is assumed to be a fixed resource. TPP increases up to the 7th unit of labour and then begins to decline. APP rises with the application of labour up to five units and then starts to decrease. Marginal product increases from 15 units to 30 units as labour input rises from the first to the fourth unit but decreases as labour input continues to increase. The marginal product becomes negative when labour input reaches the 8th unit and beyond.

Table 2.1.1 Total, Average and Marginal Physical Product

Input level	Total Physical Product (TPP)	Average Physical Product (APP)	Marginal Physical Product (MPP)
1	15	15	-
2	38	19	23
3	66	22	28
4	96	24	30
5	120	24	24
6	126	21	6
7	126	18	0
8	120	15	-6
9	90	10	-30
10	50	5	-40

2.1.2.2 Three Stages of Production Function

The production function showing the relationship between factor and product (input and output) is illustrated in figure below.

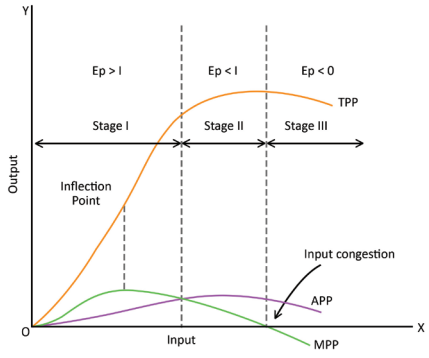

Fig 2.1.1 Three stages of Production Function

The production function can be divided into three stages or three regions to study the factor-product relationship. This

division identifies the region in which the production decisions are rational. Stage 1 begins at the origin and ends when MPP equals APP. During this stage, MPP is greater than APP, causing APP to increase. MPP reaches its maximum at the "point of inflection," after which it begins to decline. TPP increases at an increasing rate until the inflection point and then increases at a decreasing rate. The elasticity of production (Ep) is greater than one throughout Stage 1 and equals one at the end of this stage. In this phase, fixed resources are abundant relative to the variable resource. The technical efficiency of the variable resource improves, as seen in the rising APP, and the technical efficiency of the fixed resource also increases, as indicated by the growing TPP. This stage is considered an irrational (sub-optimal) phase of production.

- Increasing returns

Stage II starts when MPP equals APP and ends when MPP reaches zero, the point where TPP is at its maximum. In this stage, MPP is less than APP, and both follow a declining trend. Although average productivity (APP) decreases throughout this stage, it is at its highest at the beginning of Stage II. TPP continues to increase but at a diminishing rate as MPP decreases. The elasticity of production (Ep) is less than one throughout Stage II and becomes zero by the end of the stage. This is considered the rational (optimal) stage of production. The technical efficiency of the variable resource declines, as indicated by the decreasing APP, while the technical efficiency of the fixed resource continues to improve, reflected in the increasing TPP. During this phase, the variable resource is abundant relative to the fixed resources.

- Decreasing Returns

Stage III begins, where Stage II ends, with MPP at zero. In this stage, MPP becomes negative, APP continues to decline, and TPP, which reaches its maximum at the end of Stage II, starts to decrease. The elasticity of production (Ep) is less than zero. This is considered an irrational stage of production. The technical efficiency of both the variable and fixed resources declines, and the variable resource is in excessive quantities relative to the fixed resource.

- Negative Returns

2.1.2.3 Reasons for Increasing, Decreasing and Negative Returns

In Stage I, fixed resources are abundant, but they are not efficiently utilised due to an insufficient number of variable resources. The fixed resources are underutilised and readily available to the farmers. In this situation, applying more variable

resources helps to efficiently use the previously idle fixed resources, resulting in increasing returns. As more variable resources are added, the marginal physical product eventually reaches its maximum. Beyond this point, any further increase in the use of variable resources leads to diminishing returns as the additional output produced becomes smaller. This occurs because the relatively smaller number of fixed resources must now accommodate the larger quantity of variable resources. Production, in general, relies on the combined effort of both fixed and variable resources. When the proportion of variable resources becomes too large compared to the limited fixed resources, the balance between the two is disrupted, leading to negative returns in Stage Third.

- Different stages of production

2.1.3 Factor - Factor Relationship

Farmers often face the challenge of selecting the most appropriate production technology in the production process. Farm production usually facilitates the substitution of resources. For example, a farmer producing farm products may choose between organic manures and inorganic fertilizers, human labour and machinery, or human labour and herbicides. The key challenge they face is selecting the most suitable resource, method, or combination that minimises costs while producing a given output level. The managerial problem is to determine the least-cost combination of inputs to achieve a given output level.

- Selecting the most suitable that minimises costs while producing a given output level

Here, the production function is represented as:

$$Q = f(X_1, X_2)$$

Where 'Q' is the fixed level of output, and X_1 and X_2 are the quantities of variable inputs. The factor-factor relationship involves two independent variables and one dependent variable. The factor-factor relationship can be explained using the concepts of isoquants and isocosts.

2.1.3.1 Isoquant

"Iso" means equal, and "quant" refers to quantity. An iso-quant, represents all combinations of inputs that produce the same level of output. An iso-quant, also known as an iso-product curve or product indifference curve. More clearly, if a specific quantity of a crop is to be produced, the two-variable production function will reveal different combinations of two inputs capable of yielding the same output. By plotting all the

- Same level of output with different input

points representing these combinations and connecting them, we obtain a curve known as an isoquant. This curve represents the same level of output at every point along it. The figure below shows iso quant.

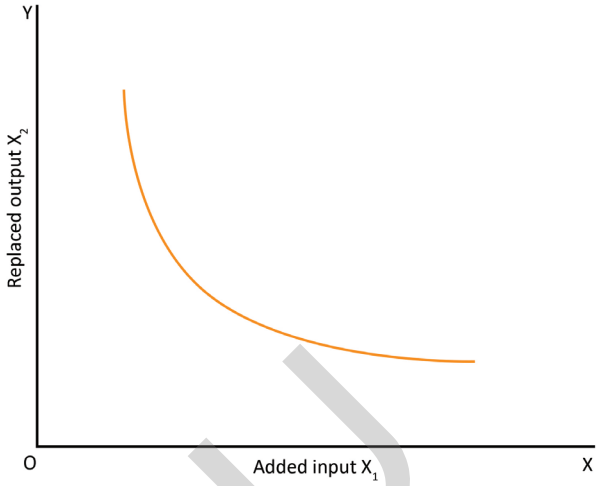

Figure 2.1.2 Isoquant

The Isoquant Map

- Combination of two variable inputs required to produce a specific level of output

An isoquant represents the combination of two variable inputs required to produce a specific level of output. When all such isoquants for different output levels are plotted on a graph, the result is referred to as an isoquant map. The diagram below illustrates an isoquant map.

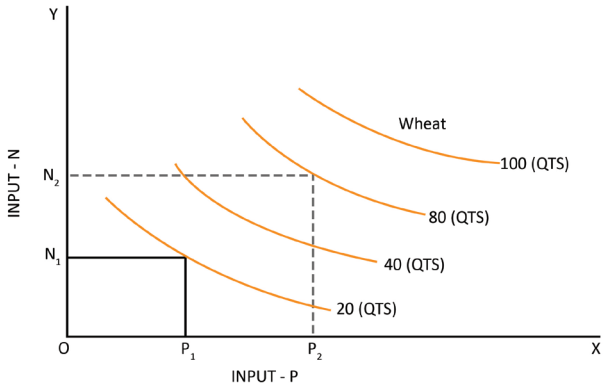

Fig: 2.1.3 Isoquant map

- Isoquants for different output levels

The diagram shows isoquants corresponding to output levels of 20 quintals, 40 quintals, 80 quintals, and 100 quintals of wheat. These outputs are achieved through varying combinations

of two inputs, namely P and N, representing two different fertilizers.

Properties of Iso-quant

1. **Isoquants Slope Downwards from Left to Right:** When the quantity of one input, such as X_1 is increased, the amount of another input, say X_2 must be reduced to maintain the same level of output. The slope of an isoquant, known as the Marginal Rate of Technical Substitution (MRTS), shows the rate at which one input can be reduced to gain an additional unit of another input. MRTS of X_1 and X_2 is written as:

$$MRTS\ X_1X_2 = \Delta X_2 / \Delta X_1$$

2. Isoquants are Convex to the Origin: As we move from left to right along the isoquant, the slope gradually decreases, illustrating a diminishing rate of technical substitution. This means that with each additional unit of one input, the amount of the other input that can be substituted becomes progressively smaller.

- Factor-factor relationship in actual practice

3. Higher Isoquants represent a higher level of output: Iso quant placed for a higher level of output lies above the isoquant, representing a lower level of output.

4. Isoquants do not intersect: Two isoquants never intersect each other because a given combination of two inputs cannot produce different levels of output.

The Iso-Cost line is the next topic we need to study to understand the factor-factor relationship. Let's discuss it below.

2.1.3.2 Iso Cost Line

- Iso-cost curve includes all points representing combinations of inputs costing the same total amount

An isoquant represents all possible combinations of two variable inputs that produce the same output level. Similarly, an iso-cost curve illustrates the various combinations of two inputs that can be purchased with a fixed budget. In other words, an iso-cost curve (which forms a straight line if input prices are constant) includes all points representing combinations of inputs costing the same total amount. The total cost depends on the quantities of the two inputs, denoted as X_1 and X_2, and can be graphed like isoquants. For example, if a farmer has ₹80 to spend (Total Cost -Tc), with the price of one unit of X_1

being ₹4 and one unit X_2 being ₹8, the possible combinations of inputs he can purchase are summarised in the table.

Table 2.1.2 Iso cost Schedule

Combinations	Unit of input X1	Unit of input X2
1	20	0
2	16	2
3	12	4
4	8	6
5	4	8
6	0	10

All the above 6 combinations of two variable inputs, X1 and X_2, cost the same amount. The figure below shows an Iso cost line for Rs. 80 (Tc).

- Variable input with same income

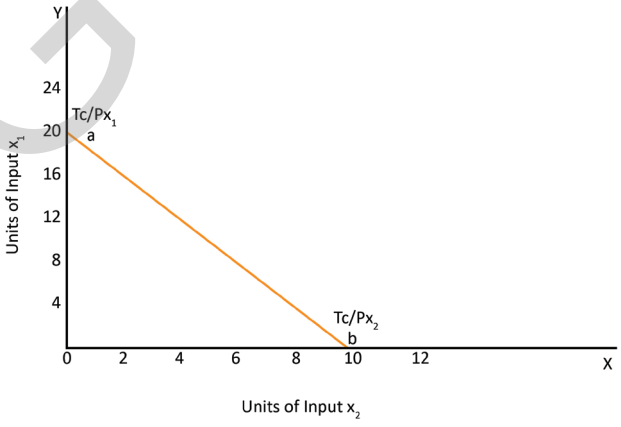

Fig: 2.1.4 Iso Cost Line

2.1.3.3 Efficient Use of Resources (Least Cost Combination)

- Determining the most cost-effective combination of resources

Factor-factor analysis focuses primarily on determining the most cost-effective combination of resources. A farmer optimally distributes resources such as land, labour, and water to maximise income at the lowest possible cost while ensuring

long-term sustainability. While several combinations of two inputs may yield the same level of output, the key challenge is identifying the specific combination that produces the desired output at the lowest possible cost. This least-cost combination can better be explained with the help of a figure.

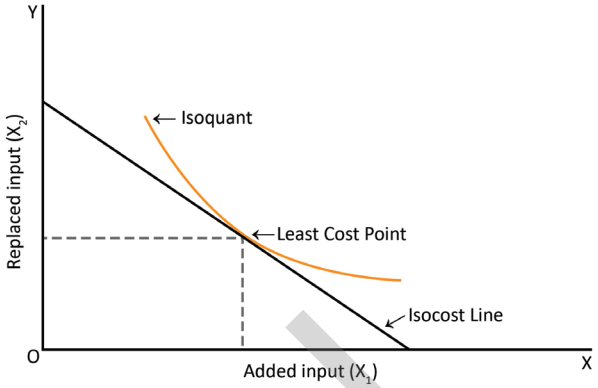

Fig: 2.1.5 Least Cost Combination

The isoquant and the iso-cost line are plotted on the same graph to determine the optimal combination of resources using a graph. The slope of the isoquant reflects the Marginal Rate of Technical Substitution (MRTS) between the two inputs, while the slope of the iso-cost line shows the inverse price ratio of the inputs. The point where the isoquant and iso-cost line are tangent represents the least-cost combination, which is shown in the above figure. An efficient use of resources is possible at this point. The point where the slope of the isoquant equals the slope of the iso-cost line shows that the MRTS is equal to the price ratio.

- Cost-effective resource allocation

2.1.4 Product- Product Relationship

The main resources needed for farming, viz., land, labour, and capital, are limited. These limited resources, however, can be allocated across various possible uses. They may be directed towards the production of different crops or livestock operations. This creates a challenge for farmers in determining what to produce. Farmers must decide whether to focus solely on crops, only on livestock, or on a combination of both. Ideally, the choice of crop and livestock mix should maximise profitability. The product-product relationship focuses on how resources are allocated across various crop and livestock enterprises to maximise profit. In this relationship, resources remain fixed while the types of products produced are

- Fixed inputs and variable output

adjusted. This concept is explained by the principle of product substitution, where substitution ratios and price ratios are used as choice indicators in the determination of the optimum combination. To determine the optimality conditions in a product-product relationship, two analytical tools are required: (a) the production possibility curve and (b) the iso-revenue lines.

2.1.4.1 Production Possibility Curve

- The farmer faces a decision on how to allocate this limited land between the two choices

Consider a farmer with a fixed resource, such as 5 acres of land, facing two production options: Product Y_1 and Product Y_2. The farmer faces a decision on how to allocate this limited land between the two choices. The options include using all 5 acres either solely for producing Product Y_1 or entirely for Product Y_2. Between these two extremes, there exist different possibilities, such as 1 acre for Y_1 and 4 acres for Y_2, two acres for Y_1 and three acres for Y_2, and so on. If the entire 5 acres is used to produce Y_1, then the entire output is from Y_1, say, 300 units, while the output of Y_2 is zero. On the contrary, if a whole 5 acres is used for the production of Y_2, then the output of Y_2 will be 300 units and Y_1 will be zero. So, the different levels of land and their corresponding output levels can be represented through a production possibility curve.

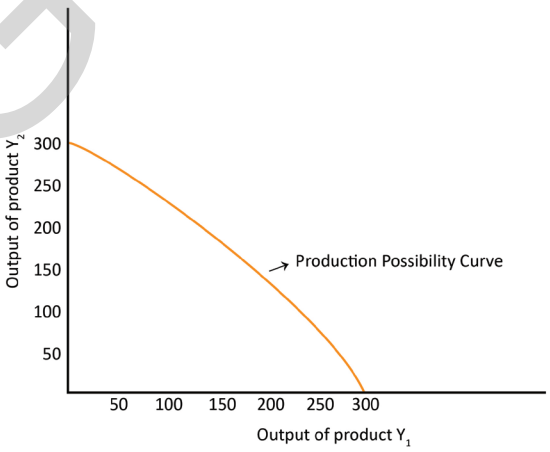

Fig: 2.1.6 Production Possibility Curve

- Combinations of two products with the same amount of variable input

The Production Possibility Curve (PPC), therefore, shows various combinations of two products that can be produced using a fixed quantity of resources. It provides producers with a view of all production possibilities attainable with the available resources. That is why it is sometimes called the opportunity curve. The slope of the PPC shows the trade-off

between the two goods, showing the rate at which one can be substituted for the other. As a frontier, the PPC marks the boundary of production capabilities since resources cannot support output levels beyond this curve. The area under the curve, including the axes, is the feasible or attainable set of outputs. It represents what can be produced given the resource constraints.

The Characterises of PPC are as follows

a. PPC is concave to the origin

b. The slope of PPC shows the marginal rate of product substitution

c. Change in input shifts the PPC

2.1.4.2 Iso Revenue Line

- Same level of revenue from different input combinations

An iso-revenue line represents all possible combinations of two products that yield the same revenue. For instance, if a farmer aims for total revenue of Rs. 5000 with product X priced at Rs. 10 and product Y at Rs. 20. Then the farmer could achieve this by producing 500 units of X or 250 units of Y. Similarly, combinations such as 300 units of X with 100 units of Y or 100 units of X with 200 units of Y would yield the same revenue. By plotting these extreme points, representing 500 units of X and 250 units of Y, and connecting them, the farmer obtains the iso-revenue line. It is shown below:

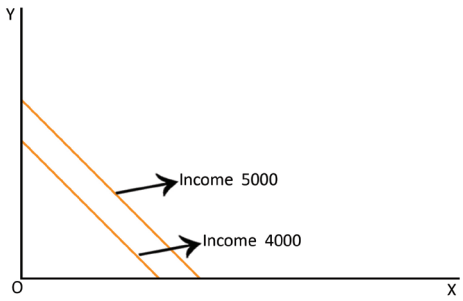

Fig: 2.1.7 Iso Revenue Line

The Characterises of Iso-revenue Line are :-

a. The iso-revenue line is straight, reflecting constant output prices regardless of the quantity sold.

b. When total revenue grows, the iso-revenue line shifts upward.

c. Iso-revenue lines remain parallel to each other, as the price ratio is fixed.

d. The line's slope represents the inverse price ratio of the outputs, and this slope varies with price changes.

2.1.4.3 Determination of Optimum Product Combination

- Optimum Product Mix:Point where the Iso revenue line tangent to PPC

To identify the revenue-maximising combination of two products, two key questions must be addressed: what combinations should be produced? And how can this be determined? By using graphical methods, these questions can be resolved. It is shown below:

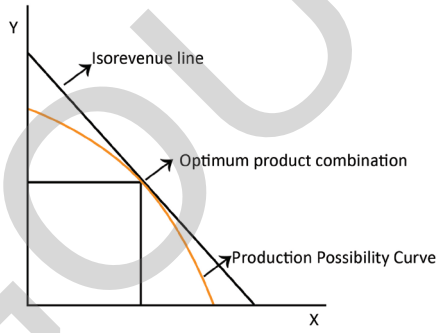

Fig 2.1.8 Optimum Combination of Products

- Tangency between Iso revenue and PPC

Both the production possibility curve and the iso-revenue line are plotted on the same graph above. This will help a farmer to find the optimal product combination. The slope of the production possibility curve reflects the marginal rate of substitution, while the iso-revenue line's slope represents the inverse price ratio of the products. The optimal product mix is achieved at the point where the iso-revenue line is tangent to the production possibility curve, indicating that both curves share the same slope at this tangency point.

2.1.5 Labour Absorption Issues in Agriculture

- Labour absorption raise the income

The agriculture sector is labour-intensive, especially in developing economies. Labour absorption in agriculture leads to employment generation for a significant portion of the population, particularly in rural areas. Labour absorption contributes to income generation for rural households,

which is crucial for alleviating poverty. Labour absorption in agriculture faces several challenges. They are discussed below:

- **Farm size:** As farms increase in size, the demand for manual labour declines, with larger farms often opting for machinery to boost productivity.
- **Mechanisation:** The introduction of tractors for tasks like tilling, sowing, threshing, and transportation has further diminished the need for human labour in farming.
- **Technological advancements:** New chemical and mechanical technologies, especially those from developed countries, have allowed for greater productivity with reduced reliance on labour.
- **Child labour:** Child labour remains persistent in agriculture, which is made worse by weak union representation, insufficient labour inspection, and the tradition of children working in agriculture from a young age.
- **Income inequality:** Income inequality between agricultural and non-agricultural sectors often causes poverty among farm workers. Moreover, agriculture in many countries relies heavily on small and marginal farms, which are primarily focused on subsistence, limiting opportunities for larger-scale employment.

- Challenges in labour absorptin in agriculture

2.1.6 Gender Issues in Agricultural Services

Gender in agriculture refers to the important roles, responsibilities, and access to resources that men and women have within agricultural activities. These differences are influenced by social, cultural, and economic factors. The important issues related to gender in agriculture are discussed below:

- **Unequal labour division:** Gender disparities in agricultural services are evident in labour division and resource accessibility. Typically, men handle tasks like ploughing and managing livestock, while women carry out much of the labour-intensive work, such as sowing, weeding, fertilising, harvesting, and threshing.
- **Differences in working conditions:** Women in agriculture often face inferior working conditions compared to men, characterized by irregular, informal, and low-skilled work that is generally labour-intensive and part-time.

- Role of men and women in agricultural sector

- **Barriers to access finance:** Women frequently encounter barriers to acquiring land, production inputs, credit, and extension services, further reducing their productivity and ability to sustain independent livelihoods.
- **Decision-making power:** Men also hold more decision-making authority, with women largely underrepresented in cooperatives, labour unions, and conflict resolution forums.
- **Wage Differences:** Women tend to work longer hours, with a significant portion of their labour going unpaid.
- **Social norms:** Social norms also reinforce gender-based constraints, prioritising men's farm plots and limiting women to managing their work without interfering with their husband's responsibilities.

Summarised Overview

The foundational concepts of agricultural production and resource management emphasises the dynamic relationships between inputs and outputs and their interdependencies. By analysing the production function, we have understood how factors of production, such as land, labour, and capital, contribute to agricultural output. The relationships between factors and products, factors and factors, and products and products have been highlighting their relevance in maximising productivity while minimising costs.

By adopting resource-efficient practices, farmers can optimise the allocation of limited inputs. Labour absorption plays a significant role in addressing unemployment while ensuring agricultural processes remain labour-intensive where necessary. Finally, the unit focuses on gender issues in agriculture, which continue to hinder the equitable distribution of resources and opportunities. Addressing disparities in labour division, resource access, and decision-making power between men and women is important. Promoting gender equity is not only a matter of social justice but also a way to improve agricultural outcomes.

Assignments

1. Describe the relationship between factor and product. How does the law of diminishing returns apply to this relationship?
2. Graphically explain the relationship between the production possibility curve (PPC) and iso-revenue line. Explain how a farmer can use these tools to achieve the best combination of products.
3. Explain the concept of the iso-cost line and how it can be used with the isoquant to determine the least-cost combination of inputs.
4. Evaluate the issues in agriculture labour absorption.

Suggested Reading

1. Hansra Parumal and Chandrakarn, *Modernization of Indian Agriculture in 21st-Century Challenges, Opportunities, and Strategies,* Concept Publication Co., New Delhi.
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Space for Learner Engagement for Objective Questions

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UNIT 2

Supply Response Models in Agriculture

Learning Outcomes

After completing this unit, the learner will be able to:

- undrstand supply response models
- discuss the concept of the Cobweb model
- know the applications of the Nerlove model in agriculture

Background

Supply response models are key in understanding how producers react to price signals and other factors in determining their production levels. These models, the Cobweb and Nerlove models, are central to agricultural economics and related disciplines, where the relationship between supply and its influencing variables, such as price and input costs, are vital. These models offer an understanding of the mechanisms that control production cycles and market stability. The Cobweb production model is one of the earliest and simplest models for studying supply response. Developed in the context of agricultural markets, it explains how production and prices interact over time, particularly in markets characterised by time lags in production decisions. The model assumes that producers base their output decisions on current prices, leading to cyclical adjustments in supply and price levels. The Nerlove model is particularly relevant for analysing long-term supply adjustments, making it a valuable tool in policy design.

Keywords

Supply, Cobweb Model, Convergent, Divergent, Nerlove Model

Discussion

2.2.1 Supply Response Models

- Decision-making power of price

Consumers engage in market transactions to acquire the goods they require. The price of a commodity represents its value expressed in monetary terms. Prices play a major role in guiding producers by signalling which goods to produce. Similarly, prices inform consumers on whether to maintain or reduce their demand. Fluctuations in supply and demand directly influence price levels, which in turn affect the welfare of both producers and consumers in a free-market economy. Supply response models are designed to study how producers adjust their production in reaction to changing market conditions, especially shifts in prices. These models examine both short-term and long-term adjustments, highlighting factors such as production elasticity, lag effects, and overall market stability. The Cobweb Model and the Nerlove model are two models that better explain supply response in agriculture.

2.2.1.1 Cobweb Production Model

- Changes in commodity prices influence production with a time lag

The prices of agricultural commodities often exhibit cyclical patterns and it is described in Cobweb theories. This theory suggests that changes in commodity prices influence production with a time lag. However, the duration of this lag varies across commodities, depending on the production technologies involved. In agriculture, time lags arise due to the fundamental characteristics of crops. Changes in the area under cultivation, controlled by price fluctuations, can impact crop production even before the sowing season begins. For dryland farming, the lag is typically one year, while for irrigated crops, it may be a single season. In the case of livestock and orchards, the lag period is significantly longer. In the Cobweb Model, the supply function is expressed as $S_t = f P_{(t-1)}$. Where S_t represents the supply or production of the crop in year t, and $P_{(t-1)}$ denotes the price in the previous year. Here, the time lag is one year. In the cobweb model, the relationship between price and demand assumes no time lag, meaning that the demand for a crop in the current year directly depends on the price of that year.

The demand function, therefore, is expressed as:

$D_t = f(P_t)$

- Analyse the occurrence of price cycles in agricultural commodities

The supply and demand equations are combined to analyse the occurrence of price cycles in agricultural commodities. In these cobweb models, the quantities demanded, quantities supplied, and prices in subsequent periods move towards equilibrium or away from equilibrium. This behaviour depends on the relative slopes of the demand and supply curves and the respective price elasticities. This supply response is better explained with the help of the figure below.

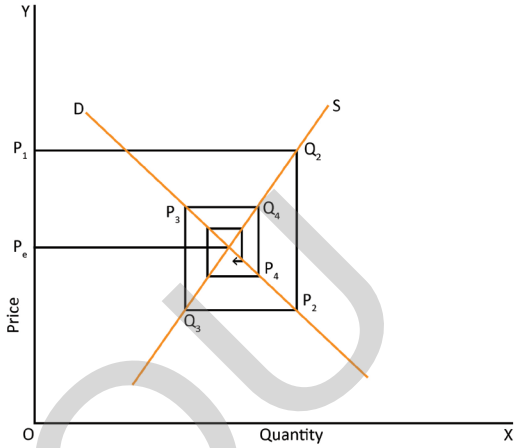

Fig: 2.2.1 Convergent Cobweb model

- Price movement towards equilibrium

Assume that the price in the initial period (t_1) is P_1. This price prompts farmers to produce a quantity Q_2 during period t_1. Based on the demand D and the quantity supplied Q_2 in the market, the resulting market-clearing price is P_2 in period t_2. Since the P_2 price is lower than P_1, farmers reduce their production to Q_3 in period t_3. This reduction in output leads to an increase in the price of P_3, and this process continues over subsequent periods. It is observed that prices (P_1, P_2, P_3, and P_4) oscillate above and below the equilibrium price, gradually moving closer to the equilibrium price (P_e) as adjustments proceed. It is the convergent cobweb model. The operations under a divergent cobweb model are shown in the figure below.

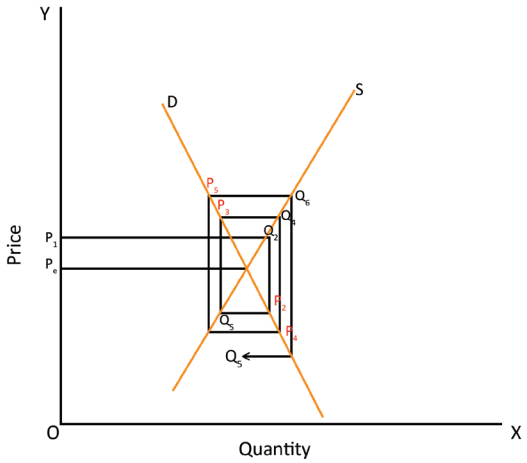

Fig: 2.2.2 Divergent Cobweb Model

- Price moves away from equilibrium

Initially, the price is assumed to be P_1, which motivates farmers to produce a quantity of Q_2 in period t_2. However, the price in period t_2 is P_2, which is lower than P_1. Discouraged by this decline, farmers reduce production to Q_3 in period t_3, which results in a price of P_3. This price prompts farmers to increase production to Q_4 in period t_4, only to face a further price drop to P_4. This cycle continues, with prices oscillating around the equilibrium price (P_e). Over time, the deviations from the equilibrium price grow larger. This pattern is described as a divergent model or explosive oscillation model. In a cobweb model, divergence occurs when the absolute slope of the demand curve exceeds that of the supply curve.

2.2.1.2 Nerlove Model

The Marc Nerlove model, commonly called the partial adjustment model, is widely used by agricultural economists to analyse the impact of prices on crop acreage. This model assumes that farmers base their decisions on expected prices and the previous year's prices when determining the acreage to allocate for crops. As a result, it is also known as the price expectation model or the acreage adjustment model. This model is expressed in the following form:

$A_t = a+bP_t +U_t$

A_t = Actual acreage in year, t

a = Intercept

b = Parameter to be estimated

P_t =Expected price of the crop in year, t

U_t = Error term

- Price variability is used as an explanatory variable to account for changes in crop acreage

In the Nerlovian model, price variability is used as an explanatory variable to account for changes in crop acreage. Subsequently, other economists incorporated factors such as rainfall, relative crop yields, and total irrigated area to capture the influence of price variability in a better way. Models of this kind are commonly referred to as price expectation models.

In the supply response model, the desired acreage under the crop (A_t) depends on last year's price and the coefficient of adjustment in the crop acreage. This coefficient of adjustment depends on the difference between the desired acreage of the crop during the current year (A_t) and the last year's actual crop acreage i.e., $A_{(t-1)}$ This model is specified as follows:

$$A_t^* = a + bP_{t-1} + U_t \quad \ldots\ldots (2)$$

$$A_t - A_{t-1} = \lambda (A_t^* - A\,t - 1) \quad \ldots\ldots (3)$$

A_t^* = Desired acreage in the current year. This is not seen in the time series data

$A_t^* - A_{(t-1)}$ = Desired change in the acreage

$A_t - A_{(t-1)}$ = Actual change in the acreage

λ= Coefficient of adjustment in the acreage

- Allocation of acreage according to price expectation

The actual change in the acreage at any given period is some function of λ of the desired change in the acreage. If λ= 1, it means that the actual acreage is equal to the desired change in acreage. If λ= O, this means that last year's acreage and current year's acreage are the same. But, in reality, the crop acreage adjustment lies between O and 1, so O λ <1. Hence, this model is called the partial acreage adjustment model.

Summarised Overview

The Cobweb Production Model illustrates how price fluctuations influence production decisions over time. By examining scenarios of convergence and divergence, this model offers an understanding of how market forces interact with producer's decisions. The

Nerlove Model, on the other hand, refines the analysis by incorporating the producer's expectations and adaptive behaviour. This model highlights how farmers adjust their production based on past experiences and anticipated prices. It provides a better understanding of supply responses, particularly in the context of long-term adjustments. By studying these models, producers can better anticipate the effects of price policies on agricultural production.

Assignments

1. Discuss the factors that influence supply response in agriculture.
2. Define supply response models and explain their significance in agricultural economics.
3. With the help of a diagram, illustrate the two types of cobweb patterns (convergent and divergent). Provide examples of agricultural commodities that might show these patterns.
4. Discuss the Nerlove model. How do farmers adjust their production based on expected prices?

Suggested Reading

1. Hansra Parumal and Chandrakarn, *Modernization of Indian Agriculture in 21st-century Challenges,* Opportunities, and Strategies, Concept Publication Co., New Delhi.
2. Bharadwaj K, (1974): *Production conditions in Indian Agriculture-A study-based Farm Management,* Cambridge University Press
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1. S.Subba Reddy, P.Raghu Ram, T.V. NeelakandaSastry and I.Bhavani Devi (2004), *Agricultural Economics,* Oxford and IBH, Newdelhi
2. Soni. R.N. (2004), *Leading Issues in Agricultural Economics*, Vishal Publishing Co. Jalandhar.
3. Hanumantha Rao C.H., (1994): *Agricultural Growth, Rural Poverty and Environmental Degradation,* Oxford University Press, New Delhi.

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UNIT 3 Farm Management Principles

Learning Outcomes

After completing this unit, the learner will be able to:

- understand the concept of farm management
- know the principles of farm management
- discuss the limitations of farm management

Background

Farm management is an important aspect of agricultural economics. It focuses on the effective use of resources at the farm level to maximise productivity and profitability. It applies economic and managerial principles to farming operations. The need for farm management arises from fluctuating market conditions, technological advancements, and resource constraints. Its relevance lies in helping farmers adapt to these challenges by optimising resource use. Core principles include factor substitution, where one input replaces another to maintain output cost-effectively. Cost principles help in analysing fixed, variable, and marginal costs for better decision-making.

Farm management also incorporates the concepts of opportunity cost and comparative advantage to improve farm efficiency. Opportunity cost evaluates the benefits of the next best alternative forgone, enabling farmers to prioritise high-return activities. Comparative advantage emphasises specialisation in crops with the lowest relative opportunity cost. However, farm management is not free from limitations. Recognising these challenges is key to refine strategies for effective farm management and ensure long-term agricultural sustainability.

Keywords

Farm Management, Product Substitution, Factor Substitution, Cost Principle

Discussion

2.3.1 Farm Management

- Farm act as an economic unit

A farm operates as both a socio-economic and decision-making unit. Socio-economically, it serves as a primary income source for farmers and sustains their families. As a decision-making unit, it involves choices regarding the allocation of resources across various crop and livestock enterprises. Each farm has a defined productive capacity, contributing to the overall agricultural output when aggregated nationally. Thus, national agricultural progress depends on the combined performance of small farms. The prosperity of a country is closely linked to the welfare of its farmers, which in turn relies on their ability to make informed choices about resource allocation and adopt new production methods. Agriculture contributes around 26 percent to the national income and provides essential raw materials to industries, showing its importance in the economy.

- Importance of farm management

Improving farmers' managerial skills has become essential in an era increasingly focused on commercialising agriculture. While many farm managers have adapted effectively to advancements in agricultural technology, not all have done so equally. This creates a visible distinction between high-performing and underperforming farmers. Farm managers must recognise and respond to changes within the sector, as failing to do so could threaten their success in a dynamic economy. Consequently, they need to continuously develop the skills required to address diverse challenges that emerge in farm business management. To support farmers in adapting to evolving demands, knowledge of various aspects of farming is important. Farm management is key in providing farmers with reliable information for sound decision-making tools to address the operational and strategic challenges of running a successful farm.

2.3.1.1 Definition of Farm Management

According to Bradford and Johnson "Farm management is a branch of agricultural economics, which deals with wealth

earning and wealth spending activities of farmer in relation to the organisation and operation of the individual farm unit for securing the maximum possible net income". According to Heady and Jensen "Farm management, as the sub-division of economics, which considers the allocation of limited resources within the individual farm, is a science of choice and decision-making; and thus, a field requiring studied judgment". According to G.F. Warren "Farm management is defined as the science of organisation and management of the farm enterprises to secure greatest continuous profits".

- Organisation and operation of the individual farm

2.3.1.2 Need for Farm Management

The need for managing a farm on an individual basis arises from several key reasons:

- Managing a farm on an individual basis

i) Farmers aim to achieve two main goals: maximising farm profits and improving the standard of living of their family

ii) The resources available to reach these goals, specifically the factors of production, are limited in availability.

iii) Farm profitability is affected by a variety of factors, including biological, technological, social, economic, political, and institutional influences.

iv) The resources or factors of production can be utilised in various alternative ways.

2.3.1.3 Relevance of Farm Management

- Farm operations influence agricultural efficiency

Farm management is typically regarded as a branch of microeconomics, focusing on the allocation of resources at the individual farm level. While it also addresses resource allocation issues in the broader agricultural sector and the economy, its primary emphasis is on the farm as a distinct unit. The discipline examines aspects of farm operations that influence economic efficiency. This includes decisions related to the combination of enterprises, selection of crops and varieties, application of fertilizers, choice of implements, and execution of various farming activities. All these areas fall under the scope of farm management. Farm management includes several key components, including research, training, and extension activities aimed at improving farm efficiency and productivity.

2.3.2 Principles of Farm Management

Planning is very important in effective management. For farmer-managers to achieve this function, specific procedures and methods are necessary to provide direction. Economic knowledge equips decision-makers with essential principles that aid in creating farm plans and organising farm activities. These economic principles help managers set goals, devise plans that optimise resource allocation, substitution, and combinations, and integrate various enterprises effectively. Farm management involves applying economic principles to the organisation and operation of farm businesses. Different economic principles relevant to farm management are discussed below:

- Economic principles help to maximise profit

2.3.2.1 Principles of Factor Substitution

As a manager, a farmer faces major operational decisions, primarily concerning the question: how to produce? This shows selecting production methods, technology, or specific resource combinations, which are guided by factor-factor relationships. The principle of factor substitution aids the farmer-manager in identifying the most cost-effective production method to achieve a target output level. There are multiple ways to produce farm products, and the chosen method largely depends on resource availability. For example, if land is plentiful, the producer may opt for extensive cultivation; conversely, if land is limited, intensive, land-saving techniques are employed. Similarly, when labour is scarce, labour-saving or capital-intensive technology becomes the cost-effective choice, especially if capital resources are readily available.

- Selection of the method of production

The scale of production or the size of a farming operation also influences the choice of production technology. Generally, large-scale farming calls for capital-intensive technology, while small-scale farming, often more subsistence-focused, tends to rely heavily on labour. However, it is also important to consider factor prices when determining the most suitable combination of input factors. Producers typically seek the most cost-effective production method. A production technique is considered efficient when it generates a specified level of output at the lowest possible cost. To accomplish this, producers substitute less costly resources for more expensive ones, using greater quantities of the cheaper resources and smaller amounts of the costlier ones. Substitution remains

- Producers produce output at the lowest possible cost

economical as long as the expense of one resource is lower than that of another. The principle of factor substitution suggests that it is cost-effective to replace one resource with another as long as the cost savings from reducing the use of the replaced resource exceed the additional costs incurred from using more of the substituted resource. By comparing these cost factors, the principle of factor substitution helps identify the most economical combination of resources.

2.3.2.2 Principle of Product Substitution

- Managing product combinations

Risks and uncertainties are the two characteristics of agricultural production. To manage these challenges, farmers often cultivate a variety of crops and raise different types of livestock on their farms. This flexibility in selecting from various enterprise options creates a significant management question: what combination of products should be produced? This decision centers on the concept of product-product relationships, which is explained by the principle of product substitution. This principle helps producers identify the most profitable mix of enterprises.

To apply this principle effectively, a clear understanding of the following product relationships is essential.

- Helps producers identify the most profitable mix of enterprises

(a) Complementary Enterprises: Two products are considered complementary when an increase in the output of one leads to a corresponding increase in the output of the other, with resources held constant.

(b) Supplementary Enterprises: Products are termed supplementary if changes in one's output have no impact on the other's.

(c) Competitive Enterprises: Products are competitive when increasing the output of one, which can only be achieved by reducing the output of the other. For competitive products, determining the optimal combination involves considering three key factors: the marginal rate of substitution between the products, the price ratio, and the cost of cultivation. If the cultivation costs for both products are equal, the marginal rate of substitution and the price ratio become the primary criteria for selecting the most profitable combination.

The principle of product substitution suggests that when inputs are fixed, it is economically beneficial to replace one product with another if the returns from the substituted

product are higher. In this substitution process, shifting from one product mix to another leads to an increase in the output of one product while reducing the output of the other, as the total input remains constant. This shift results in a decline in returns from the product with reduced output and an increase in returns from the one with increased output. According to this principle, adjustments should continue as long as the reduction in returns from the replaced product is outweighed by the gains from the added product.

- Optimising returns through product substitution

2.3.2.3 Cost Principles in Farm Management

In any business, understanding the details of costs and returns is essential to assess profitability. The cost of production represents the expenses associated with producing a unit of output within a specified timeframe. In farming, short-term costs can be divided into two categories: fixed costs and variable costs. Fixed costs are those that remain constant regardless of output level and are incurred even if there is no production. These costs stem from prior investments in fixed resources and include items like depreciation, interest on fixed capital, rent, land taxes, insurance, wages for permanent labour, and family labour wages. Variable costs, on the other hand, fluctuate with the level of output. When there is no production, variable costs are absent. These include costs for seeds, feed, fertilizers, casual labour wages, electricity, and machinery rentals. Variable costs play a major role in short-term decision-making, as farmers aim to cover these expenses. Although expenses like seeds, fertilisers, pesticides, and organic manure initially fall under variable costs, they effectively become fixed once used, as they cannot be recouped in the mid-crop cycle. Similarly, items like tractors and land, considered fixed resources, are variable costs until they are purchased by the farmer. In the long term, however, the distinction between fixed and variable costs fades as all resources become adjustable.

- Short-term costs

The point of optimality in production is achieved when marginal revenue (MR) equals marginal cost (MC), marking the profit-maximizing condition. However, in practice, farmers may experience losses rather than profits if MR (the selling price) does not cover the unit cost of production. In such cases, farmers aim to minimise losses rather than maximise profits. The principle of minimising losses guides how producers can reduce losses in challenging pricing environments. If the selling price exceeds the average total

- Profit loss management

cost (ATC), the producer can expect profits and will continue producing until MR equals MC to maximise profit. When the selling price is below ATC but remains above the average variable cost (AVC), losses are anticipated, and the objective shifts to loss minimisation by continuing production until MR equals MC. In this scenario, losses remain less than the fixed costs. If the selling price falls below AVC, stopping production temporarily can help minimize losses. Over the long term, if the selling price consistently remains below ATC, ongoing losses will accumulate, and the producer may need to cease production permanently.

2.3.2.4 Opportunity Cost

When an input is utilised in a specific production process, it cannot be used for any alternative purpose at that time. This results in a loss of potential income from its alternative use, which is referred to as opportunity cost. By definition, opportunity cost represents the income that could have been earned if the input had been employed in its most profitable alternative use. In other words, it is the value of the product foregone because the input was allocated to a different purpose. The concept of opportunity cost plays a crucial role in a farmer's decision-making process, especially regarding input allocation. Opportunity cost, often called the real cost of an input, is not the input's purchase price but rather the income it could generate in its next best use. If the returns from the current use of the input are lower than its opportunity cost, the farmer may need to reconsider and adjust the decision to optimise resource use.

- Input allocation decisions

For instance, if a farmer has ₹1,000 available, they can invest in one of three options: sugarcane, cotton, or paddy. Suppose spending ₹1,000 on sugarcane yields a marginal value product (MVP) of ₹3,200. The farmer forgoes the potential returns from the other two options by choosing sugarcane. Among the alternatives, cotton provides a higher MVP than paddy. Therefore, the farmer sacrifices ₹2,200 from cotton, the next best alternative to sugarcane. This forgone amount represents the opportunity cost of the decision.

- Forgone amount represents the opportunity cost

2.3.2.5 Comparative Advantage

Various crop and livestock enterprises can be cultivated across diverse soil types and climatic conditions. But they differ in terms of yields, costs, and returns. These variations

- Regional specialisation in agriculture

lead individual farmers or regions to specialise in producing specific agricultural commodities. For instance, wheat farming is dominant in Uttar Pradesh, Punjab, and Haryana, while rice cultivation is in Andhra Pradesh, West Bengal, Tamil Nadu, and Assam. Similarly, cotton farming is prevalent in Maharashtra and Tamil Nadu, sericulture in Karnataka, apple cultivation in Himachal Pradesh, sheep farming in Rajasthan, poultry farming in Andhra Pradesh and Tamil Nadu, and freshwater prawn culture in Andhra Pradesh and Odisha. This regional specialisation in crop and livestock production is best explained by the principle of comparative advantage, which considers relative yields, costs, and returns as principal criteria.

In farm commodity production, two types of economic advantages are recognised: (1) Absolute advantage and (2) Relative or Comparative advantage. Absolute advantage is determined by the extent of the margin between the costs incurred and the returns generated from utilising productive inputs. When this margin is greater for a specific farm commodity in one region compared to another, it indicates that the first region holds an absolute advantage in producing that commodity. This is explained with the help of the below table.

Table 2.3.1 Absolute Advantage

	Region A		Region B	
Particulars	Groundnut	Sunflower	Groundnut	Sunflower
Gross income (Rs./acre)	5000	5010	7300	2500
Total costs (Rs./ acre)	4700	4320	6500	2450
Net income (Rs./ acre)	300	690	800	50
Returns per rupee of investment	1.06	1.16	1.12	1.02

Consider two regions, ‘A’ and ‘B,’ where farmers cultivate groundnut and sunflower. In region ‘A,’ the gross income per acre for groundnut is Rs. 5,000, with production costs

amounting to Rs. 4,700, resulting in a net income of Rs. 300 per acre and a return of Rs. 1.06 per rupee invested. The return per rupee of investment indicates how much income is generated for every rupee spent on an investment. It helps in assessing the profitability and efficiency of the investment. (Return per Rupee of Investment = Gross Income per Acre/ Total Cost per Acre). In region 'B, the gross income for groundnuts is Rs. 7,300 per acre, and the costs are Rs. 6,500, yielding a net income of Rs. 800 per acre and a return of Rs. 1.12 per rupee invested. For sunflowers, region 'A' generates a gross income of Rs. 5,010 per acre, with cultivation costs of Rs. 4,320. The net income stands at Rs. 690 per acre, with a return of Rs. 1.16 per rupee invested. In contrast, region 'B' earns a gross income of Rs. 2,500 per acre from sunflowers, incurring costs of Rs. 2,450. This results in a net income of Rs. 50 per acre and a return of Rs. 1.02 per rupee invested. Based on these figures, region 'A' demonstrates an absolute advantage in sunflower production due to the larger margin between costs and returns. Similarly, region 'B' exhibits an absolute advantage in groundnut production for the same reason.

- Absolute advantage in production

To explain comparative or relative advantage, we can compare region B with region C. The table below illustrates this.

Table 2.3.2 Comparative Advantage

Particulars	Region B		Region C	
	Redgram	Groundnut	Redgram	Groundnut
Gross income (Rs./acre)	5600	7300	2300	3300
Total costs (Rs./ acre)	5200	6500	2000	3100
Net income (Rs./ acre)	400	800	300	200
Returns per rupee of investment	1.08	1.12	1.15	1.06

In both regions, farmers produce red gram and groundnut. The table indicates that region 'B' holds a greater absolute advantage over region 'C' in cultivating both redgram and groundnut. The net income per acre in region 'B' is Rs. 400 and Rs. 800, respectively, reflecting returns of 1.08 percent

and 1.12 percent above costs. This suggests that farmers in region 'B' can profitably grow both crops. However, to maximize their earnings, they should focus on allocating more acreage to groundnut, as it aligns with their comparative advantage. Similarly, farmers in region 'C' can achieve profits by cultivating both crops, but they hold a relative advantage in redgram production. By prioritising redgram, which offers a 1.15 percent return over the cost of cultivation compared to 1.06 percent for groundnut, they can optimise their profitability.

- Comparative advantage in production

2.3.3 Limitations of Farm Management

Farm management is major for the success of agricultural operations but comes with several challenges, such as:

- **Resource Limitations:** Restricted availability of capital, labour, and advanced technologies can impede the adoption of efficient management practices.
- **Unpredictable Weather:** Variations in weather patterns can heavily affect crop yields and livestock, making effective planning and management difficult.
- **Market Instability:** Fluctuating prices for agricultural commodities create uncertainty, complicating revenue forecasting for farm managers.
- **Environmental Challenges:** Problems like soil erosion, water scarcity, and the effects of climate change pose significant hurdles to sustainable farm management.
- **Regulatory Demands:** Navigating complex and frequently changing agricultural regulations can increase administrative burdens and operational costs.
- **Risk Management:** Addressing risks from pests, diseases, and natural disasters requires robust strategies, which can be difficult to implement effectively.
- **Limited Technological Access:** Insufficient access to modern agricultural tools and reliable information can restrict the application of advanced farming methods.

- Farm management is major for the success of agricultural operations

Summarised Overview

The principles of factor substitution highlight the economic benefit of replacing one product with another when returns are higher. It enables efficient use of resources. The cost principles introduce the categorisation of costs into fixed and variable costs, which

is essential for assessing the profitability of farm operations. Additionally, the concept of opportunity cost is discussed. It explains the value of the next best alternative use of inputs in decision-making. The principle of comparative advantage shows how regions or farmers specialise in particular crops based on relative yields, costs, and returns. Finally, the limitations of farm management are addressed, acknowledging the challenges caused by changing market conditions, risk, and resource constraints. Thus, the unit emphasises that farm management is key for farmers to make informed decisions, adapt to market demands, and ensure sustainable agricultural practices.

Assignments

1. Discuss the need for farm management in modern agriculture. How does it contribute to farm profitability?
2. Explain the role of factor substitution in increasing farm efficiency and maximising resource use.
3. Differentiate between fixed and variable costs in farm management. Provide examples of each.
4. Explain how comparative advantage leads to regional specialisation in agriculture. Provide examples of regions in India that have a comparative advantage in specific crops.
5. What are the major limitations of farm management?

Suggested Reading

1. Hansra Parumal and Chandrakarn, *Modernization of Indian Agriculture in 21st-Century Challenges, Opportunities, and Strategies,* Concept Publication Co., New Delhi.
2. Bharadwaj K, (1974): *Production onditions in Indian Agriculture-A study-based Farm Management,* Cambridge University Press
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BLOCK 3

Agricultural Finance, Pricing and Marketing

UNIT 1

Agricultural Finance

Learning Outcomes

After learning this unit, the learner will be able to:

- understand the importance of rural credit in supporting agriculture
- examine the contributions of the National Bank for Agriculture and Rural Development
- analyse different types of agricultural credit

Background

Credit access is crucial for rural economies to expand, especially in agriculture, as it is the main source of income for the majority of India's rural residents. Rural credit plays a vital role in helping farmers invest in improved inputs, adopt contemporary farming methods, and mitigate the risks involved in agricultural pursuits. Rural credit in India is primarily segmented into two main categories: Institutional and Non-institutional sources. Institutional providers such as banks, cooperatives, and government bodies offer credit with stipulated terms that are regulated, whereas non-regulated sources like moneylenders and traders, although readily available, frequently levy excessive interest rates. Rural households have seen substantial efforts over the years to transition their reliance from informal financial sources to institutional credit systems, prioritising both cost-effectiveness and ease of access.

The creation of NABARD in 1982 was a significant achievement in setting up a system for rural credit in India. NABARD holds a crucial position by offering refinancing services to banks and other credit organisations and supporting rural development projects. Rural credit, a significant component of agricultural credit, addresses both short-term requirements like purchasing seeds and fertilisers and long-term investments such as machinery and irrigation systems. Despite progress made, ongoing difficulties remain, notably for small and marginal farmers, an over-reliance on informal sources, and inefficiencies in the delivery of credit. Overcoming these challenges offers the chance to utilise technology more effectively, increase access to microfinance, and enhance the capabilities of farmer-producer organisations. Implementing targeted strategies can transform the rural credit system, guarantee inclusive growth, empower farmers, and promote sustainable development within the agricultural sector.

Keywords

Rural Credit, NABARD, RRB, Commercial Banks, Credit Challenges

Discussion

3.1.1 Sources of Rural Credit

- Borrowings by rural farmers

Agriculture is the main livelihood for most people in India's rural areas. Farmers often need substantial financial investments annually to ensure good crop yields. Consequently, they commonly rely on borrowing from moneylenders or financial institutions to fulfil their essential needs before harvest, expecting to earn income through crop sales. Therefore, Agricultural Rural Credit encompasses loans for agricultural activities or small-scale home-based enterprises in rural India. The All India Rural Credit Survey Committee classifies the various sources supplying rural credit into two categories viz. non-institutional sources and institutional sources.

3.1.1.1 Non-Institutional Sources

- Informal agents supplying rural credit

Historically, non-institutional sources fulfilled most of the credit needs of farmers. This was because they had simpler loan procedures and were open to lending even for unproductive purposes. Non-institutional sources include the following:

Agriculturist Moneylenders: Their main occupation is agriculture but are involved in money lending activity, which is of minor importance.

Professional Moneylenders: They earn a substantial part of their income from money lending activity are professional moneylenders.

Traders: These are the individuals who are involved in trading, and loans from these persons are called borrowings from traders.

Landlords: Landlords also advance loans to the tenants. Such loans are called loans by landlords.

Relatives: Any loan taken free of interest by a farmer is only considered a loan from relatives.

3.1.1.2 Institutional Sources

The institutional sources primarily include the government, co-operative societies, rural financial institutions and other organisations. The government established these sources with two key objectives viz. to provide farmers with sufficient credit at low interest rates and to support small and marginal farmers in increasing agricultural productivity and maximising their income. Some of the notable institutional sources of rural credit are discussed below.

i) Co-operative Credit

- Shift to Cooperative credit

In the past, rural credit services were largely dominated by non-institutional agencies, particularly moneylenders, who imposed exploitative interest rates on vulnerable farmers. Following India's independence, the government, influenced by the recommendations of the All-India Rural Credit Survey Committee (1951), identified co-operatives as a key mechanism to advance agricultural credit and rural development. Consequently, co-operatives received significant support in the form of credit provision from the Reserve Bank of India under its loan policy, alongside substantial assistance and encouragement from both Central and State governments. Government schemes offering subsidies and concessions to vulnerable groups were often implemented through co-operative channels. This support led to notable progress in the co-operative sector during the post-independence era. The co-operative credit system operates within a three-tier structure comprising State Co-operative Banks (SCBs), District Central Co-operative Banks (DCCBs), and Primary Agricultural Co-operative Credit Societies (PACS).

State Co-operative Banks (SCBS)

- State-level co-operative framework

State-level co-operative credit organisations consist of State Co-operative Banks, with District Central Co-operative Banks (DCCBs) and Primary Agricultural Co-operative Societies (PACS) as their members. These institutions oversee the operations of member banks and manage the flow of financial resources among them. They also act as intermediaries between the Reserve Bank of India (RBI) and the PACS. The primary functions of State Co-operative Banks include: (a) assisting State governments in designing development plans related to cooperative institutions, (b) aligning co-operative policies with government strategies, (c) developing and enforcing

standardised credit policies for co-operative growth within the state, (d) serving as the central bank for DCCBs, overseeing and guiding their operations, (e) providing subsidies to DCCBs to ensure smooth co-operative functioning, (f) carrying out typical banking activities, much like commercial banks.

District Central Co-operative Banks (DCCBS)

These banks act as intermediaries between State Co-operative Banks and PACS, primarily designed to fulfil the credit needs of PACS. They also perform various banking functions, such as accepting public deposits, handling bills, cheques, and drafts, as well as providing credit to individuals in need. While their operational scope generally spans from the taluk to the district level, in most states, their activities are concentrated at the taluk level. Membership is open to individuals and societies within their operational area, with marketing societies, consumer societies, farming societies, urban banks, and PACS typically becoming members. The key functions of these banks include: (a) supervising and inspecting the activities of PACS to ensure smooth operations, (b) maintaining regular contact with primary societies, offering guidance, and providing leadership, (c) engaging in non-credit activities such as supplying seeds, fertiliers, sugar, kerosene, and other consumer goods (d) offering necessary financial support to the societies under their jurisdiction.

- Intermediaries for PACS credit

Primary Agricultural Co-operative Societies (PACS)

Following the enactment of the Co-operative Societies Act of 1904, PACS was established. To ensure the effective functioning of these societies, principles such as limited liability, restricted operational areas, voluntary participation, and honorary management were implemented. PACS operates at the village level, primarily serving farmers by providing essential short-term and medium-term loans. They also supply agricultural inputs and other necessary commodities. Beyond these core functions, PACS plays a significant role in shaping and executing agricultural development plans. They are also involved in advisory and welfare activities aimed at rural development. The specific functions of PACS include: (a) borrowing timely and sufficient funds from DCCBs to assist members with their financial needs, (b) encouraging local savings through share capital and deposits from villagers, fostering a culture of thrift, (c) distributing agricultural inputs like fertilizers and insecticides, (d) offering machinery to farmers on a hire basis, (e) participating in socio-economic

- Village-level co-operative support

development programs for the village, (f) providing storage and marketing finance (g) supplying essential consumer goods such as rice, sugar, wheat, and cloth at fair prices.

ii) Land Development Banks

- Land mortgage bank evolution

Land Mortgage Banks (LMBs) were established on co-operative principles in Punjab in 1920. Between 1920 and 1929, similar banks were set up in regions such as Punjab, Madras, Mysore, Assam, and Bengal. However, the growth of these banks remained limited until 1945. Significant progress occurred in the post-independence period (1948-1953). However, during this time, the benefits of LMBs were largely confined to wealthy and affluent farmers, with small and marginal farmers receiving little support. Institutional agencies like the Reserve Bank of India, State Bank of India, Life Insurance Corporation, and Agricultural Refinance Corporation provided substantial assistance to LMBs. This enabled the banks to revise their lending policies to focus more on small and marginal farmers, prioritising agricultural development. In 1974, LMBs were renamed Land Development Banks (LDBs) and were structured to serve the farmers at the taluk level. At present, Land Development Banks play an important role in providing long-term credit for agricultural and rural development. Despite their expanded reach and support for small-scale farmers, these banks face challenges such as overdue loans and limited financial resources, which impact their operational efficiency.

The primary functions of Land Development Banks (LDBs) include:

1. Offering long-term financing to farmers for land development and improving agricultural production and productivity.
2. Providing loans for minor irrigation, debt redemption, and land purchase.
3. Financing the acquisition of tractors, machinery, and other agricultural equipment.
4. Supporting the construction of farm structures.
5. Encouraging rural savings and mobilising financial resources.

iii) Commercial Bank Credit

Private sector banks, predominantly urban-focused and controlled by a small group of industrialists, were not proper

to meet the socio-economic goals of the country. They largely overlooked the credit needs of agriculture, small-scale industries, small traders, and artisans. Despite agriculture being the main occupation for nearly three-fourths of the population and contributing almost half of the gross national product, the banking sector allocated just 1% of its total credit to agriculture as of June 1967. Instead, the majority of public deposits were directed towards the organised industrial and trade sectors. In the absence of institutional financial support, private moneylenders dominated the rural credit landscape, exploiting farmers with high interest rates.

- Private sector banking limitations

These disparities prompted the introduction of social control over banks in 1968. The objectives included expanding the reach of bank credit, channelling more funds to priority sectors, and reducing the influence of industrialists who controlled bank policies through managing committees. Social control stimulated branch expansion, with 785 new offices established in the first half of 1969. However, it failed to significantly redirect credit towards priority sectors and weaker sections. Many banks continued to operate under the influence of their previous controllers, often disregarding government directives. The inadequacies of social control led the government to conclude that it was insufficient to transform the commercial banking system into a tool for socio-economic development. Consequently, nationalisation emerged as an alternative. On July 19, 1969, the Government of India issued the Banking Companies (Acquisition and Transfer of Undertaking) Ordinance. This ordinance nationalised 14 commercial banks, each holding deposits of at least ₹50 crores. Together, these banks operated 4,134 branches, managed deposits totalling ₹2,626 crores, and advances amounting to ₹1,813 crore. The nationalisation of commercial banks continued in subsequent years.

- Nationalisation of banks leads to priority sector lending

Commercial banks established specialised branches to address the needs of weaker sections in rural areas. Notable among these were Agricultural Development Branches (ADBs), Agricultural Banking Divisions (ABDs) of the State Bank of India and its associate banks, Grama Vikas Kendras (GVKs) of the Bank of Baroda, Rural Service Centres (RSCs) of Dena Bank, Farm Clinics (FCs) of Syndicate Bank, and the Rural Credit and Development Division (RCDD) of Indian Overseas Bank. These branches were designed to address challenges in lending activities, minimise operational costs, and enhance

- Specialised rural banking branches

measures such as follow-ups and supervision. Managers of these specialised branches were granted greater discretionary powers to sanction higher credit amounts to farmer borrowers compared to managers in regular commercial bank branches. Despite the establishment of specialised branches, commercial banks in India face challenges in sustaining agricultural lending due to rising non-performing assets (NPAs) in the sector and structural inefficiencies. However, they continue to play a critical role in financing agriculture through initiatives like the Priority Sector Lending (PSL) mandate, though private sector participation remains limited compared to public sector banks.

iv) Regional Rural Banks

- Challenges in rural credit

The All-India Rural Credit Review Committee (1969) observed that small farmers across large parts of the country faced significant challenges in accessing co-operative credit for both current inputs and investments. This highlighted the necessity for establishing dedicated institutional agencies. Consequently, the first phase of bank nationalisation was undertaken with high expectations. While it contributed to strengthening the institutional framework, it also brought about certain challenges.

- Prioritising agricultural finance

The Government of India examined the issue of financial assistance to weaker sections in rural areas and, in 1975, appointed a Working Group under the chairmanship of Sri M. Narasimham to address the matter. The Working Group identified deficiencies in the functioning of commercial banks and co-operatives and recommended the establishment of rural-based institutional agencies known as Regional Rural Banks (RRBs). With an extensive branch network across rural and semi-urban areas, RRBs prioritise lending to agriculture, small and marginal farmers, rural artisans, and micro-enterprises, aligning with their mandate to support rural development. Recent technological advancements have enabled RRBs to enhance operational efficiency and improve access to financial services. Consolidation measures undertaken by the government have strengthened their financial viability and operational effectiveness. Despite challenges such as rising non-performing assets (NPAs) and dependency on sponsor banks, RRBs continue to be instrumental in implementing government schemes like Kisan Credit Cards (KCC), PM-KISAN, and MUDRA loans. They serve as a bridge between rural communities and formal financial institutions, addressing

unique challenges in rural credit and development while promoting financial literacy and savings habits.

The major objectives of RRBs were the following:

1. to develop the rural economy
2. to provide credit for agricultural and allied activities
3. to encourage village industries, artisans, carpenters, craftsmen, etc,
4. to reduce the dependence on weaker sections on money-lenders
5. to fill up the gap created by moratorium on borrowings from money lenders
6. to help the poor financially for their consumption needs; and
7. to make backward and tribal areas economically better off by opening new branches.

v) National Bank for Agricultural and Rural Development (NABARD)

To review the arrangements for institutional credit for agriculture and rural development, the B. Sivaraman Committee was constituted in 1979. Based on its recommendations, the National Bank for Agricultural and Rural Development (NABARD) was established on 12 July 1982. Its primary objective is to provide both production and investment credit for agriculture and rural development. At the time of its establishment, existing national-level institutions such as the Agricultural Refinance and Development Corporation (ARDC), the Agricultural Credit Department (ACD), and the Rural Planning and Credit Cell (RPCC) of the RBI were integrated into NABARD. The organization was launched with an initial paid-up capital of ₹500 crore, equally contributed by the Government of India and the Reserve Bank of India. NABARD operates through its headquarters in Mumbai, 17 regional offices across major states, 10 sub-offices in smaller states and union territories, and 213 district offices.

- NABARD for agriculture development

Objectives of NABARD

1. **Apex Refinancing Institution:** NABARD is an apex refinancing institution that provides all types of credit required for the farm sector and rural development.

2. **Promoting Rural Development:** It is entrusted with

promoting and integrating rural development activities through refinancing.

- NABARD supports rural development through credit and coordination

3. **Direct Credit Provision:** NABARD provides direct credit to institutions, organizations, or individuals, subject to approval from the Central Government.
4. **Collaboration with RBI:** It maintains close ties with the Reserve Bank of India (RBI) for guidance and assistance in financial matters.
5. **Catalyst for Rural Development:** NABARD plays a significant role as a catalyst in rural development by formulating and implementing effective plans and policies.

Functions of NABARD

The functions of NABARD are classified under three broad categories:

A. Credit Activities

1. NABARD develops an annual potential-linked credit plan for each district, serving as the foundation for district-level credit planning.
2. It takes part in formulating annual action plans at block, district, and state levels.
3. It participates in the execution of credit plans to ensure their effective implementation.

- NABARD's credit planning support

4. NABARD establishes guidelines and conditions for credit institutions to finance production, marketing, and investment activities in rural farm and non-farm sectors.
5. It provides short-term, medium-term, and long-term credit to agriculture

B. Development Activities

The following are the developmental activities undertaken by NABARD for the productive use of credit.

1. Institutional Development

- NABARD assists co-operative banks and Regional Rural Banks (RRBs) in critically assessing their operations and preparing Development Action Plans (DAPs) for self-improvement.
- It signs Memoranda of Understanding (MoUs) with State Governments and co-operative banks, outlining mutu-

al obligations to enhance the functioning of these banks within a specified timeframe.

- NABARD facilitates MoUs between RRBs and their sponsor banks, defining commitments and responsibilities to improve the operations of RRBs within a stipulated period.
- It offers financial support to cooperative banks and RRBs for setting up technical and monitoring cells to enhance the quality of project formulation, implementation, and monitoring.
- NABARD provides Organisational Development Interventions (ODI) through its training institutes, such as the Bankers Institute for Rural Development (BIRD) in Lucknow, the National Bank Staff College in Lucknow, and the College of Agricultural Banking (CAB) in Pune, targeting staff of selected RRBs and co-operative banks.

• NABARD strengthens rural banks through training and support

- It extends financial assistance for establishing training institutes for cooperative banks.
- NABARD conducts training programs for senior and middle-level executives of commercial banks, RRBs, and co-operative banks through its training institutes (BIRD, Lucknow, and CAB, Pune).
- It promotes borrower education in selected areas, focusing on the ethics of loan repayment through initiatives like Vikas Volunteer Vahini.

2. Research and Development Fund

NABARD maintains a research and development fund for

- Promoting operational research projects focused on upgrading technology and facilitating its practical application from laboratories to the field.
- Undertaking research studies on contemporary topics in economics and banking to generate valuable insights.
- Organising national and international events such as seminars, conferences, and symposia on rural development and banking issues.
- Conducting skill enhancement programs designed for prospective borrowers to improve their capabilities.
- Offering grants to select Krishi Vikas Kendras to support rural development efforts.

• NABARD supports research, technology, training and rural development

3. Agricultural and Rural Enterprises Incubation Fund (AREIF): This fund provides flexible support to new and innovative small and micro enterprises in rural areas, focusing on ventures that involve technology and market risks and have the potential for viability and growth.

4. Rural Promotion Corpus Fund (RPCF): The fund is intended to support initiatives that promote enterprise development, including training-cum-production centers, rural entrepreneurship development programs, district rural industries projects, women-centric and environment-focused programs, consultation services, technical monitoring and evaluation units, and initiatives like Vikas Volunteer Vahini.

- Funds for rural innovation and development

5. Credit and Financial Services Fund (CFSF): The fund is designed to support innovations in rural banking and credit systems and assist institutions in conducting research activities, surveys, conferences, and similar initiatives.

C. Regulatory Activities

As the apex development bank, NABARD collaborates with the RBI in performing certain regulatory and supervisory functions for co-operative banks and Regional Rural Banks (RRBs):

1. **Inspection and Compliance:** Under the Banking Regulation Act, 1949, NABARD conducts inspections of RRBs and co-operative banks (excluding primary co-operative societies) to evaluate whether they meet statutory requirements for capital and reserves and are managed to safeguard depositors' interests.

- Regulatory and supervisory collaboration

2. **Branch Expansion Recommendations:** RRBs and co-operative banks seeking RBI approval to open branches or expand operations must obtain NABARD's recommendation as part of the process.
3. **Authorisation for Assistance:** State and District Central Co-operative Banks require NABARD's authorisation to provide financial assistance to non-cooperative sector entities or non-credit co-operatives for specific purposes exceeding a defined threshold.

3.1.2 Agricultural Credit

- Agricultural credit definition

Murray has defined agricultural credit as an economic study of farmers borrowing funds, the organisation and operation of farm lending agencies, and society's interest in credit for

agriculture. This includes addressing monetary concerns related to the production and distribution of agricultural goods. Tandon and Dhondyal defined agricultural finance "as a branch of agricultural economics, which deals with the provision and management of bank services and financial resources related to individual farm units.

Agricultural credit or finance can be analysed at both the macro and micro levels. At the macro level, it focuses on the overall sources of funding for agriculture within the economy. It examines lending policies, regulatory frameworks, monitoring systems, and the operations of various agricultural institutions. Macro-level finance addresses how credit is made available to the agricultural sector as a whole and studies how individual farmers choose credit sources and allocate borrowed funds across different uses on their farms. It also considers the long-term utilization of financial resources. In essence, macrofinance encompasses the total credit requirements of the agricultural sector, the conditions under which credit is provided, and its effective use for agricultural development. Conversely, micro-level finance pertains to managing the finances of individual farm businesses.

- Agricultural finance involves macro policies and micro management

3.1.2.1 Classification of Agricultural Credit

Credit is a certain amount of money provided for a certain purpose on certain conditions with some interest, which should be repaid sooner or later. Credit is broadly classified based on various purposes. These are discussed below.

1. Based on Purpose

▶ **Production Loans**

These loans are provided to farmers to support crop production and enhance agricultural output. Commonly referred to as Seasonal Agricultural Operations (SAO) loans, short-term loans, or crop loans, they are repayable in a single instalment within 6 to 18 months.

▶ **Investment Loans**

These loans are offered to purchase equipment or assets with long-term productivity. Examples include loans for tractors, pump sets, tube wells, and work stock. The benefits of such investments extend beyond a single year, making them essential for sustained agricultural growth.

- Agricultural loans support production, investment, marketing, consumption

▶ Marketing Loans

These loans help farmers avoid distress sales by enabling them to market their produce effectively. Financial assistance, typically amounting to 75% of the value of the produce, is provided by regulated markets and commercial banks based on warehouse receipts. This allows farmers to repay existing loans and sell their produce at favourable prices.

▶ Consumption Loans

These loans, intended for non-production purposes, indirectly support the efficient use of crop and investment loans by preventing the diversion of funds. Although not widely distributed, they are critical in areas affected by natural calamities. Usually granted on a group guarantee basis, with a maximum of three members, these loans provide vital support during emergencies.

2. Based on Time

This classification is based on the repayment period of the loan

▶ Short-term Loans

These loans must be repaid within 6 to 18 months, depending on the crop duration. Farmers typically use these loans to cover expenses related to ongoing agricultural activities, such as sowing, applying fertilizers, pest control, and paying casual labour wages. Repayment is usually made from the sale proceeds of the crops produced.

- Agricultural loans - short, medium, long term based repayment

▶ Medium-term Loans

These loans have a repayment period ranging from 15 months to 5 years. They are intended for investments that improve farm productivity, such as purchasing implements, electric motors, milch cattle, or livestock like sheep and goats. Due to their partially liquidating nature, farmers are given a relatively longer time to repay these loans.

▶ Long-term Loans

These loans are repayable throughout 5 to more than 20 years. Along with medium-term loans, they are categorized as investment or term loans. Long-term loans are used for permanent improvements to agricultural lands, such as levelling, reclamation, conservation, constructing farm buildings, purchasing tractors, or establishing orchards. Since these activities require substantial capital investment, farmers are allowed an extended repayment period to cover

the costs through the additional returns generated from these improvements.

3. Based on Security

Loan transactions between lenders and borrowers primarily rely on the trust and confidence placed in the borrower, often rendering the need for collateral unnecessary in certain cases. However, this assumption is more applicable to private lending. In contrast, institutional lenders typically adhere to specific procedural requirements when providing credit. Consequently, loans under this category are broadly classified into two subcategories: Secured loans and Unsecured loans.

A. Secured Loans

Loans advanced against some security by the borrower are termed secured loans. Various forms of securities are offered in obtaining the loans, which are as follows:

- Loans are secured or unsecured with varied securities

▶ Personal Security

In this type, the borrower acts as their own guarantor, and the loan is extended based on a promissory note signed by the borrower. A third-party guarantee may or may not be required.

▶ Collateral Security

Collateral refers to assets pledged to secure a loan. Borrowers offer movable properties as security, such as LIC bonds, fixed deposit certificates, warehouse receipts, jewellery, machinery, and livestock. These assets are commonly accepted by institutional lenders as collateral.

▶ Chattel Loans

These are loans secured by pledging movable items, typically provided by specific categories of lenders like pawnbrokers. Examples of items pledged include jewellery and utensils made of various metals.

▶ Mortgage

A mortgage involves transferring an interest in immovable property to secure a loan or fulfil a financial obligation. It does not involve selling the property but creating a legal charge over it. The borrower (mortgagor) retains ownership and possession while granting the lender (mortgagee) certain rights, such as earning income from the property, selling it in case of default, or appointing a receiver. Immovable properties like land and farm buildings are commonly used for mortgages.

▶ Hypothecation

It refers to a legal charge created when movable property is offered as security for a loan. This charge is equitable or notional, granting the lender the right to take possession of the property and sell it in case of default or to sue the borrower to recover the debt by initiating the sale of the secured property. The borrower, known as the hypothecator, creates the charge in favour of the lender, referred to as the hypothecate (typically a bank). The asset used as security is called the hypothecated property. This arrangement is commonly used for loans such as tractor or machinery loans. While the borrower is permitted to use the equipment or machinery to generate income and make loan repayments, they are restricted from selling the asset until the loan is fully repaid.

B. Unsecured Loans

Loan transactions are primarily built on mutual trust and confidence between the borrower and the lender. There is no requirement for any form of security in such cases.

3.1.3 Challenges of Agricultural Credit

The various challenges faced by agricultural loans are discussed below.

1. Widespread Illiteracy

The high rate of illiteracy among Indian farmers, particularly in rural areas, exacerbates issues in accessing agricultural credit. According to NABARD, around 70–80% of farmers are unaware of institutional credit sources that offer loans at lower interest rates. This lack of knowledge makes it difficult for farmers to distinguish between cheaper institutional credit and the high-interest loans offered by private moneylenders.

2. Lack of Collateral

Even when farmers are aware of institutional credit, their limited resources often leave them unable to provide the required security, a fundamental requirement for such loans. In contrast, village moneylenders exploit this gap by offering loans without demanding security but imposing excessively high interest rates and sometimes forcing farmers to sell their produce at lower prices to repay the debt.

3. Small and Uneconomic Land Holdings

Most farmers possess small, uneconomic holdings that produce minimal surplus for sale. This lack of marketable surplus

hinders their ability to repay institutional loans, forcing them to rely on local moneylenders. Additionally, farmers often pledge their future produce to moneylenders, eliminating any opportunity for surplus sales.

4. Inaccessibility of Villages

Poor infrastructure, particularly during the rainy season, combined with inadequate transport and communication, discourages institutional lenders from operating in remote villages due to high transaction costs.

5. Subsistence Farming and Record Maintenance

- Illiteracy, lack of collateral, and small landholdings hinder institutional credit.

Farming in rural India is often subsistence-based, with farmers treating it as a livelihood rather than a business. This mindset, coupled with illiteracy, results in poor record-keeping, which hinders institutional agencies from formulating effective lending policies tailored to the farmers' needs.

6. Diversion of Production Loans

Production loans are often used for non-agricultural purposes due to pressing family needs, as farming and household finances are deeply intertwined. This diversion further complicates the repayment of loans.

7. Monopolistic Practices of Moneylenders

In the absence of competition from institutional lenders, moneylenders dominate agricultural credit markets, charging exorbitant interest rates.

3.1.4 Opportunities and Strategies for Agricultural Credit

- Agricultural credit and sustainability

Agricultural credit plays a vital role in promoting growth and long-term sustainability within the agricultural industry. The initiative offers farmers the financial support they require to purchase inputs, implement cutting-edge technologies, and increase their output. With agricultural practices adapting to fluctuating market requirements and environmental pressures, improving access to farm loans presents various possibilities. Implementing targeted strategies that meet the specific needs of farmers, particularly those who are small and marginal, is crucial to capitalise on these opportunities fully.

3.1.4.1 Opportunities for Agricultural Credit

Farmers can boost productivity and income with agricultural credit, which provides vital functioning for inputs, equipments

and technology. Fortunately, new and innovative opprtunities for agricultural credit are emerging, offering primary solution to address the financial gap. Opportunities for agricultural credit are discussed under following heads.

1. **Increased Productivity:** Obtaining credit enables farmers to acquire high-quality seeds, fertilisers, equipment, and other vital resources. Substantial increases in productivity and crop yields can be achieved, allowing farmers to fulfil growing food requirements.
2. **Technological Adoption:** Credit facilities enable farmers to invest in cutting-edge farming technology including precision agriculture, drip irrigation, and state-of-the-art equipment. Implementing this strategy can lead to increased efficiency, lower costs, and a more sustainable outcome.
3. **Diversification of Crops:** Diversification of farming activities is supported by credit, allowing farmers to expand their production into high-value crops, horticulture, and livestock farming. Diversifying investments can help reduce income fluctuations and increase the ability to withstand market and weather-related disruptions.
4. **Infrastructure Development:** Investing in post-harvest infrastructure, like storage facilities and cold chains, is possible with sufficient access to credit from farmers.

- Increased productivity and diversification

5. **Finance to small and marginal farmers:** Agricultural credit can help bridge the financial gap for small and marginal farmers, allowing them to compete more effectively with larger operators in the market.
6. **Rural Development:** Providing credit has a positive impact on rural economic activities, creating employment opportunities and enhancing the overall quality of life for people living in farming communities.

3.14.2 Strategies for Improving Agricultural Credit

To meet these challenges and make the most of the opportunities available, the following approaches can be taken.

1. Promoting financial inclusion via microfinance institutions, self-help groups (SHGs), and cooperative banks can increase access to credit for small and marginal farmers.
2. Providing digital banking services through technology simplifies loan applications, lowers transaction expenses,

and increases transparency. Mobile banking can also ensure timely disbursement of funds.

3. Implementing credit guarantee schemes is a strategy that can motivate financial institutions to extend credit to individuals with a higher risk profile. Crop insurance programs can reduce the likelihood of defaults caused by unexpected events.
4. Creating tailored loan products that meet farmers' unique requirements, like adjustable repayment plans tied to seasonal fluctuations, can increase credit availability and make it more suitable for farmers.

- Promoting financial inclusion strategies

5. Revitalising cooperative banks and societies can grant farmers convenient access to low-cost credit in rural settings through enhanced cooperative credit systems.
6. Implementing awareness campaigns to educate farmers about existing credit options, financial knowledge, and the advantages of institutional credit can lead to higher levels of engagement.
7. Implementing women-focused policies involves creating tailored credit initiatives for female farmers and ensuring shared ownership of assets, thereby enhancing their autonomy and increasing access to credit.
8. Financial institutions can enhance their risk assessment capabilities by leveraging data-driven methods, including satellite images and predictive data analysis, thereby facilitating more informed credit decisions.
9. Governments should offer ongoing support through subsidies, interest rate reductions, and tax incentives to facilitate the growth of agricultural credit programs.

Summarised Overview

Rural credit is a fundamental component of agricultural and rural development, offering farmers and rural communities the financial assistance required to boost productivity and upgrade their living standards. Banks, cooperatives, and government agencies, as institutional sources of rural credit, have been instrumental in establishing a formal credit system and lessening reliance on exploitative informal credit sources. The creation of NABARD has played a crucial role in forming rural credit policies and promoting financial inclusion using its support for refinancing, infrastructure development, and capacity-building initiatives. Agricultural credit, as a vital component, has made significant contributions to addressing the varied financial requirements of farmers, allowing them to invest in both short-term supplies and long-term enhancements in their agricultural methods.

The rural credit system still faces several major difficulties, such as limited access to credit for small and marginal farmers, ongoing dependence on informal lenders, and problems with the administration of credit-linked programs. A multi-faceted approach is necessary to address gaps in coverage and improve efficiency. The rural credit environment can be revolutionized by utilizing technology, bolstering farmer groups such as producer associations, expanding microfinance systems, and encouraging cutting-edge financial products. Implementing a comprehensive credit system that is inclusive, accessible, and efficient will not only enhance farmers' capabilities but also promote sustainable agricultural growth and rural economic development, providing a solid basis for long-term national progress.

Assignments

1. Discuss the major sources of rural credit in India, highlighting their advantages and limitations.
2. Explain the classification of agricultural loans based on purpose, tenure, and security.
3. Elaborate on the origin, objectives, and key functions of NABARD in promoting rural development.
4. Discuss the role of NABARD's in financial inclusion and rural credit delivery.
5. How do issues such as illiteracy, lack of collateral, and small landholdings impact the accessibility and repayment of agricultural loans. Discuss.

Suggested Reading

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2. Soni. R.N. (2004), *Leading Issues in Agricultural Economics,* Vishal Publishing Co. Jalandhar.
3. Hanumantha Rao C.H., (1994), *Agricultural Growth, Rural Poverty and Environmental Degradation,* Oxford University Press, New Delhi.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 2

Agriculture Pricing

Learning Outcomes

After completing this unit, the learner will be able to:

- discuss the behaviour of agricultural prices and the factors influencing their fluctuations
- understand the characteristics of the demand for agricultural products
- know the relationship between demand and supply in agricultural markets

Background

Agricultural prices shows significant price fluctuations primarily as a result of external influences, such as weather patterns, seasonal fluctuations, and the short shelf life of commodities. Unlike industrial goods, where supply and demand tend to remain stable, agricultural prices are susceptible to sudden and significant fluctuations, which can hurt both producers and consumers. Developing policies such as price stabilisation schemes and support mechanisms hinges on comprehending these price patterns to reduce risks for farmers and ensure consumer affordability. Agricultural product demand and supply are shaped by population expansion, changes in income levels, dietary shifts, and technological progress. Biological and natural factors influencing agricultural production frequently restrict the sector's capacity to adapt to fluctuations in demand rapidly. The situation is further complicated by agricultural supply responses, which involve farmers adjusting their output according to price and market stimuli. Limited access to resources, credit, and infrastructure frequently hinders farmers' ability to respond promptly and effectively. To overcome these difficulties, a thorough understanding of the connections between prices, demand, and supply is essential, along with specific measures to enhance productivity and market effectiveness.

Keywords

Agricultural Price, Demand, Supply, Price Determination

Discussion

3.2.1 Behaviour of Agriculture Prices

- Price signals economic decisions

The term "price" refers to the monetary value assigned to goods and services. Before the use of money, commodities were exchanged directly in a barter system, where goods were traded based on mutual needs. With the emergence of money, the barter system largely faded. Prices act as an important signal in an economy. For producers, price indicates which goods should be produced, guiding decisions to maximize earnings and sustain production. For consumers, prices influence purchasing behaviour, determining whether to maintain or reduce demand. In a free-market economy, changes in supply and demand directly affect price levels, subsequently impacting the welfare of both producers and consumers.

- Agricultural prices are volatile

Agricultural prices are inherently volatile, fluctuating significantly over time and across regions. These irregular variations can profoundly impact the economic well-being of individuals. In agricultural-based economies like India, farm product prices tend to be more unstable than industrial goods prices. This volatility affects growth, equity, and economic stability, influencing the incomes and living standards of farmers, labourers, and consumers alike. Rising prices generally encourage producers to increase output, while falling prices may disincentive production if allowed to persist over time. Therefore, managing price fluctuations is essential to ensure balanced economic growth and equity.

3.2.1.1 Instability in prices

- Price instability involves fluctuating prices over time

Price instability refers to the lack of consistent or steady prices in an economy. It is characterised by continuous changes in prices over time and across different regions. These fluctuations can occur over varying periods and are influenced by several factors. The period-wise variations in prices can be categorized as follows:

1. **Long-term Variations:** Known as cyclical variations, these are price changes that occur over extended periods

due to economic cycles.

2. **Short-term Variations:** Also referred to as seasonal or intra-year variations, these occur within a single year and are often influenced by seasonal patterns or temporary supply and demand factors.
3. **Inter-year Variations:** These variations are observed over consecutive years, reflecting more prolonged shifts in market conditions.
4. **Irregular Fluctuations:** Also called random variations, these are unexpected and do not follow any predictable pattern.

Agricultural products experience more severe price fluctuations compared to non-agricultural goods due to the inherent characteristics of their supply and demand. Economists such as Schultz have substantiated this observation by studying price variations in both agricultural and non-agricultural products over extended periods in developed economies. The important reason behind the greater price volatility in agriculture lies in the relatively inelastic nature of both supply and demand for most agricultural products. For instance, if there is a fall in demand for an agricultural product and its supply is inelastic, a significant price reduction is necessary to achieve the desired decrease in supply. In contrast, if the supply is elastic, a smaller price drop would be enough to bring about the required reduction in supply. Similarly, if supply decreases, the price will rise sharply if demand is price inelastic, as consumers will still be willing to pay higher prices. However, if demand is more price-elastic, the price increase will be less significant.

- Supply and demand for agriculture are relatively less price-elastic

Now, we are discussing the reason why supply and demand for agricultural products are relatively less price elastic in the succeeding paragraphs

3.2.1.2 Demand for Agricultural Products

Agricultural crops can be classified into two main categories for demand analysis: food crops and fibre crops. When it comes to food crops, it is clear that people's consumption cannot vary significantly, as it is largely determined by biological needs. In countries where people have adequate income and are already consuming these crops to meet their basic dietary requirements, a decrease in prices will not lead to a notable increase in consumption. Similarly, even if prices rise, consumption will remain relatively stable, as people in high-income countries can afford to pay higher prices without

- Demand and price relation for crops

reducing their intake. As a result, the price elasticity of demand for food crops tends to be very low, especially in economically developed, high-income nations. The demand for fibre crops is generally more elastic than for food crops. However, in most developed countries, the price elasticity of demand for fibre crops remains below unity. This is because many fibre crops are essential for meeting basic needs, and their demand at any given time is not highly responsive to price changes.

3.2.1.3 Supply of Agricultural Products

There are several reasons for the low price elasticity of agricultural products. The most important are discussed below.

a. **Peculiar nature of cost:** In the short run, production costs can be divided into fixed and variable costs. In agriculture, especially in developed countries, the variable costs form a relatively small portion of total production costs compared to fixed costs. This means that even if the price of a crop declines, it may still be sufficient to cover the variable costs, allowing production to continue. An important factor to consider is how variable costs in agriculture gradually transform into fixed costs over time. For instance, the cost of seeds is initially a variable cost before sowing. However, once the crop is planted, this cost becomes fixed and no longer influences decisions about whether to continue cultivation if prices fall. The same applies to other variable costs, such as fertilizers and irrigation. By the time of harvest, the only significant variable cost remaining may be the cost of harvesting itself. If the price at harvest is sufficient to cover this cost, the crop will still be harvested and brought to market, even if prices are lower than anticipated. Additionally, family labour, which is often treated as free by farmers, can further reduce the effective variable costs. As a result, even when crop prices decline, they may still cover the remaining variable costs, ensuring that production does not decrease significantly.

- Production costs to price

b. **Biological Nature of the Production Process:** The distinction between fixed and variable costs clarifies why farmers do not reduce the supply of a crop after it has been sown, even if prices decline. Meanwhile, the biological characteristics of crops explain why production cannot be increased during a season when prices rise. Once a crop is sown, any price increase may not lead to an expansion in the cultivated area during that season. Simply because the climate suitable for the sowing of that crop has already passed.

- Production cannot be increased when prices rise

- Changes in demand for agricultural crops result in price fluctuation

c. Market Structure: The market structure in agriculture contributes to the inelasticity of supply for individual crops or all crops collectively, whether for a single season or an extended period. The agricultural sector is characterised by a large number of producers who typically operate independently and lack effective coordination. Farmers often do not have an organised marketing system. Consequently, any shifts in demand for a crop do not result in a unified or coordinated adjustment in supply. This lack of coordination causes significant price fluctuations. Prices drop sharply when demand decreases and rise steeply when demand increases. In contrast, the industrial sector, with its oligopolistic market structure and well-established producer organisations, is better equipped to align supply with changes in demand, leading to more stable prices.

- Reallocation of land when the price of other crops hiked

d. Inflexibility in the Total Area Under Cultivation: Another factor contributing to the inelastic supply of agricultural products, particularly when the prices of all crops rise simultaneously, is the fixed nature of land as the primary resource for agricultural production. While the production of an individual crop may increase beyond a season in response to rising prices, this growth typically occurs by reallocating land from other crops to the higher-priced crop. However, when prices for all crops rise together, overall agricultural production does not significantly increase. Although there may be some adjustments in the crop mix due to inter-crop land diversion, the total agricultural output remains largely unchanged because the total available land is fixed. It is important to emphasize that this analysis focuses on the price elasticity of supply for agricultural products as a whole rather than for any single crop.

- Agricultural production is more stable and less price-elastic

Due to the relatively inelastic demand and supply of agricultural products, their prices tend to experience greater fluctuations compared to industrial products over a given period. Schultz, conducted a study on production and price fluctuations in both the agricultural and industrial sectors for the period 1911–1943. His findings revealed that in the United States, the average annual deviation in agricultural production from the previous year was 3.9%, whereas for non-agricultural production, it was significantly higher at 15%. This supports the observation that agricultural production is more stable and less price-elastic than industrial production. Furthermore, the study highlighted that the average annual deviation in prices for the agricultural sector was 12.3%, compared to 7.3% for

the non-agricultural sector, clearly indicating that agricultural prices are more volatile than industrial prices.

3.2.2 Supply Response in Agriculture

Agriculture has been recognised as a powerful engine of economic growth, particularly in developing countries. Various measures can be implemented to increase agricultural production and encourage the flow of crops to markets. One such measure involves changes in the price levels of different agricultural crops in the correct direction. It is anticipated that appropriate price change can lead to increased agricultural output and the quantity of crops supplied to the market. Here, we try to examine this suggestion in detail. Such an analysis is essential because the effect of price changes on agricultural production and market supply has been highly debated. Without delving into this debate, it would be challenging to reach a well-informed conclusion. The controversy arises from three distinct perspectives on how price changes influence the supply of agricultural products. These are:

- Measures to increase agricultural production

(A) Farmers respond normally to price change

This view suggests that when farmers are offered higher prices for their crops, they will, in order to benefit from the new opportunities, increase the production of these crops. Conversely, if crop prices decline, farmers are likely to reduce their output. Many economists argue that a positive relationship exists between crop prices and the amount of crops marketed. To support this claim, some depends on straightforward reasoning, asserting that higher prices lead to increased agricultural production, which in turn results in a greater volume being marketed. However, economists like Khusro take a different approach. They separate the volume marketed from the level of production and argue that the relationship between prices and marketed quantities exists regardless of whether production rises or falls with price changes. Their analysis indicates that higher prices incentivize producers to release a larger portion of their existing stock into the market, thereby increasing the marketed surplus as prices rise.

- Positive relation between price and supply of crops

(B) Production and amount of crops marketed are inversely related to price.

During the Great Depression of 1929-32, it was noted that agricultural commodity exports from certain underdeveloped countries increased despite declining prices. This observation

- Supply of agricultural products falls when their price rises

led some economists to propose that the supply response of agricultural commodities to price changes might be inverse in backward agricultural economies. Their theoretical explanation is based on the assumption that agriculture in such economies is entirely traditional, heavily reliant on labour, and stagnant. It is also assumed that either the non-agricultural sector is entirely absent, resulting in no purchase of agricultural inputs or consumer goods from the industrial sector, or the non-agricultural sector exists, but farmer's consumption patterns, including goods and services provided by the non-agricultural sector, are deeply rooted in tradition and remain unchanged even when their income increases for any reason.

The possible existence of a backwards-sloping supply curve for aggregate production in an underdeveloped agricultural economy can be explained by the labour-intensive nature of agriculture in such economies. In these economies, the supply curve for labour itself tends to slope backwards. When the prices of agricultural commodities rise, the resulting increase in income (or wages) for agricultural labourers leads to a decline in the supply of labour, ultimately reducing overall output. Mellor provides further insights into the reasons for this phenomenon. He introduces two key concepts:

- The supply curve for labour slope backwards

(a) the substitution effect of higher agricultural prices, which encourages farmers to allocate more labour to their farms to increase production.

(b) the income effect, which discourages labour use on farms because the additional income cannot be effectively utilised due to rigid, tradition-bound consumption patterns.

Initially, higher agricultural prices incentivise farmers to work harder and use more labour on their farms, representing the positive substitution effect. However, as incomes continue to rise, the negative income effect becomes stronger, reducing the willingness of farmers to supply labour. Eventually, a point is reached where the negative income effect of higher prices will over-neutralise the positive substitution effect of higher prices on labour use. It will cause the labour supply curve and, consequently, the aggregate production supply curve to bend backwards after that point. The following diagram shows the backward-slopping supply curve for aggregate agricultural production.

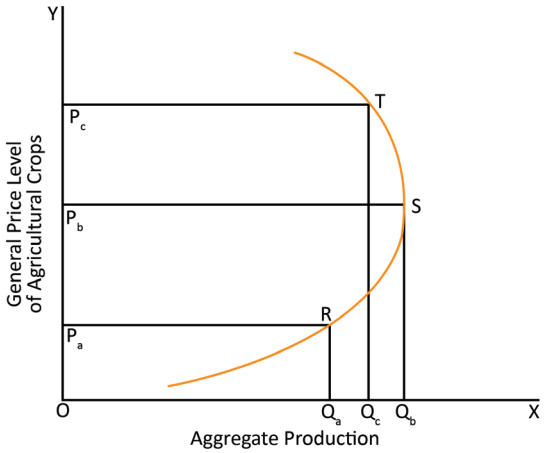

Fig 3.2.1. Backwards Bending Supply Curve for Agricultural Production

- Negative response of production to price change

The Fig 3.2.1 clearly shows that as the general level of agricultural prices rises, agricultural production rises (of course, with a time lag) but only up to a certain point (Pb in the diagram). If the prices continue to rise beyond that point, agricultural production does not increase. Rather, it starts decreasing with every successive rise in agricultural prices. In other words, the supply curves start moving backwards.

- Inverse relationship between prices and marketed surplus

An inverse relationship can also be seen between the prices of agricultural products and the amount sold from the existing stock, which is the marketed surplus. When agricultural prices rise, leading to a decrease in total agricultural output, the quantity of crops marketed will subsequently drop as a direct result of the higher prices and lower output. Further, the inverse relationship between prices and the quantity of agricultural crops is founded on the assumption that farmers in underdeveloped agriculture have fixed or near-fixed financial commitments and sell only as much of their harvest as is required to obtain the desired monetary income. The nearly insatiable desire for money among these farmers is largely explained by their nearly fixed need for manufactured goods, as well as rather fixed charges for rent, debt services, etc. The quantity of output not required to be sold in order to meet the demand for cash has a high marginal utility for subsistence farmers due to its limited availability. It is contended that rising prices will lead to a reduction in marketed surplus due to farmers being able to cover their financial commitments with a smaller quantity of crops. Farmers' surplus sold at reduced

prices has been referred to as 'distress marketed surplus', and its volume is expected to decrease if prices for agricultural commodities increase.

(C) Supply of crops is insensitive to price changes

Supporters of this perspective argue that in an underdeveloped economy, numerous social and institutional barriers exist which isolate the cultivation and sale of a crop from price fluctuations in the market. Farmers' conservative attitudes, their reliance on traditional crop production methods, and their focus on producing mainly for domestic use, combined with limited knowledge and inflexible tastes, are seen as hindrances to altering crop patterns in response to changing prices. In numerous underdeveloped economies, the typical farm size is often too limited, and the farmers typically lack products to sell in the market. Additionally, substandard transportation infrastructure, a flawed agricultural marketing system, and market anomalies caused by oligopsony, which leads to farmer exploitation, also discourage farmers from relying on the market. To a similar extent, the effect of price fluctuations on the supply of agricultural products is consequently diminished as well. The proponents of this perspective argue that the cost of a crop is an unequivocal factor influencing either its cultivation or sale. In a backward economy, the factors that protect production or the quantity of crops sold from price fluctuations are particularly robust. Consequently, fluctuations in the prices of different crops will not be reflected in their production or sales. Thus, the above discussion of several factors influencing the relationship between crop prices and supply levels highlights that, in practice, different situations will exhibit varying patterns of connection between prices and supply for various crops.

- No direct correlation between the price of agricultural crops and their supply

Summarised Overview

Agricultural prices exhibit unique behaviours due to the interplay of demand and supply. It is influenced by factors such as seasonality, perishability, and market structures. The demand for agricultural products is shaped by income levels, consumer preferences, price relationships, etc., while supply is determined by variables like market prices, input costs, technological advancements, environmental factors, and credit accessibility. Supply response in agriculture reflects farmers' adaptability to changes in market conditions, influenced by price incentives, technological support, and government policies. Efficient supply chains, market accessibility, and favourable socio-economic conditions enhance

this response, while constraints like high input costs, limited credit, and unpredictable environmental conditions affect it. Understanding these factors is essential to stabilising prices, ensuring consistent supply, and promoting sustainable agricultural growth.

Assignments

1. Analyse the factors that led to agricultural price fluctuations.
2. Collect data on the prices of any three agricultural products over the past decade. Analyse the price trends and identify factors that might have influenced them, such as changes in demand, supply, or government policies.
3. Analyse the supply response of banana cultivation by using historical data from past decades.

Suggested Reading

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 3

Agricultural Marketing

Learning Outcomes

After completing this unit, the learner will be able to:

- comprehend the agricultural marketing system in India
- identify key challenges in agricultural marketing
- examine institutional support systems
- know the functioning of regulated markets and cooperative markets

Background

In India, the agricultural marketing system plays a crucial role by enabling the transportation of goods from farms to end-users. The system is hampered by considerable difficulties, such as insufficient infrastructure, substandard storage facilities, and market segmentation, which cause price instability and unfair treatment of farmers. The current situation illustrates a significant gap between rural and urban areas in terms of market access, with small and marginal farmers frequently facing difficulties due to their limited negotiating influence and heavy reliance on intermediaries. The implementation of Agricultural Produce Market Committees (APMCs) and the integration of the National Agriculture Market (e-NAM) are intended to simplify the system, increase transparency, and decrease inefficiencies. However, the pace of progress has been gradual and inconsistent across different areas.

Institutional support networks, including state marketing boards, cooperative groups, and farmer producer cooperatives (FPOs), are crucial in tackling these issues by offering financial aid, marketing assistance, and collective negotiating abilities. Regulated markets are intended to provide fair marketplaces, guarantee equal pricing and reduce exploitative activities, but they frequently encounter problems with red tape and restricted accessibility. Unlike conventional markets, cooperative markets, based on collective action principles, give farmers more control by enabling them to combine their resources and enhance their ability to bargain effectively. This unit examines the composition, difficulties, and strategies to enhance the agricultural marketing system in India, with an emphasis on institutional frameworks and the functions of regulated and cooperative markets.

Keywords

Agricultural Marketing, Support Systems, Regulated Markets, Cooperative Markets

Discussion

3.3.1 Agricultural Marketing System in India

- Goods from farm to consumers

The concept of agricultural marketing involves farmers and farm owners selling their goods and services. This system encompasses several key functions, including assembling, transportation, storage, purchasing, sales, standardisation, grading, processing, and promoting sales. In general, marketing includes the execution or conduct of various business activities that facilitate the movement of goods and services from producers to consumers. The origin of market supply in agricultural marketing is primarily the farm. The marketing cycle commences at this stage and persists through to the point of ultimate customer use. We essentially have two markets: the input market and the output market.

- Utility creation through marketing channel

Manufacturing firms provide a range of inputs to farms through the input market. The output market handles different marketing activities for crops and livestock products through their respective distribution channels. Through the various marketing channels for the product, marketing initiatives give rise to new utility, leading to a transfer of ownership of the commodities among intermediaries over time and across different locations. In marketing processes, products will possess form, time, place, and possession utilities. Commodity utility is enhanced through the processing activity of marketing. The storage function of marketing adds utility to a commodity. The creation of place utility is facilitated through the transportation service, a component of marketing activity. Marketing functions generate utilities for commodities at different stages of the marketing process, incorporating costs and profit margins for each intermediary involved.

Therefore, a market is a place where goods and services are exchanged. The market consists of buyers and sellers with facilities to communicate with each other for transactions of goods and services. Marketing is the economic process by which goods and services are exchanged between producers

and consumers, and their values are determined in terms of money prices. The concept of agricultural marketing can be derived by combining the meanings of the two terms; viz; agriculture and marketing. Agriculture, in its widest context, encompasses all farming activities that utilise natural resources to benefit humanity. Typically, it refers to the cultivation of crops and the rearing of livestock using available resources and technology. Marketing, on the other hand, includes all economic activities that facilitate the movement of goods and services from producers to consumers.

- Market is a place of value determination

3.3.1.1 Classification of Markets

Markets can be categorised based on different criteria, as mentioned below:

1) Based on the Number of Commodities: following this criterion, we have general markets and specialised markets

a. General Markets: These markets offer a wide range of commodities, including food grains, textiles, and more.

- Markets classified by commodity range and focus

b. Specialised Markets: These markets focus on specific commodities and are named accordingly. For instance, a market dedicated to vegetables is referred to as a vegetable market. Similarly, markets dealing in wool, cotton, jute, or fish are called wool markets, cotton markets, jute markets, and fish markets, respectively.

2) Based on Market Area: Markets can be categorised according to the geographical area they cover into the following types:

a. Local Markets

- Markets classified by local, regional, national, international

Also known as village markets, primary markets, or 'hats,' these markets serve a limited area, typically a cluster of nearby villages. They primarily deal in perishable goods like vegetables, fruits, fish, milk, and other essentials. Occasional gatherings, such as fairs held on special days, are also part of this category. In some regions, these markets operate daily, while in others, they may function weekly or bi-weekly. Examples include tribal markets in Madhya Pradesh and livestock markets for cattle and sheep.

b. Regional Markets

Regional markets cater to a broader area than local markets, often encompassing several districts or even an entire state.

These markets deal with specific commodities such as food grains or fruits. Transactions in regional markets are usually conducted regularly, and they often focus on commodities regulated under notified trading standards.

c. National Markets

These markets have a country-wide scope, facilitating the trade of goods that are in demand across the entire nation. Examples include markets for textiles, jute, and tea, which have a substantial reach within the domestic economy.

d. International Markets

International markets operate on a global scale, dealing in commodities that are in demand across multiple nations. Products such as cashew, coffee, tea, spices, gold, silver, diamonds, machinery, and even processed goods like sugar and cut flowers are examples of items traded in these markets. Over time, the range of internationally traded commodities has expanded significantly.

3) Based on Location

Markets can also be classified according to their location into the following types:

a. Village Markets

These markets operate within a small village or a group of nearby villages. Transactions primarily occur among local buyers and sellers, and these markets may be held regularly or occasionally, depending on the region's needs.

b. Primary Wholesale Markets

- Markets classified as village, primary, secondary, terminal

Situated in larger towns, taluks, or mandal headquarters, these markets serve as collection centres for agricultural commodities brought in from village markets. Transactions are mostly conducted between producers and traders.

c. Secondary Wholesale Markets

Located in district headquarters, these markets handle significant volumes of key agricultural commodities like rice, pulses, oilseeds, and chillies. Wholesalers and village traders are the primary participants, with most arrivals sourced from village and primary wholesale markets. The transactions here involve large quantities, and numerous intermediaries such as commission agents, brokers, porters, and weigh-men play essential roles in facilitating operations.

d. Terminal Markets

Found in major cities, state capitals, or seaports, terminal markets are highly organised and often regulated by government agencies to ensure efficient marketing practices. Activities such as processing, storage, and forward marketing are common in these markets, which cater to consumers, wholesalers, and marketing agents. Cities like Chennai, Bangalore, and Mumbai host such markets, which are hubs for large-scale and future-oriented transactions.

4) Based on Time

Markets can also be categorised based on the duration of their operation into the following types.

a. Short-Period Markets

These markets operate for a limited duration, within a day. The supply of commodities in these markets is fixed and cannot be adjusted quickly, making it inelastic. Examples include fish markets, vegetable markets, and flower markets in villages, towns, or cities. The pricing of commodities in such markets is heavily influenced by daily demand.

b. Long-Period Markets

- Markets classified as short period, long period, secular

These markets deal with durable commodities that can be stored for an extended period. Supply is more flexible, and prices are primarily determined by the interplay of supply and demand. Typical examples include markets for food grains and oilseeds.

c. Secular Markets

Secular markets are permanent and well-organised, focusing on goods such as manufactured products and machinery. These markets are equipped with advanced storage and processing facilities and are often involved in both import and export transactions.

5) Based on Volume of Business

- Markets classified as wholesale and retail transactions

Markets can also be categorised according to the scale of transactions into the following types.

a. Wholesale Markets:

These markets involve the buying and selling of large quantities of commodities, primarily among traders. Retailers often

purchase goods here to supply them further to end consumers.

b. Retail Markets

In retail markets, commodities are sold in small quantities directly to consumers to meet their specific needs. These markets typically include producers, retailers, and consumers as the main participants.

6) Based on Nature of Transaction

Markets can be categorised into two types depending on the nature of transactions.

a. Cash Markets

- Markets classified as cash (spot) and forward transactions

In cash or spot markets, transactions involve the immediate exchange of goods and payment.

b. Forward Markets

Forward markets facilitate agreements for the future purchase or sale of commodities at prices determined in the present. This practice is known as hedging.

7) Based on Competition

Markets can be classified into two types depending on the level of competition.

- Markets classified as perfect and imperfect

a. Perfectly Competitive Markets: These markets have many buyers and sellers, with no single entity able to influence prices significantly.

b. Imperfectly Competitive Markets: These markets are characterised by fewer participants or other factors that allow individual entities to have significant control over prices or trade conditions.

8) Based on Government Intervention and Regulation

Markets are categorised based on the degree of government oversight.

a. Regulated Markets

- Markets classified as regulated and unregulated by government

These markets are controlled by statutory market committees and operate under government-enforced marketing laws. Marketing expenses, margins, and fees are standardised, and regulations ensure fairness in trade practices. Facilities are provided for smooth operations, and prevailing prices are disseminated through mass media.

b. Unregulated Markets

In unregulated markets, transactions occur without government supervision or rules. Such markets often lack transparency, allowing middlemen to exploit both farmers and consumers. Producers may suffer losses due to unfair practices in weighing, measuring, and payment.

9) Based on the Nature of Commodity

Markets can be classified according to the type of goods traded.

a. Commodity Markets

These markets focus on the trade of physical goods like cotton, wheat, chilies, cattle, and bullion.

- Markets classified as commodity and capital trading

b. Capital Markets

Capital markets deal with financial instruments such as shares, bonds, and securities. Examples include the stock market and the money market.

10) Based on Visibility

Markets can also be categorised by the transparency of trade practices.

a. Black Markets (Invisible Markets)

- Markets classified asblack (invisible) and open

In black markets, goods are stored out of sight, often in warehouses, and are not openly displayed. Transactions are conducted discreetly, typically involving cash, and such markets thrive on scarce or in-demand goods. Black marketing is prevalent during crises such as wars, droughts, or natural disasters.

b. Open Markets

In open markets, goods are displayed openly, and transactions are conducted transparently without restrictions.

3.3.2 Current Scenario in Agricultural Marketing

- Market transformation

Over the past 70 years, agricultural marketing in India has undergone significant transformation. This shift has been driven by increased production and marketable surplus of key agricultural commodities, rising income levels, urbanisation, changing consumer demand patterns for farm products, gradual integration with international markets, and evolving government involvement in agricultural markets. An effective marketing system plays a critical role in reducing costs and maximising benefits for all stakeholders in the food supply chain. It helps farmers secure fair prices for their produce,

ensures the availability of high-quality food to consumers at reasonable prices, and provides sustainable margins for supply chain participants, enabling them to remain viable in the business.

• Marketing activities

The agricultural marketing system is comprehensive in its activities involving the movement of agricultural produce from producers to consumers. These activities can be broadly classified into three categories, viz, exchange functions, physical functions, and facilitating functions. Exchange functions include buying and selling, which are central to agricultural marketing. However, the scope of agricultural marketing extends far beyond these functions to include physical functions, such as storage, transportation, and processing, as well as facilitating functions like standardisation, financing, risk management, and market intelligence. These functions are depicted in a table as follows.

Table 3.3.1 Categorisation of Marketing Functions

Exchange functions	Physical functions	Facilitating functions.
• Buying	• Storage	• Standardisation
• Selling	• Transportation	• Financing
	• Processing	• Risk Bearing
		• Market Intelligence

• Export growth

A significant trend is the increasing interconnectedness between India's agricultural sector and international markets, with India positioning itself as one of the largest producers and exporters of commodities like rice, spices, and cotton. India's foreign exchange earnings have received a substantial boost from the increase in agricultural exports, with exports in the agricultural sector totalling approximately USD 52.5 billion for the period 2022-23. The government has implemented various schemes to enhance the agricultural marketing system, including promoting organised markets, boosting investment in rural infrastructure, and facilitating mechanisms for price discovery. Storage and cold chain facilities are insufficient, resulting in significant post-harvest losses. Despite the positive changes in India's agricultural marketing sector, there is still a requirement for additional reforms to rectify infrastructure shortcomings, increase access to financial services, and strengthen market connections for smallholder farmers.

3.3.3 Problems in Agricultural Marketing

Despite the Indian government's various efforts to enhance the marketing system, numerous challenges continue to obstruct farmers and other stakeholders. These efforts include making the system more responsive, conducive to participation from diverse sectors, and well-equipped with infrastructure. However, these challenges prevent farm produce from effectively reaching the market. Below are some of the key issues.

1. **Inadequate transportation infrastructure:** Transportation is vital in the distribution of agricultural products, aids in generating a market for agricultural produce, and decreases spoilage and wastage of farm products. However, due to insufficient transportation infrastructure, farm produce wastage has risen.
2. **Lack of Market Information:** Agriculture has become increasingly reliant on access to market information. Farmers require access to information to make informed decisions at various stages of production and marketing. Farmers have restricted access to market-related data concerning prices and the arrival of agricultural commodities that are of importance to them. Having access to current market prices is crucial for developing a strategy that enables producers to achieve a more favourable price for their products. Despite numerous initiatives by both the public and private sectors, such as agmarknet (Agricultural Marketing Information Network), Kisan Sanchar, etc, it remains a challenge to disseminate information to all farmers in an accessible format.
3. **Insufficient Credit:** Farmers are forced to conduct distress sales due to a lack of credit availability. The adoption of technologies is often influenced by the availability of financial resources. Farmers require a connection to institutional credit.
4. **Existence of intermediates:** A lengthy sequence of middlemen results in farmers receiving a small portion of the price due to the numerous intermediaries present in the supply chain. Long chains of intermediaries result in inefficiencies and disadvantageous prices at both the production and consumption ends.
5. **Inadequate storage facilities:** It will result in post-harvest losses, forcing the producer to sell the crop at a low price because the produce cannot be safely stored

until a more favourable market price becomes available. It is estimated that around 20-30 percent of the gains are being lost due to rodents and insects. Inadequate storage facilities result in a rise in distressed sales of farm products.

6. **Lack of Awareness on Standardisation and Grading:** An inadequate understanding of standardisation and grading is apparent, as trade in the Indian agricultural marketing system often occurs without a basis in grade and standardisation. This poses a challenge in determining a fixed price for farm products. As a result of inadequate standardisation and grading, customers encounter difficulties when buying high-quality products, while farmers are also impacted by price fluctuations.
7. **Availability of Machinery and Manpower:** The availability of machinery and manpower facilitates the migration of agricultural labour, which is frequent between states as they engage in various agricultural activities, from planting to harvesting, during a typical year. The availability of labour and machinery, as well as their movement, were impacted during the COVID-19 period due to lockdowns and other regulations.

• Challenges reduce marketing efficiency

8. **Size of Holdings:** Around 85% of farmers are involved in small to marginal-sized landholdings. The limited size of operational holdings results in a low marketable surplus for farmers, making it impossible to achieve economies of scale.

3.3.4 Measures to Improve Agricultural Marketing

Various factors have been examined that negatively impact the efficiency of agricultural marketing systems in India. Given the flaws in agricultural marketing highlighted by the preceding analysis, several remedial measures can now be suggested.

3.3.4.1 Establishment of Regulated Markets

• Pre-Independence Market Regulations

Before independence, government policies related to agricultural marketing were primarily focused on controlling food prices for consumers and ensuring affordable agro-raw materials for industries. Regulations introduced during the 19th century were largely aimed at maintaining the supply of pure cotton at reasonable prices for Manchester's textile mills. The first regulated market, the Karanjia Cotton Market, was established in 1886 under the Hyderabad Residency Order. This was followed by the Berar Cotton and Grain Market Act

of 1897, which served as a model for similar legislation across the country. To further strengthen the agricultural marketing system and protect farmers from systemic flaws, the Royal Commission on Agriculture in 1928 and the Central Banking Enquiry Committee in 1931 recommended implementing regulations in agricultural markets. In response, the Directorate of Marketing and Inspection (DMI) was established in 1935. In 1938, the DMI drafted a Model Bill to regulate agricultural markets and advised state governments to adopt measures to protect producers by addressing malpractices prevalent in these markets.

As agriculture was a state subject, the DMI's role under the central government was limited to providing advisory support. However, in 2020, the central government introduced ordinances that were nationwide applicable to regulate the foodstuff trade. The primary goal of introducing these regulations was to safeguard farmers from exploitation and establish an efficient agricultural marketing system that ensured fair prices for producers and affordable delivery of goods to consumers. The administration of regulated markets is entrusted to market committees composed of members representing various stakeholders, including growers, traders, officials from marketing societies, and representatives from the Agricultural or Animal Husbandry departments. These committees are tasked with ensuring compliance with the established rules and regulations.

- Centralised Market Regulations

Functions of the Regulated Markets

The regulated markets play a crucial role in assisting farmers with the equitable sale of their produce, and are entrusted with the following responsibilities.

1. Implementing the provisions of the Farm Produce Markets Act, along with the associated rules and bylaws.
2. Facilitating marketing activities for designated crops within the notified area.
3. Regulating the marketing practices for specified crops.
4. Establishing market yards equipped with necessary infrastructural facilities.
5. Issuing, renewing, suspending, or cancelling licenses for market functionaries and prescribing the terms of these licenses.
6. Defining market practices and setting appropriate market

- Regulated markets ensure fari trade and transparency

charges.

7. Providing personnel to mediate and resolve disputes.
8. Collecting, maintaining, and disseminating market-related information.
9. Preventing adulteration and encouraging grading of agricultural produce.
10. Imposing and collecting market fees and license fees as permitted by law.

Benefits of Regulated Markets

1. Farmers are encouraged to sell their produce directly in the markets.
2. Protection is provided to farmers against exploitation by market intermediaries.
3. Specific market charges are established and enforced to ensure a well-organised marketing system.

- Regulated markets ensures fair prices and efficiency

4. Farmers receive better prices for their produce.
5. Dispute resolution between producers and traders is facilitated through available staff.
6. Essential facilities such as sales platforms, storage spaces, cart parking, and rest houses are provided.
7. Farmers gain access to timely and accurate market information.
8. Sales transactions are commonly conducted through an open auction system in regulated markets.
9. The marketable surplus of agricultural produce is increased.
10. The reliance on village-level sales is minimised.
11. Marketing costs are reduced, leading to a higher share of the consumer's expenditure reaching the producer.

3.3.4.2 Encouragement of Co-operative Market

- Cooperative Marketing Societies

An effective agricultural marketing system should motivate producers to enhance their production while ensuring fair prices for their produce and providing consumers with goods at reasonable rates. Recognising the significance of marketing, cooperative marketing societies were established to address farmers' needs, with a history spanning over eight decades. Cooperative marketing involves the structured sale of agricultural products on a non-profit basis, prioritising the welfare of individual producers. Farmers form these societies,

and any profits generated are distributed among the members based on the volume of produce they contribute to the market.

Need for Cooperative Marketing

- Reducing Middlemen Dependency

Intermediaries play a significant role in delivering produce from farmers to consumers. However, these middlemen often charge service fees that are disproportionately high relative to the services they provide, resulting in farmers receiving an unfairly low share of the consumer's expenditure. To address these issues, it is essential to empower farmers to market their produce directly, ensuring they receive a fair share of the market value. Since individual marketing is often impractical, a collective approach becomes necessary. This highlights the need for cooperative efforts in agricultural marketing. Adopting an institutional framework through a producer-owned cooperative marketing system can provide farmers with the benefits and fairness they deserve.

Objectives of Cooperative Marketing

1. To facilitate the sale of produce for the benefit of members.
2. To offer credit facilities to members using agricultural produce as collateral.
3. To provide grading services to help members secure better prices for their produce.
4. To arrange for the scientific storage of members' agricultural products.
5. To ensure the supply of necessary inputs required by farmers.
6. To implement a system for pooling members' produce and enhancing bargaining power through collective action.
7. To organise the export of produce, enabling farmers to achieve higher returns.
8. To serve as a government agent in the procurement of food grains and related items.

The cooperative marketing framework consists of national, state, central, and primary cooperative marketing societies. Farmers primarily interact directly with primary cooperative marketing societies. These societies are generally divided into two categories: general-purpose societies, which handle a variety of commodities, and specialised societies, which focus

- Cooperative Marketing Structure

exclusively on specific commodities. National Agricultural Cooperative Marketing Federation (NAFED), National Cooperative Development Corporation (NCDC), National Consumer Cooperative Federation (NCCF), and State Cooperative Marketing Federation (SCMF) are examples of Cooperative markets in India.

3.3.4.3 Institutional Setup in Agricultural Marketing

The institutional setup for agricultural marketing in India comprises various organisations and agencies. These organisations work at different levels to support farmers and facilitate the marketing process. They also aim to promote fair trade practices. This institutional framework seeks to create a fair, efficient, and transparent agricultural marketing system. The goal is to benefit both producers and consumers. Some of the major institutions are discussed below.

Food Corporation of India (FCI)

- Buffer stocks management for accessibility and price stability

The Food Corporation of India (FCI) was set up under the Food Corporation Act of 1964 with the main aim of guaranteeing the efficient purchase, storage, and supply of food grains throughout India. It plays a vital part in ensuring the country's food security by purchasing food grains from farmers at the Minimum Support Prices (MSP) to safeguard their income and protect them from market fluctuations. The grains acquired are subsequently housed in FCI warehouses and dispensed via the Public Distribution System (PDS). This initiative endeavours to supply food grains to disadvantaged groups at reasonable prices. Moreover, FCI plays a crucial role in maintaining buffer stocks, thus guaranteeing food accessibility during periods of scarcity, which helps to stabilise prices and ensure a steady supply of food across the country. It is responsible for the logistics and transportation of food grains, facilitating their delivery to distant regions and thereby assuming a crucial function within India's overall food management framework.

Objectives of FCI

1. To make provisions for providing remunerative prices to the farmers
2. To maintain buffer stocks as a measure of food security.
3. To ensure the availability of food grains at affordable prices, especially to the poor section of society.

4. Intervene in the market to ensure price stabilisation.

Directorate of Marketing and Inspection (DMI)

The Directorate of Marketing and Inspection (DMI) plays a vital part in putting the Union Government's marketing initiatives for agricultural goods into action. DMI serves as an intermediary between the central government and state governments, facilitating cooperation on agricultural marketing matters, policies, and programmes. Its duties involve facilitating the efficient functioning of agricultural markets, enforcing relevant laws, and managing the development of market infrastructure. DMI is based in Nagpur and has a comprehensive network consisting of 11 Regional Offices and 37 sub-offices nationwide, allowing for effective oversight and support of agricultural marketing initiatives at multiple levels. DMI operates a wide-reaching network that aims to promote equitable marketing practices, price stability, and enhanced market access for farmers, ultimately supporting the expansion and advancement of India's agricultural industry.

- Coordinates policies and promotes equitable practices

Functions of DMI

1. Grading: It includes promoting grading and standardising agricultural and related commodities, such as AGMARK
2. Agmark Laboratories: DMI has established 22 Regional Agmark Laboratories nationwide to provide quality certification for agricultural commodities.
3. Cold Storage: DMI is highly engaged in providing consultancy services for the design, construction, and management of cold storage facilities. The organisation hosts various events such as workshops, conferences, seminars, and lectures that concentrate on issues associated with cold storage facilities.
4. Meat food products: DMI enforced the Meat Food Products Order to guarantee that the necessary hygienic and sanitary standards are met regarding the production, import, and export of meat food products within the country.

- DMI ensures grading, quality, storage and hygiene

Commission for Agricultural Costs and Prices (CACP)

The Commission for Agricultural Costs and Prices was established in January 1965. Previously known as the Agricultural Prices Commission, it was set up with the main aim of advising the government on the pricing policy of vital agricultural commodities. The commission has a crucial role in setting the Minimum Support Prices (MSPs) for primary

- Ensuring fair profits for farmers

crops, which safeguards farmers from price fluctuations and guarantees a fair profit from their harvests. CACP considers several factors when suggesting MSPs, such as production costs, market trends, the balance between supply and demand, and the economic effects on consumers and farmers. The CACP supports agricultural market stability by offering informed guidance on pricing and assisting the government in its agricultural policy decisions, ultimately contributing to sustainable agricultural growth and ensuring domestic food production.

Functions of CACP

1. It advises the government to prioritise MSP for significant agricultural commodities, taking into account various factors such as production costs, market fluctuations, adjustments in input prices, supply and demand dynamics, and international price movements.
2. Conduct surveys directly in the fields and gather pertinent information from the farmers.

Council of State Agricultural Marketing Boards (COSAMB)

- Strengthens agricultural marketing infrastructure

The Council of State Agricultural Marketing Boards was established as a national-level organisation in 1988. The main objective of COSAMB is to function as a central coordinating authority for all the State Agricultural Marketing Boards in India, with a focus on enhancing and fortifying the agricultural marketing infrastructure nationwide. COSAMB offers technical and policy assistance, thereby facilitating the execution of diverse agricultural marketing projects, such as infrastructure development, regulatory frameworks, and measures to promote market efficiency. The organisation also assists in promoting uniformity and consistency within the operation of state-level agricultural markets, guaranteeing that they function in a way that benefits both farmers and consumers. COSAMB's collaboration with central and state authorities is crucial for enhancing agricultural marketing systems, thereby enabling farmers to receive better prices and gain improved market access.

Objectives

It is supposed to meet the following objectives

1. Collaboration with both the central and state governments

to safeguard the interests of producers, traders, and consumers.

2. Facilitating information exchange both domestically and globally.
3. Creating a shared platform for all relevant stakeholders.
4. Hosting a range of seminars and conferences for its constituent members.

3.3.4.4 Support System in Agricultural Marketing

The agricultural marketing support system includes the infrastructure, institutions, and services. These are required to efficiently transport, process, and disperse agricultural products from farms to users. The goal is to guarantee equitable pricing, reduce waste after harvest, and enhance farmers' ability to access markets. The system covers market information systems, price support systems, and regulated and cooperative markets. They are discussed below.

Market Information Services

Developing a strong market information system is crucial to providing comprehensive information on prices, arrivals, availability, trends, analysis, laws, and more. Such a system requires a dependable programme capable of collecting and disseminating accurate and practical information in a farmer-friendly manner. However, merely offering information is insufficient; it must be complemented by initiatives that empower farmers to effectively market their produce. The Food and Agriculture Organisation (FAO) defines a Market Information Service as a system, typically managed by the public sector, that regularly collects data on prices and, in some cases, quantities of commonly traded agricultural products from rural assembly markets, wholesale markets, and retail markets. This information is then disseminated promptly through various media channels to farmers, traders, government officials, consumers, and other stakeholders to support informed decision-making. Several government-initiated information systems are prevailing in India nowadays. The most important among them are AGMARKNET and Kisan Sanchar. They are discussed below.

- Market information system ensures accurate data

Agriculture Marketing Information System (MIS) of the Indian Government – (AGMARKNET)

The Government of India has implemented several initiatives to ensure fair returns for farmers, such as market regulation, grading of agricultural produce, and cooperative marketing. However, farmers often fail to benefit significantly due to their inability to develop effective marketing strategies for their products. They were also unable to secure fair prices due to the lack of accurate and timely market information about agricultural commodities. The market data provided by states, union territories, and their respective offices was often insufficient and delayed. To bridge this gap, the Government of India launched a Central Sector Scheme known as the 'Agricultural Marketing Information System Network' (AGMARKNET) with specific objectives. The scheme is implemented and managed by the Directorate of Marketing and Inspection (DMI) under the Department of Agriculture and Cooperation. The specific objectives include.

- AGMARKNET aids farmers with market information

1. Establish a nationwide network for the rapid collection and distribution of market information and data to ensure its effective use.
2. Facilitate the dissemination of information to help farmers secure better prices for their products.
3. Educate and empower farmers to adapt to emerging challenges in agricultural marketing by leveraging information and communication technologies (ICT) as an extension tool.
4. Enhance agricultural marketing efficiency by offering region-specific training and outreach programmes in local languages tailored to farmers' needs.
5. Provide support for marketing research to generate valuable insights and share this information with farmers and other stakeholders at the grassroot level, promoting best practices in agricultural marketing across the country.

Kisan Sanchar

Kisan Sanchar is an autonomous, self-funded organisation legally registered under Section 25 of the Indian Companies Act of 1956. Its primary mission is to empower farmers and agricultural workers by delivering reliable and actionable information. This initiative enables farmers to make well-informed decisions, promoting sustainable and profitable

farming practices. Kisan Sanchar provides farmers across the country with essential updates, including weather alerts, warnings, and medium-range forecasts, helping them plan key agricultural activities such as sowing, transplanting, irrigation, and the application of fertilisers and pesticides.

- Kisan Sanchar supports informed farming decisions

Price Support Mechanisms

In India, the primary goal of the Government's price policy for agricultural produce is to guarantee fair prices to farmers, thereby motivating greater investment and boosting production. To achieve this, Minimum Support Prices (MSPs) for key agricultural commodities are announced annually based on recommendations from the Commission for Agricultural Costs and Prices (CACP). The CACP considers several crucial factors when recommending these prices, including production costs, fluctuations in input prices, market price trends, inter-crop price parity, demand-supply dynamics, impacts on industrial costs, general price levels, cost of living, global market trends, and the balance between prices farmers pay and receive. Among these, the cost of production stands out as the most significant factor, accounting for both operational and fixed expenses. To implement the MSP, the Government operates the Price Support Scheme (PSS) through various public and cooperative organisations such as the Food Corporation of India (FCI), Cotton Corporation of India (CCI), Jute Corporation of India (JCI), NAFED, and the Tobacco Board. For crops not included in the PSS, the Government facilitates market interventions upon specific requests from States for defined quantities at mutually agreed prices. Any resulting losses are shared equally between the Central and State Governments.

- Support system promotes farmer's condition

Minimum Support Price (MSP)

The Minimum Support Price (MSP) is a market intervention strategy implemented by the Government of India to protect agricultural producers from steep declines in market prices. It serves as a guaranteed price mechanism designed to prevent farmers from resorting to distress sales. MSPs are declared at the start of the sowing season for specific crops, based on the recommendations provided by the Commission for Agricultural Costs and Prices (CACP, established in 1985). The primary objectives of MSP are to shield farmers from financial losses caused by distress sales and to secure food grains for the Public Distribution System. Suppose market prices drop below

- Market interventions to prevent price fluctuation of agricultural products

the announced MSP due to factors like surplus production or market oversupply. In that case, government agencies step in to purchase the entire quantity offered by farmers at the predetermined price.

The Minimum Support Price (MSP) system, which began with wheat in 1966-67, has expanded to cover 23 commodities today. These include seven cereals (paddy, wheat, barley, jowar, bajra, maize, and ragi), five pulses (gram, arhar/tur, moong, urad, and lentil), eight oilseeds (groundnut, rapeseed/mustard, toria, soybean, sunflower seed, sesame, safflower seed, and niger seed), as well as copra, raw cotton, and raw jute.

The MSPs are set at levels designed to incentivise farmers and achieve several key objectives like.

1. To encourage greater investment in agriculture
2. To promote the adoption of advanced crop production techniques, and
3. To boost overall agricultural production and improve farmers' income.

Procurement Price

- Procurement prices motivate farmers to increase production

In 1966-67, the Government of India introduced a 'procurement price' for wheat, set slightly above the Minimum Support Price (MSP). This was intended to secure adequate food stock for the Public Distribution System (PDS). While the MSP was announced before the sowing season, the procurement price was declared before harvesting to motivate farmers to sell more and increase production. However, this approach failed to provide a strong incentive, as the increased price was announced too late to influence farmers' decisions. Recognising this limitation, the government decided, starting from the 1968-69 fiscal year, to announce only the MSP, which also became the effective procurement price.

Issue Price

- Subsidised price for customers

The issue price is the rate at which the government permits the release of food grains from the Food Corporation of India (FCI), essentially the price at which the FCI sells its stocks. The FCI incurs significant losses due to food subsidies. Once procured, the food grains are transported to FCI warehouses across the country, forming part of the buffer stock. These stocks are then distributed either through the Targeted

Public Distribution System (TPDS) or the Open Market Sale Scheme. The expenses associated with transportation, storage, operational costs of the FCI, and losses during transit increase the overall cost of food grains. This total cost, combined with the Minimum Support Price (MSP), is referred to as the 'economic cost of food grains.' To ensure affordability for consumers, the government sets the issue price below the economic cost. The gap between the economic cost and the issue price is absorbed as a 'food subsidy.'

- Enhancing agricultural marketing

Currently, there are four centrally sponsored schemes which are being used to enhance the marketing structure as of 2007. The objectives of these schemes are to (1) establish a marketing research and information network, (2) incentivise rural godown construction by offering subsidies, (3) enhance the marketing infrastructure and grading and standardisation processes, and (4) secure venture capital for farmers through the small farmers' agri-business consortium to facilitate agri-business project development. It can be confidently assumed that the implementation of these measures will lead to a system of agricultural marketing that is extremely conducive to farmers' needs. Implementing this measure will serve the interests of farmers and, as a consequence, support the growth of the agricultural sector.

Summarised Overview

The agricultural marketing system in India has undergone substantial changes to establish a more efficient and equitable marketplace for both farmers and consumers. The present situation is marked by a multitude of difficulties, such as subpar infrastructure, restricted access to market intelligence, insufficient credit facilities, and the dominant influence of middlemen. Problems in the system result in unfair prices for farmers and lack of efficiency. Government initiatives such as setting Minimum Support Prices (MSPs) and implementing reforms such as e-NAM have been undertaken to address these issues.

The setup of agricultural marketing in India is composed of government organisations, regulatory bodies, and organisations focused on farmers' needs. Institutions such as Agricultural Produce Market Committees (APMCs), the Directorate of Marketing and Inspection (DMI), and cooperative organisations are crucial in overseeing and controlling market activity. Various support systems, including price support systems, financial institutions, and market information services, play a crucial role in streamlining the marketing process, minimising post-harvest losses, and enhancing market access for farmers. Regulated markets maintain fair prices and promote transparency, and cooperative

markets offer a platform for collaborative negotiation, enabling farmers to achieve higher prices and decrease their reliance on middlemen. The current reforms and efforts to bolster institutions are essential for tackling the existing challenges and enhancing the efficiency and fairness of India's agricultural marketing system.

Assignments

1. Identify the problems faced by farmers in marketing and suggest measures to improve the efficiency of the marketing system.
2. Evaluate the role of institutional setups in agricultural marketing in India.
3. How do market information services and price support mechanisms contribute to strengthening the marketing system for farmers?
4. Critically assess the impact of regulated markets on agricultural marketing in India.
5. Discuss the role of cooperative markets in the agricultural marketing system.

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3. Hanumantha Rao C.H., (1994): *Agricultural Growth, Rural Poverty and Environmental Degradation,* Oxford University Press, New Delhi.

Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

BLOCK 4

Issues in Agriculture and Agricultural Policies

UNIT 1 Agriculture and Rural Indebtedness

Learning Outcomes

After completing this unit, the learner will be able to:

- comprehend the relationship between agriculture and the environment
- identify the causes of rural indebtedness and their effects on rural households
- analyse the infrastructural constraints faced in agriculture
- discuss the challenges related to agricultural credit

Background

Agriculture plays an important role in the Indian economy by providing livelihoods to a large section of the population. However, agriculture is also closely linked to environmental issues, as unsustainable farming practices can lead to soil degradation, water scarcity, deforestation, and climate change.

In our country, the agricultural sector faces many challenges that affect farmers and rural communities. One significant issue is rural indebtedness, where farmers borrow money but struggle to repay it due to various reasons. These reasons include poor crop yields, low market prices, and high-interest loans. This debt can trap farmers in a cycle of poverty, and it impacts their lives and the rural economy. Another challenge is the lack of adequate infrastructure for agriculture. This includes issues like poor irrigation facilities, insufficient storage for crops, and limited access to markets. These problems reduce agricultural productivity and income for farmers. Additionally, credit issues further complicated the situation. Farmers often find it difficult to access formal loans from banks and are forced to rely on informal sources, such as moneylenders, who charge high interest rates.

Identifying these challenges is important because agriculture is the backbone of rural life and contributes significantly to national development.

Keywords

Agriculture, Environment, Rural Indebtedness, Infrastructural Constraints, Credit

Discussion

4.1.1 Agriculture and Environment

- Agriculture is vital yet strains resources, ecosystems, and climate

Agriculture is essential for global food security and economic growth, but it poses significant environmental challenges. Agriculture occupies nearly 40% of the Earth's terrestrial area and uses 70% of globally consumed freshwater. This extensive use of resources impacts soil health, forests, biodiversity, and water reserves. The use of pesticides, fertilisers, and energy in farming leads to water contamination, greenhouse gas emissions, and air pollution. Livestock farming and operations contribute to climate change by producing greenhouse gas emissions from animal digestion and manure. They also play a role in water contamination.

- Agriculture contributes 22% of global GHG emissions

According to the OECD-FAO (Organisation for Economic Co-operation Development and the Food and Agricultural Organisation) Agricultural Outlook published in 2024, agriculture, forestry, and other land use contribute about one-fifth (22%) of global greenhouse gas (GHG) emissions caused by human activities. Half of these emissions come directly from farming practices, such as methane emissions from livestock and nitrous oxide from fertilisers. The other half comes indirectly from carbon dioxide (CO2) emissions due to land use, land use change, and forestry, often linked to expanding agricultural areas.

- Agricultural GHG emissions to rise 5%

The estimation of greenhouse gas (GHG) emissions in agriculture uses data from the Food and Agriculture Organisation Statistics (FAOSTAT) Climate Change, Agrifood Systems Emissions database, based on the IPCC's Tier 1 approach. This method calculates emissions using basic factors like herd size, synthetic fertiliser use per hectare, and emissions from rice cultivation per hectare. It assumes no changes in current policies or significant shifts in technological progress. The findings revealed that, over the next decade, the expected growth in agricultural production is projected to increase direct GHG emissions by 5%. Livestock production, particularly ruminants, will contribute 62% of this increase. Synthetic fertilisers, which release nitrous oxide during use,

will account for 34% of the additional emissions.

Rice cultivation is another significant source of direct GHG emissions due to methane emissions from irrigated paddy fields. However, the projected increase in rice production is expected to result from higher yields rather than an expansion of paddy field areas. This means that the growth in emissions from rice cultivation will be limited despite the increase in production.

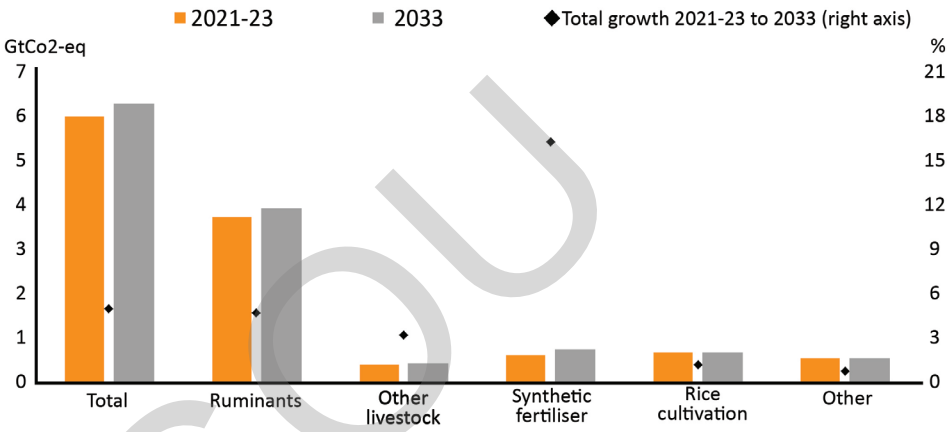

Fig 4.1.1 Direct GHG Emissions from Crop and Livestock Production by Activity

Source: OECD-FAO Agricultural Outlook 2024

- Ruminants, fertilisers contribute rise in agricultural GHG emissions

The graph represents the greenhouse gas (GHG) emissions measured in gigatonnes of CO2 equivalent for different agricultural activities over two periods 2021-23 and 2033. Total emissions are expected to rise slightly over the period. Ruminants (Cattle, Sheep, Goats) contribute significantly to GHG emissions. The emissions from ruminants are projected to rise from 2021-23 to 2033. The emissions from non-ruminant livestock, shown as other livestock in the graph, such as pigs and poultry, are much lower. There is only a slight increase expected by 2033. The emissions from synthetic fertilisers are projected to increase slightly by 2033. Emissions from rice cultivation, which produces methane, will increase only slightly due to yield improvements rather than expanded paddy areas.

Most of the increase in greenhouse gas (GHG) emissions from

agriculture is expected to happen in middle and low-income regions because their production methods are still more emission-intensive compared to high-income countries.

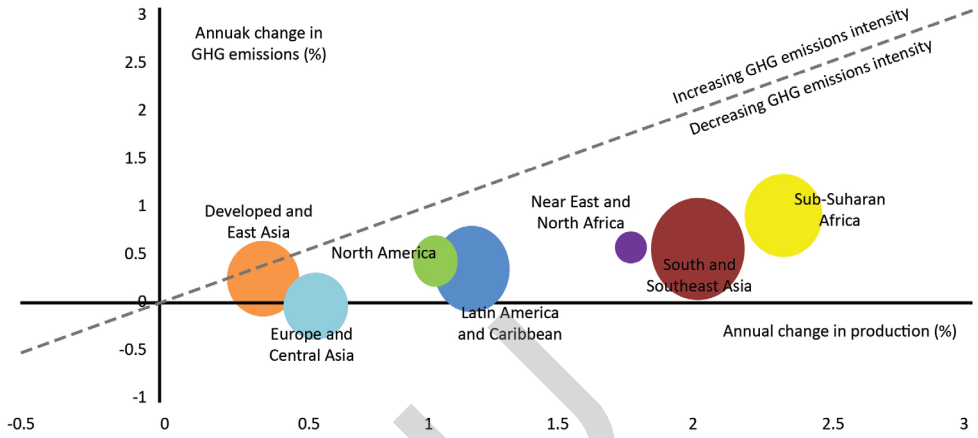

Fig 4.1.2 GHG Emissions and Emissions Intensity from Agriculture, 2021-23 to 2033

Source: OECD-FAO Agricultural Outlook 2024

The graph illustrates the projected changes in greenhouse gas (GHG) emissions from agriculture between 2021 and 2033 across different regions. It compares the annual change in GHG emissions with the annual change in agricultural production. Globally, agricultural production is expected to grow at a faster rate than GHG emissions, leading to a decline in the carbon intensity of agriculture. However, regional variations exist. Sub-Saharan Africa is expected to experience the most significant reduction in emissions intensity due to its initially high emissions per unit of production, allowing for greater efficiency improvements. In contrast, South and Southeast Asia are projected to see a considerable increase in both agricultural production and emissions, indicating slower progress in reducing emissions intensity. Latin America and the Caribbean will witness moderate agricultural growth with slightly increasing emissions, while the Near East and North Africa will have low agricultural growth with stable emissions. Developed regions such as Europe, North America, and East Asia will continue reducing their emissions intensity, reflecting ongoing efforts in sustainability. The global trend suggests a movement toward more climate-friendly agricultural practices, though some regions may require additional efforts to balance

- Agricultural production grows faster than emissions, reducing carbon intensity

growth with sustainability.

- Mitigates global warming, protects soil, and supports wildlife

Despite these, agriculture also offers environmental benefits. Agricultural land can mitigate global warming by sequestering carbon, providing habitats for wildlife, and protecting against soil erosion and flooding. Environmental elements such as buffer strips, conservation lands, and grasslands enhance biodiversity and improve water quality.

- Better farming methods reduce harm and boost sustainability

Enhanced farm practices and policies can address environmental challenges. Conservation tillage, cover cropping, nutrient management, and integrated pest management reduce environmental harm while maintaining productivity. Technologies like satellite imagery, sensors, and precision agriculture improve the efficient use of fertilisers and pesticides, detect water stress, and monitor soil conditions. These innovations not only boost environmental performance but also improve policy effectiveness.

- Policymakers should promote balanced sustainable agriculture

Policymakers have a critical role in promoting sustainable agriculture. They should target policies to address environmental impacts by regulating activities with the highest footprints and incentivising positive outcomes. The dual role of agriculture as an environmental challenge and a source of ecological benefits demands a balanced approach. By adopting sustainable practices, leveraging innovative technologies, and implementing targeted policies, the agricultural sector can reduce its negative impacts while enhancing its positive contributions. This balance is essential for meeting future food demands and preserving natural resources for future generations.

4.1.2 Rural Indebtedness

- Farmers struggle with debt due to uncertainties

Rural indebtedness is a serious challenge that affects the economic progress of rural areas, particularly in farming dependent communities. It refers to the financial burden where individuals or families have more debt than they can repay. In India, many farmers borrow money every year to meet their agricultural needs, such as purchasing seeds, fertilisers, or equipment. However, due to low agricultural productivity, poor rainfall, and unstable crop prices, they often fail to repay these loans. As a result, the debt grows year after year, creating what is known as a 'debt trap'.

Farmers face numerous difficulties, including small farm sizes,

low levels of non-farm income, and limited access to formal credit sources like banks or cooperatives. These factors force them to rely on informal moneylenders who charge extremely high interest rates. Borrowing becomes risky when loans are used for unproductive purposes, such as social ceremonies or daily expenses, instead of income-generating activities. Poverty and the lack of financial literacy further worsen rural indebtedness, as many farmers do not understand the long-term impact of high-interest loans. The debt burden often passes from one generation to the next, causing what is called 'intergenerational debt'.

- Farmers face debt due to loans and poverty

The National Statistical Office (NSO), under the Ministry of Statistics and Programme Implementation, conducted the latest All India Debt & Investment Survey in 2019 as part of the 77th round of the National Sample Survey (NSS). Similar surveys were conducted earlier during NSS rounds in 1971-72, 1981-82, 1992, 2003, and 2013. The findings of the latest survey are compiled in the report titled 'All India Debt & Investment Survey – 2019' (Report No. 588). This survey provides crucial information on rural and urban indebtedness, the role of credit agencies, and the average debt levels. The details are discussed below in the following sections.

- NSO's 2019 survey analyses India's debt patterns

Incidence of Indebtedness (IoI)

The Incidence of Indebtedness (IoI), which measures the proportion of households in debt, was 35% in rural areas compared to 22.4% in urban areas as of June 30, 2018. Among rural households, 40.3% of cultivator households and 28.2% of non-cultivator households were in debt. In urban areas, 27.5% of self-employed households and 20.6% of other households were indebted. Institutional credit agencies, such as banks and cooperatives, served 17.8% of rural households and 14.5% of urban households, while non-institutional sources, like moneylenders, served 10.2% of rural households and 4.9% of urban households. Some households borrowed from both sources, accounting for 7% in rural areas and 3% in urban areas.

- Rural debt higher than the urban debt

Average Amount of Debt (AoD)

The Average Amount of Debt (AoD) per household varied significantly between rural and urban areas. In rural India, the average debt was Rs. 59,748, with cultivator households borrowing Rs. 74,460 and non-cultivator households borrowing

- Urban households have higher debt than rural

Rs. 40,432. Urban households had a higher average debt of Rs. 1,20,336, with self-employed households at Rs. 1,79,765 and other households at Rs. 99,353. Notably, rural households relied on institutional credit for 66% of their outstanding cash debt, while urban households relied on institutional sources for 87% of their debt.

4.1.2.1 Causes of Rural Indebtedness

1. Poverty and Lack of Savings

- Poverty forces farmers to borrow and remain indebted

The main reason for rural indebtedness is the poverty of farmers. Most farmers do not have any past savings and are forced to borrow money for various purposes. For example, they may need loans to buy seeds, fertilisers, or equipment or to deal with crop failures caused by events like droughts or floods. Even when they take loans, their poverty often prevents them from repaying these debts on time, leading to a cycle of borrowing.

2. Desire for Land and Improvements

- Farmers borrow for land improvements, increasing debt

Farmers often have a strong desire to own more land or improve their existing land, such as by constructing wells or bunds (soil embankments). While these improvements are good for increasing agricultural productivity, farmers usually fund them through borrowing instead of saving. This dependence on loans increases their indebtedness over time.

3. Customary and Unproductive Expenses

- Farmers borrow for customs, festivals, and unproductive expenses

Farmers frequently borrow money to meet expenses related to social and religious customs. They spend heavily on events like weddings, religious festivals, and ceremonies for births and deaths. Additionally, many farmers are involved in costly court cases, which further strain their finances. Since these expenses are unproductive, they do not generate any income, making it harder for farmers to repay the loans.

4. Inherited Debt

- Farmers inherit debts and struggle for repayment

Many farmers inherit debts from their ancestors. For example, if a father had borrowed money, the responsibility of repaying it often falls on his son. In some cases, farmers even become

bonded labourers to repay these inherited debts, and this practice can continue for generations.

5. Exploitation by Moneylenders

Moneylenders play a significant role in rural indebtedness. They often exploit farmers by charging very high interest rates and keeping complicated accounts. Many farmers are forced to mortgage their land to borrow money. Over time, as the debts grow, moneylenders may seize the farmers' lands. Once a farmer becomes dependent on a moneylender, it becomes extremely difficult to escape from this cycle of exploitation.

- Moneylenders exploit farmers with high-interest loans

4.1.2.2 Effects of Rural Indebtedness

Rural indebtedness is a major issue affecting the agricultural sector in many developing countries, particularly in India. While borrowing may seem like a necessary solution, to fund agricultural activities, the long-term effects of rural indebtedness can be devastating, both economically and socially. The following discusses the economic and social impact of rural indebtedness.

Economic Effects

Rural indebtedness has a significant negative impact on the economy, particularly for small and marginal farmers. When farmers are unable to repay their loans, they often mortgage their land to moneylenders. Over time, if they fail to repay, they lose their land to these lenders, which turns them into landless labourers. This cycle of debt results in growing poverty, as the small farmer suffers from low prices when selling their crops but faces high prices for purchasing essential inputs like seeds, fertilisers, and equipment. This situation creates a vicious cycle where rural indebtedness both causes and worsens the poverty of Indian farmers, particularly those who are already economically vulnerable.

- Rural debt traps farmers in poverty and land loss

Social Effects

Socially, rural indebtedness leads to the creation of a class of landless labourers and tenants who are no longer independent farmers. In extreme cases, when landless labourers have nothing left to offer as collateral, they may pledge themselves to moneylenders or landlords as bonded labourers. This

practice forces them into a cycle of servitude that can last for generations. The loss of land and independence has led to social unrest in some regions. For example, in areas like Bihar, Orissa, and Andhra Pradesh, small farmers who have lost their land have risen against landlords and moneylenders. These regions have seen the rise of violent movements, such as the Naxalite movement, which is directly linked to the exploitation of marginalised farmers by high-caste moneylenders who fraudulently deprive local farmers of their land. Thus, rural indebtedness not only worsens economic conditions but also fuels social tensions and unrest.

- Rural debt creates landless labourers and fuels social unrest

4.1.2.3 Counter Measures to Rural Indebtedness

To effectively tackle the issue of rural indebtedness, a comprehensive approach is needed that addresses both the settlement of existing debts and the prevention of new, unproductive borrowing. Various measures have been introduced by the government to ease the burden on farmers, landless labourers, and rural artisans. These counter measures aim to reduce dependency on exploitative moneylenders, regulate borrowing, and provide financial support for essential needs. The following outlines some key strategies to address rural indebtedness.

a) Settlement of Old Debt

Rural indebtedness can be addressed by tackling old debts that have accumulated over time. To help small farmers and landless labourers, many state governments and union territories have passed laws to reduce or even cancel these debts. This includes legislation to reduce ancestral debts and, in some cases, eliminate them. However, a major challenge is that farmers and labourers may not benefit from these laws due to a lack of awareness or fear of moneylenders.

- Many laws help to reduce or cancel old debts for farmers

b) Reducing Dependence on Moneylenders

Another important counter measure is reducing the reliance of rural people on local moneylenders, who often charge high interest rates and exploit farmers. To do this, the government has expanded the institutional credit network, including cooperatives, commercial banks, and Regional Rural Banks (RRBs), to provide affordable and timely credit to small farmers and rural artisans. However, in practice, these services are often accessed primarily by wealthier farmers, which

- Expanding credit access helps to reduce dependence on moneylenders

limits their effectiveness for those most in need. Expanding access to institutional credit for the poorer sections of rural society is critical for reducing dependence on exploitative moneylenders.

c) Control of New Loans

While settling old debts is important, controlling new borrowing is equally essential. It is necessary to ensure that farmers only borrow for productive purposes that will help to improve their agricultural productivity rather than for non-productive expenses like social or religious functions. The government can play a role by providing targeted loans for essential needs, but it is not easy to prevent non-productive borrowing completely. The Sivaraman Committee, in its 1976 report, recommended that loans for expenses like weddings, medical costs, and education should be made available through government institutions like nationalised banks and cooperatives. This would help rural people avoid borrowing from moneylenders for such needs.

- Targeted loans for productive needs reduce non-productive borrowing

d) Legislation to Protect Land Ownership

To further protect farmers, some states have passed laws preventing them from selling land to professional moneylenders who are not farmers themselves. This helps to ensure that farmers do not lose their land to moneylenders. Additionally, measures have been implemented to regulate and control the activities of moneylenders, preventing them from exploiting farmers. The government also introduced a moratorium on debt recovery in 1975 under the 20-Point Programme, offering temporary relief to farmers and landless labourers. These measures aimed to reduce rural indebtedness and protect vulnerable farmers from the dangers of bonded labour.

- Laws protect farmers' land from moneylenders and exploitation

4.1.3 Infrastructural Constraints in Agriculture

Infrastructure plays a critical role in agriculture, supporting every stage, from input supply and crop sowing to post-harvest management. Proper investment in agricultural infrastructure enhances productivity, reduces post-harvest losses, and ensures higher incomes for farmers. In India, post-harvest losses remain high due to insufficient infrastructure like storage facilities, pack houses, and efficient supply chain systems. To address these issues, the Government of India has introduced

- Investment in infrastructure reduces post-harvest losses

several initiatives to strengthen agricultural infrastructure and modernise the sector.

- GCF in agriculture increased, but challenges persist

Gross Capital Formation (GCF) in agriculture refers to the total investment in physical assets like machinery, buildings, land improvements, equipment, and inventory changes over a specific period. It is a key indicator of investment in modernising agriculture, improving productivity, and ensuring sustainability. Infrastructure development, especially post-harvest facilities, helps reduce waste, preserve produce quality, and increase farmers' income. The agriculture sector's GCF grew by 19.04% in 2022-23, with GCF as a percentage of Gross Value Added (GVA) increasing from 17.7% in 2021-22 to 19.9% in 2022-23. Despite steady growth, further investment is needed to achieve goals like doubling farmers' income, which requires a 12.5% annual growth in agricultural investment. Challenges include fragmented land and limited private corporate sector involvement (Economic Survey 2023-2024).

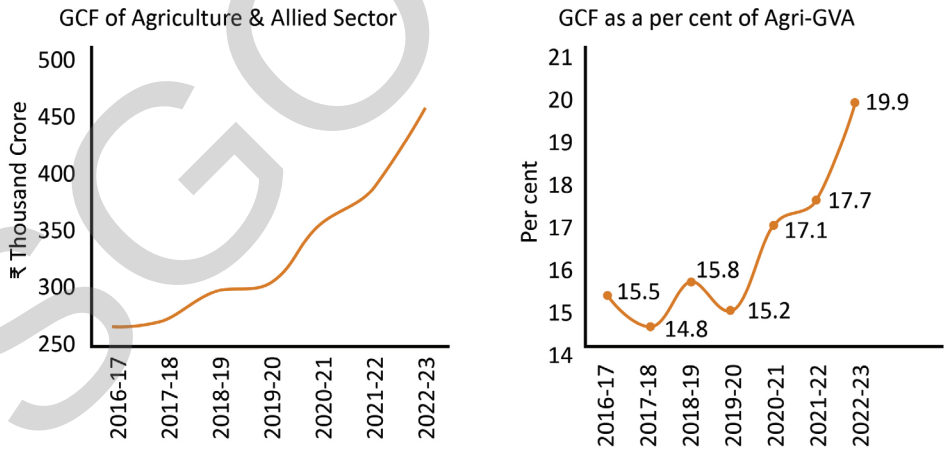

Fig 4.1.3 GCF of Agriculture & Allied Sector and GCF as a Percent of Agri-GVA

Source: Economic Survey 2023-24

The graph shows the growth of Gross Capital Formation (GCF) in the agriculture and allied sectors and its share as a percentage of Agricultural Gross Value Added (Agri-GVA). From 2016-17 to 2022-23, GCF increased significantly, reaching over ₹450,000 crores in 2022-23. The GCF as a percentage of Agri-GVA also rose from 15.5% in 2016-17 to 19.9% in 2022-23. This indicates higher investment in agriculture, improving productivity and infrastructure development.

To encourage private investment, the government launched various Programmes are:

1. **Agriculture Marketing Infrastructure (AMI):** Sub-scheme under the Integrated Scheme for Agricultural Marketing (ISAM) in 2014. According to the Economic Survey 2024-25, published in January 2025, under this AMI sub-scheme, subsidies are provided for agricultural marketing infrastructure projects. A 25% subsidy is given for projects in the plains. In contrast, projects in North-Eastern, hilly, and other specified regions, as well as those led by women, SC/ST promoters, and Farmer Producer Organisations (FPOs), can receive a higher subsidy of 33.33%. These subsidies support the development of various agricultural marketing infrastructure, including storage facilities, rural haats (local markets), common facilitation centres for FPOs, market yard infrastructure, direct marketing facilities, mobile post-harvest operations, cold storage, and integrated value chain projects up to the primary processing stage. As of October 31, 2024, a total of 48,611 storage infrastructure projects have been approved, with ₹4,795.47 crore disbursed in subsidies. Additionally, 21,004 other infrastructure projects supported under the Agricultural Marketing Infrastructure (AMI) scheme have been approved, with subsidies totalling ₹2,125.76 crore.

- Government subsidies boost agricultural infrastructure and private investment

2. **Agriculture Infrastructure Fund (AIF):** Launched in 2020, it aims to provide medium to long-term debt financing for post-harvest and community farming projects by 2025-26, with support extending until 2032-33. The scheme supports the creation of community farming assets like organic input production units, precision agriculture infrastructure, and supply chain projects for crop clusters and export clusters. Additionally, post-harvest management infrastructure such as warehouses, silos, cold chains, sorting and grading units, and logistics facilities are eligible for funding. As of July 2024, AIF mobilised ₹73,194 crore, supporting 17,196 custom hiring centres, 14,868 primary processing units, 13,165 warehouses, 2,942 sorting and grading units, 1,792 cold storage projects, and 18,981 other projects. Additionally, the Pradhan Mantri Kisan SAMPADA Yojana (PMKSY) offers grants to build efficient supply chain systems to reduce wastage and extend food shelf life. By March 2024, 1,044 projects were completed, with 1,685 projects approved, costing ₹32.78 thousand crores and receiving

- AIF supports post-harvest and community farming projects

₹9.3 thousand crores in subsidies.

The government supports state governments in improving agricultural infrastructure through various schemes discussed below.

1. **Agricultural Marketing Infrastructure (AMI):** This sub-scheme under the Integrated Scheme for Agricultural Marketing (ISAM) provides demand-driven, credit-linked subsidies to farmers, Farmer Producer Organisations (FPOs), and others for building rural storage facilities.
2. **Mission for Integrated Development of Horticulture (MIDH):** Offers financial assistance (35% of project cost in general areas and 50% in hilly/scheduled areas) for post-harvest infrastructure like cold storage linked to credit and demand.
3. **e-NAM (National Agriculture Market):** Launched in 2016, it connects 1,000 mandis across 18 states and 3 UTs, creating an online system for transparent bidding and better prices for farmers.
4. **Sub-Mission on Agricultural Mechanisation (SMAM):** Promotes farm mechanisation for small and marginal farmers by establishing Custom Hiring Centers, hubs for advanced equipment, and providing training and equipment testing since 2014.
5. **Rashtriya Krishi Vikas Yojana (RKVY):** Funds are given as grants to state governments for approved projects in agriculture and allied sectors, decided by the state-level sanctioning committee.
6. **Mission Organic Value Chain Development for the North East Region (MOVCDNER)**: Supports organic farming with financial aid for processing, certification, marketing, and infrastructure like cold storage and packaging.

- Government supports agricultural infrastructure through various schemes

4.1.4 Credit Problems

Access to credit is one of the major challenges faced by farmers in India, especially in the agriculture sector dominated by small landholders. About 89.4% of farm households own less than 2 hectares of land, making it difficult for them to secure adequate financing for investments in their farms. Their ability to invest in farming depends heavily on access to affordable and timely credit. Historically, Indian farmers relied on non-

- Indian farmers face challenges in securing affordable credit

institutional credit sources such as moneylenders, often at high interest rates. However, government initiatives have reduced the dependence on non-institutional credit.

The Government of India introduced the Kisan Credit Card (KCC) to help farmers meet their short-term working capital needs easily and quickly. This initiative has improved the flow of working capital into agriculture and related sectors. As of March 2024, there are 7.75 crore active KCC accounts with a total loan amount of ₹9.81 lakh crore. In 2018-19, the KCC was extended to cover fisheries and animal husbandry as well, with the collateral-free loan limit raised to ₹1.6 lakh. By March 2024, 1.24 lakh KCCs were issued for fisheries, and 44.40 lakh KCCs were issued for animal husbandry activities.

- Kisan Credit Card provides easy loans for farmers

Additionally, schemes like the Modified Interest Subvention Scheme (MISS) have been introduced. Under MISS, farmers can access short-term agricultural loans through KCC at a concessional interest rate of 7%. Moreover, the Prompt Repayment Incentive (PRI) rewards farmers who repay their loans on time with a 3% incentive. To make this process faster and more efficient, the Kisan Rin Portal has been introduced starting from fiscal year 2025 for digitising claim processing and settlement of MISS claims.

- Kisan Credit Card provides easy loans for farmers

To support small and marginal farmers further, banks are required to allocate 40% of their Adjusted Net Bank Credit (ANBC) or the Credit Equivalent Amount of Off-Balance Sheet Exposure (CEOBE), whichever is higher, to priority sectors, including agriculture. These efforts have greatly reduced the dependence on non-institutional sources of credit, which stood at 90% in 1950, bringing it down to around 25% in FY22. Joint Liability Groups (JLGs) have emerged as a critical source of credit for tenant farmers and marginalised groups who lack collateral. JLG accounts have grown at a Compound Annual Growth Rate (CAGR) of 43.76% in the last five years.

- Joint Liability Groups help marginal farmers access to credit

Despite these efforts, farmers face several credit problems as follows:

- **Lack of Collateral**: Many small and marginal farmers cannot provide collateral to access institutional loans.
- **Delayed Credit Disbursement:** Farmers often face delays in receiving loans, which affects their ability to invest during critical agricultural cycles.

- **High Dependence on Informal Credit:** In some regions, farmers continue to rely on informal lenders due to limited access to banks.
- **Limited Credit for Tenant Farmers:** Many tenant farmers are excluded from institutional credit due to the absence of land ownership documents.

- Farmers face credit barriers and need better policies

To overcome these challenges, policies must focus on increasing credit access for small and marginal farmers, simplifying loan processes, and encouraging private sector participation in agricultural financing. This will help to ensure sustainable investments in agriculture and improve farmers' livelihoods.

Summarised Overview

Agriculture significantly supports global food security and economic growth but poses environmental challenges like soil degradation, water depletion, and greenhouse gas (GHG) emissions, primarily from livestock and synthetic fertilisers. Sustainable farming practices and policies can mitigate these issues.

Rural indebtedness arises from poverty, unproductive expenses, reliance on moneylenders, and intergenerational debt. It leads to issues like land loss and social unrest, including movements like Naxalism. Countermeasures include settling old debts, expanding institutional credit, regulating borrowing, and protecting land ownership through laws. Encouraging productive loans, improving financial literacy, and promoting sustainable agriculture are vital for reducing rural indebtedness.

Agricultural infrastructure, like storage, cold chains, and logistics, is vital for reducing post-harvest losses and improving productivity. Infrastructural and credit challenges are addressed through initiatives like the Agriculture Infrastructure Fund (AIF) and Kisan Credit Card (KCC). However, farmers still face issues like lack of collateral, delayed disbursements, and limited credit for tenant farmers.

Assignments

1. What are the environmental issues caused by agriculture?
2. What are the main causes of rural indebtedness in India? Explain with examples.
3. What are the key infrastructural constraints faced by the agricultural sector in India?

4. Examine the challenges farmers face in accessing agricultural credit from formal institutions.
5. What steps can the government and financial institutions take to improve credit availability for small and marginal farmers?

Suggested Reading

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 2 Climate Change and Its Impact on Agriculture

Learning Outcomes

After completing this unit, the learner will be able to:

- examine climate issues affecting agriculture
- identify the causes and effects of biodiversity loss in farming
- describe the factors leading to land degradation
- know about sustainable farming methods

Background

As you know, agriculture is the backbone of many economies. It provides food, raw materials, and employment to millions of people. However, in recent years, farmers and the agricultural sector have faced several challenges. Climate change has led to unpredictable weather patterns, including droughts, floods, and heatwaves, which reduce crop yields and make farming difficult.

One major concern is the loss of biodiversity. Over time, excessive use of chemical fertilisers and pesticides, deforestation, and monocropping have reduced the variety of plants and animals in the ecosystem. This loss affects soil health, pollination, and pest control, making agriculture more vulnerable. Land degradation is another critical issue. Continuous farming without proper soil management leads to soil erosion, loss of nutrients, and desertification. As a result, farmers struggle to grow enough crops, leading to lower incomes and food shortages.

To address these challenges, adaptive agricultural practices have been developed. These include sustainable farming techniques like crop rotation, organic farming, agroforestry, and water conservation methods. Understanding these issues is essential for developing policies that support farmers.

Keywords

Climate Issues, Loss of Biodiversity, Land Degradation, Farmers Distress, Adaptive Agricultural Practices

Discussion

4.2.1 Climate Issues in Agriculture

- Climate change threatens agriculture and food security

Climate change, caused by increasing greenhouse gas emissions, is raising global temperatures and affecting weather patterns, which in turn impacts agricultural production. The 1990s saw record-high temperatures, with more heat waves and fewer frosts. Climate models predict that temperatures could rise by up to 6°C by the year 2100 (IPCC). However, the magnitude and timing of impacts remain uncertain, especially at regional levels. Food security is at risk, with tropical regions expected to face greater economic challenges than temperate areas.

- Climate change reduces crop yields, food security, and income

The Government of India recognises the serious impact of climate change on agriculture and farmers' livelihoods. To understand this impact, extensive field and simulation studies were conducted across different regions of the country. Using advanced crop simulation models, researchers analysed how projected climate conditions for the years 2050 and 2080 would affect crop yields. The results show alarming trends; i.e., without adaptation measures, rainfed rice yields could decline by 20% by 2050 and 47% by 2080. Even irrigated rice yields are expected to decrease by 3.5% in 2050 and 5% in 2080. Wheat yields are projected to fall by 19.3% by 2050 and 40% by 2080, with notable differences depending on the region and season. Similarly, kharif maize yields may decrease by 18% in 2050 and 23% in 2080. These reductions in crop yields not only threaten food security but also lower the nutritional quality of agricultural produce. Moreover, extreme weather events such as droughts can disrupt food supply, reduce farmers' incomes, and affect their consumption patterns.

- NMSA promotes climate-resilient sustainable agriculture

To address these challenges, the Government of India has implemented various strategies to make agriculture more resilient to climate change. One such initiative is the National Mission for Sustainable Agriculture (NMSA), which is part

of the National Action Plan on Climate Change (NAPCC). This mission focuses on developing and applying strategies to help farmers adapt to climate change and ensure sustainable agricultural practices.

To address the challenges of sustaining domestic food production in the face of climate change, the Indian Council of Agricultural Research (ICAR), under the Ministry of Agriculture and Farmers Welfare, launched a major research initiative called the National Innovations in Climate Resilient Agriculture (NICRA) in 2011. This project focuses on developing and promoting climate-resilient technologies to help farmers in vulnerable regions of the country cope with extreme weather conditions like droughts, floods, frost, and heat waves. These efforts aim to reduce the economic losses caused by climate change and improve agricultural productivity.

- NICRA develops climate-resilient technologies for farmers

NICRA includes both short-term and long-term research programmes to address adaptation and mitigation strategies in key areas such as crops, horticulture, livestock, fisheries, and poultry. The main focus areas of the project are as follows.

i. Identifying the most vulnerable districts and regions that are at high risk due to climate change.
ii. Developing crop varieties and management practices to adapt to and mitigate the impacts of climate change.
iii. Assessing the effects of climate change on livestock, fisheries, and poultry, and creating suitable strategies for adaptation.

- NICRA develops climate-resilient crops, technologies, and adaptation strategies

Since 2014, significant progress has been made under this initiative. A total of 1,888 climate-resilient crop varieties have been developed, along with 68 location-specific technologies that address the unique needs of different regions. These technologies have been successfully tested and demonstrated to farming communities. Through NICRA, the government aims to improve the sustainability of agriculture, protect the income of farmers, and ensure food security in the face of climate change.

4.2.2 Loss of Biodiversity

Biological diversity refers to the variety of living organisms across terrestrial, marine, and aquatic ecosystems. It includes diversity within species, between species, and among

ecosystems. Biodiversity provides essential goods and services, contributing to food security, agriculture, medicine, and industry, forming the foundation of life on Earth.

- Biodiversity is vital but poses challenges

However, biodiversity loss, driven by natural and anthropogenic pressures, poses significant challenges to India's environment and economy. With its status as one of the world's 17 megadiverse countries, India is committed to addressing this issue to safeguard its natural wealth and economic stability.

- CBD promotes biodiversity conservation

The United Nations Convention on Biological Diversity (CBD) is a major international agreement that recognises the sovereign rights of countries over their biological resources. It aims to promote the conservation and sustainable use of biodiversity while ensuring fair and equitable sharing of benefits arising from the use of biological resources. This includes addressing the cost and benefit-sharing challenges between developed and developing nations and supporting local innovation. The CBD came into force on December 29, 2003, and has been ratified by 188 countries, including India.

- India's Biodiversity Act ensures conservation and benefit-sharing

India was among the first countries to enact comprehensive legislation to meet the objectives of the CBD. The Biological Diversity Act, 2002, and Biological Diversity (Amendment) Act, 2023 provide the legal framework to conserve biodiversity, promote its sustainable use, and ensure fair benefit-sharing. A key aim of the Act is to prevent bio-piracy by requiring foreign individuals and organisations to share benefits from the use of India's biodiversity and traditional knowledge.

- NBA protects and manages India's biodiversity resources

The National Biodiversity Authority (NBA), headquartered in Chennai, is the primary institution responsible for implementing the Biodiversity Act of 2002. Its main functions include granting permissions to foreign companies to access biological resources, regulating the transfer of research findings, and advising the government on biodiversity related matters. This includes identifying threatened species, establishing biological resource repositories, and determining exemptions for resources traded as commodities. The NBA also supports the establishment of State Biodiversity Boards to strengthen biodiversity conservation efforts across India. India has made significant progress in land management and biodiversity conservation, showcasing several key achievements as listed below.

Protected Areas: India has established 1,022 protected areas covering 178,640 square kilometres, which is about 5.43% of the country's total geographical area.

Forest Cover: India's forest cover has steadily increased, from 21.23% in 2013 to 21.71% in 2021. According to the Food and Agriculture Organisation's (FAO's) Global Forest Resource Assessment 2020, India has 72.16 lakh hectares of forest cover, placing it among the top ten countries globally. The India State of Forest Report (ISFR) 2023, published by the Forest Survey of India (FSI), provides a detailed assessment of India's forest resources every two years using satellite data and field surveys. According to the latest report, published in December 2024, India's forest and tree cover now extends to 827,357 square kilometres, which is 25.17% of the country's total land area.

Eco-Sensitive Zones: To protect biodiversity, Eco-Sensitive Zones have been designated around 487 Protected Areas across the country.

Ramsar Sites: Wetlands of international importance, known as Ramsar sites, have increased significantly, from 26 in 2014 to 85 in 2024. These wetlands are crucial for maintaining ecological balance.

- India expands conservation efforts, protecting forests and wildlife

Tiger Reserves and Population: India has 55 Tiger Reserves, and its tiger population has grown from 2,226 in 2014 to 3,682 in 2022, demonstrating successful conservation efforts under projects like Project Tiger.

Project Lion: India's efforts under Project Lion have led to a significant increase in the lion population in the Gir region, from 284 in 1990 to 674 in 2020.

Cheetah Reintroduction: India successfully carried out the world's first inter-continental large wild carnivore translocation project, reintroducing cheetahs into their natural habitat.

Elephant Reserves: With 33 Elephant Reserves, India is home to the largest population of wild Asian elephants, estimated at 30,000, which accounts for nearly 60% of the global population of this species.

Leopard Population: India's leopard population has shown stability, with an estimated 13,874 in 2022, compared to

12,852 in 2018 in similarly sampled areas.

Namami Gange Programme: India's Namami Gange Programme, aimed at rejuvenating the Ganga River and its tributaries, has been recognised by the United Nations as a World Restoration Flagship Project.

- India matches biodiversity targets with global conservation framework

India has made significant progress in matching its biodiversity goals with global standards. On 10th September 2024, India submitted its National Biodiversity Targets under the National Biodiversity Strategy and Action Plans (NBSAP) to the Convention on Biological Diversity (CBD) Portal. The NBSAP, submitted on 31st October 2024 during the CBD COP held in Cali, Colombia, matches fully with the Kunming-Montreal Global Diversity Framework (KMGBF). This framework provides global biodiversity goals and targets, which countries implement based on their national circumstances, priorities, and capabilities.

- NBSAP protects ecosystems and promotes sustainability

India's NBSAP focuses on protecting terrestrial and marine areas, restoring degraded ecosystems, and reducing biodiversity threats through measures like pollution control and managing invasive species. Key strategies include species conservation, promoting the sustainable use of natural resources, and establishing wildlife corridors to prevent habitat fragmentation. India also emphasises the importance of community engagement in biodiversity governance, recognising the role of local populations in ensuring effective biodiversity conservation and sustainable resource management. These actions reflect India's commitment to preserving its biodiversity while contributing to global conservation efforts.

4.2.2.1 Biodiversity Loss and Habitat Destruction

- Habitat destruction threatens biodiversity and causes extinction

The habitat is the natural environment where an organism is biologically suited to live. Most plants and animals have specific habitat requirements, and any changes to these parameters can negatively impact their survival. Habitat degradation caused mainly by human activities is considered the greatest threat to biodiversity. As habitats are modified or destroyed, many species become threatened or face extinction.

Ecologists estimate that at least 120 out of 620 primate species (such as apes, monkeys, and lemurs) could become extinct within the next 20 years. Large animals like tigers, mountain

- Many primates and large animals face extinction

gorillas, pandas, Indian lions, tropical orchids, and spotted owls are particularly vulnerable because they require large areas of habitat to survive.

- Human activities are leading contributors to habitat loss

According to a report by the IUCN (2000), habitat loss has already adversely affected 89% of all threatened birds, 83% of all threatened mammals, and 91% of all threatened plants. Habitat degradation is often caused by natural disasters like floods, fires, and cyclones, but human activities are the leading contributors. These include shifting cultivation, overgrazing, water and soil pollution, mining, and construction of dams. Each of these activities disrupts ecosystems and reduces the availability of suitable habitats for various species.

4.2.2.2 Importance of Biodiversity to India's Economy

- Ecosystems form the backbone of several economic activities

India is home to nearly 8% of the world's documented species, including approximately 55,726 floral species and 104,561 faunal species (Table 4.2.1). These ecosystems provide provisioning, regulating, cultural, and supporting services that form the backbone of several economic activities.

Table 4.2.1 Floral and Faunal Species Diversity and Endemism-2023

Category	Number of Species	Number of Endemic Species	Number of Threatened Species
Flora	55,726	14,770	2,869
Fauna	104,561	1,582	1,024
Total	160,287	16,352	3,893
Biodiversity Hotspots	4	-	-

Source: Botanical and Zoological Survey of India, 2023

Biodiversity plays a crucial role in supporting various ecosystem services that are essential for economic activities and human well-being. In agriculture, biodiversity helps through

pollination, which is vital for crop production, maintaining soil fertility, and providing natural pest control, reducing the need for costly chemical inputs. In forestry, it supports the supply of valuable resources such as timber and non-timber products like fruits, resins, and medicinal plants, which contribute to livelihoods and industries. For water resources, ecosystems like wetlands and forests regulate water cycles, ensuring a steady supply of clean water, which is critical for agriculture, industries, and domestic use. Moreover, biodiversity aids in climate regulation, as forests and mangroves act as carbon sinks, absorbing carbon dioxide and mitigating the impacts of climate change. These ecosystems also provide natural protection against natural disasters such as floods and cyclones, reducing potential economic losses.

- Biodiversity supports ecosystems, economy, and climate regulation

4.2.2.3 Drivers of Biodiversity Loss

India's biodiversity is under pressure due to multiple factors.

1. **Deforestation and Habitat Loss:** Rapid urbanisation, agricultural expansion, and infrastructure projects have led to the loss of forest cover. Between 2000 and 2023, India's protected areas grew marginally from 1.54 lakh sq. km to 1.78 lakh sq. km, but habitat fragmentation persists.

- Rapid urbanisation, agricultural expansion, and infrastructure projects have to the loss of forest cover

Table 4.2.2 Forest Cover Trends in India (2000-2023)

Year	Total Forest Area (sq. km)	Protected Areas (sq. km)
2000	67,914	1,54,156
2023	71,747	1,78,641

Source: ***Wildlife Institute of India***

2. **Agricultural Intensification:** Monocropping, excessive use of chemical fertilisers, and pesticide application reduce soil fertility and harm pollinators such as bees.

3. **Climate Change:** Rising temperatures and erratic rainfall patterns disrupt ecosystems, impacting species distribution and agricultural productivity.

4. Invasive Alien Species: India hosts 178 invasive species, including 60 terrestrial plants and 57 aquatic species, which threaten native ecosystems (Table 4.2.3).

Table 4.2.3 Key Invasive Alien Species in India

Ecosystem	Number of Invasive Species
Terrestrial Plants	60
Aquatic Ecosystems	57
Agricultural Ecosystems	47

Source: ***National Biodiversity Authority, 2023***

- India's biodiversity is threatened by habitat loss, invasive species

4.2.2.4 Economic Impacts of Biodiversity Loss

The loss of biodiversity has significant economic impacts across various sectors. In agriculture and food security, the decline in pollinators has led to reduced yields for important crops like fruits and oilseeds, directly affecting rural livelihoods. Additionally, soil degradation caused by biodiversity loss lowers agricultural productivity, forcing farmers to rely more on chemical fertilisers, which increases production costs. In forestry, deforestation has reduced the availability of valuable resources such as timber and non-timber forest products, negatively impacting industries and communities that depend on these resources for their income. Biodiversity loss also increases disaster vulnerability; the destruction of ecosystems like mangroves and wetlands worsens the effects of floods and cyclones, leading to higher economic costs for disaster management and recovery. Furthermore, the loss of biodiversity affects healthcare by reducing the availability of medicinal plants and increasing reliance on expensive synthetic alternatives.

- Biodiversity loss harms agriculture, economy

Table 4.2.4 Estimated Economic Costs of Biodiversity Loss in Key Sectors

Sector	Estimated Annual Loss (INR Crore)
Agriculture	15,000
Forestry	10,000
Disaster Response	5,000
Healthcare	2,000

- The destruction of ecosystems worsens the effects of floods and cyclones

Source: ***Ministry of Environment, Forest and Climate Change, 2024***

4.2.2.5 Government Initiatives to Combat Biodiversity Loss

National Biodiversity Action Plan: Focuses on conservation and sustainable use of biological resources.

Protected Areas Network: India's network of 106 national parks and 573 wildlife sanctuaries protects critical habitats (Table 4.2.5).

Soil Health Card Scheme: Launched in 2015, it promotes sustainable agricultural practices that benefit biodiversity in agroecosystems.

Table 4.2.5 Protected Areas in India (2023)

Category	Number	Area (sq. km)
National Parks	106	44,403
Wildlife Sanctuaries	573	1,27,198
Conservation Reserves	123	5,585
Total	1,022	1,78,641

- India implements initiatives to conserve and protect biodiversity

Source: ***Wildlife Institute of India, 2023***

4.2.2.6 Linkages with Sustainable Development Goals (SDGs)

- Biodiversity conservation helps to achieve key SDGs

Biodiversity conservation is closely connected to achieving several Sustainable Development Goals (SDGs), which aim to promote economic, social, and environmental well-being. For Goal 2 (Zero Hunger), biodiversity plays a key role in improving soil health and supporting pollination, which is essential for increasing food security and ensuring sustainable agricultural productivity. For Goal 6 (Clean Water), ecosystems like wetlands and forests help to regulate water cycles, ensuring access to clean and reliable water resources for households, industries, and agriculture. In line with Goal 13 (Climate Action), forests act as carbon sinks, absorbing carbon dioxide and helping to mitigate the effects of climate change. Finally, for Goal 15 (Life on Land), protecting ecosystems and preventing habitat destruction are vital for ensuring the long-term sustainability of natural resources, which support livelihoods and economic growth.

4.2.2.7 Recommendations for Sustainable Biodiversity Management

- Biodiversity conservation ensures sustainability

Effective management of biodiversity requires a combination of strategies to ensure long-term sustainability and economic benefits. Integrated conservation approaches should be strengthened, including in-situ conservation, such as creating and maintaining protected areas, and ex-situ conservation, like establishing gene banks to preserve genetic diversity. Encouraging community participation is crucial, and this can be achieved by involving local communities through Biodiversity Management Committees, empowering them to take part in decision-making and resource management. In sustainable agriculture, practices such as organic farming, crop rotation, and agroforestry should be promoted to increase agricultural productivity while conserving ecosystems. To tackle the issue of invasive species, strict monitoring and control measures must be implemented to prevent their introduction and spread, which can harm local ecosystems and economies. Finally, increasing public awareness and education about the economic value of biodiversity is essential. This can be done through educational campaigns and community engagement, ensuring that people understand the importance of preserving biodiversity for sustainable development.

4.2.3 Land Degradation

- India aims for 33% forest and tree cover

India, the seventh-largest country in the world, comprises a total geographic area of 328.73 million hectares, representing only 2.4% of the world's land area. Despite this, it supports over 18% of the global human population and an equal proportion of the world's cattle population. India is among the top ten forested nations, with its forest and tree cover expanding in recent years due to national policies aimed at conservation and sustainable forest management. The National Forest Policy of India (1988) targets to achieve forest and tree cover over 33% of its total land area.

- Land degradation affects India's economy, environment, and livelihoods

Land degradation, a significant environmental challenge, refers to the decline in the productive capacity of land due to natural processes and human activities. In India, this issue has become a critical concern, affecting the economy, environment, and livelihoods of millions. Land degradation in India is caused by both biotic factors like human and animal activity and abiotic factors (natural disasters like droughts and floods). Overexploitation of soil and water resources, unscientific land use, and population pressure are the primary drivers of this problem. Drylands account for 69.6% of India's land (approximately 228.3 million hectares). Current estimates indicate that 29-35% of the total geographical area is affected by degradation. According to the Desertification and Land Degradation Atlas of India (2021), land degradation impacted 97.85 million hectares, or 29.77% of India's geographical area, during 2018–19. Additionally, a 1.45 million-hectare increase in degraded land (0.44% of the total area) was recorded between 2011–13 and 2018–19. States contributing most significantly to land degradation include Rajasthan (23.79%), followed by Maharashtra, Gujarat, Karnataka, Ladakh, Jharkhand, Odisha, Madhya Pradesh, and Telangana.

- Wasteland restoration in India has shown progress

On a positive note, efforts to restore wastelands have shown measurable success. According to the Wasteland Atlas of India (2019), the area classified as wastelands decreased from 566,070.36 sq. km. in 2008–09 to 557,665.51 sq. km. in 2015–16, reflecting a restoration of 8,404.86 sq. km. Significant improvements were noted in Rajasthan, where 4,803.56 sq. km. of sandy wastelands were converted into productive land, followed by Uttar Pradesh and Bihar, with 1,082.29 sq. km. and 1,130.07 sq. km. restored, respectively.

Conversely, some states saw an increase in wastelands, including Odisha (465.82 sq. km.), Assam (406.69 sq. km.), Telangana (377.79 sq. km.), and Chhattisgarh (373.54 sq. km.), which require urgent attention under current action plans. The most significant reductions in wastelands occurred in categories such as 'Land with Dense Scrub,' 'Snow/Glacial Cover,' and 'Sands–Semi Stabilised.' However, increases were noted in categories such as 'Barren Rocky/Stony Waste,' 'Land with Open Scrub,' and 'Degraded Forests.' Notable progress was observed in the transformation of wastelands to 'Cropland', with considerable improvements also in forested areas and fallow lands between 2008-09 and 2015-16.

- Wasteland increased in some states

4.2.3.1 Causes of Land Degradation in India

Water Erosion: The leading cause of land degradation in India, water erosion, affects 11.01% of the total land area. It occurs due to unchecked deforestation, overgrazing, and unsustainable agricultural practices, which lead to loss of topsoil and reduced fertility.

Vegetation Degradation: This accounts for 9.15% of land degradation and results from deforestation, overgrazing, and excessive exploitation of forest resources.

Wind Erosion: Predominantly affecting arid and semi-arid regions, wind erosion impacts 5.46% of the land area, leading to desertification in states like Rajasthan and Gujarat.

Salinisation: Excessive irrigation and poor drainage systems have caused salinity issues, rendering land unproductive. This problem is particularly severe in states like Punjab and Haryana.

- Water erosion is the leading cause of degradation

Anthropogenic Activities: Rapid urbanisation, industrialisation, mining, and unregulated use of natural resources contribute significantly to land degradation.

4.2.3.2 Economic Impacts of Land Degradation

- Land degradation costs India approximately 2.5% of its GDP

The annual cost of land degradation in India is estimated at ₹3177 billion, equivalent to 2.5% of the national GDP. This financial burden stems from reduced agricultural productivity, loss of biodiversity, and increased costs for restoration. Additionally, land degradation disproportionately affects sectors like agriculture, forestry, and fisheries, which account for 15.9% of the gross value added to the economy. For a

country where agriculture employs 42.6% of the workforce, this poses significant economic challenges.

Socio-economic Consequences

Land degradation has significant effects on society and the economy. For farmers and pastoralists who rely on the land for their livelihood, declining soil quality and productivity mean lower crop yields and reduced income. This can push many families into poverty. When land becomes unproductive, people are often forced to migrate to cities in search of better opportunities. This migration leads to overcrowding in urban areas, and places stress on housing, transportation, and other urban infrastructure. Additionally, reduced agricultural output affects food security, as there is less food available locally. This situation can increase dependency on imported food, which may raise prices and strain the economy.

- Land degradation affects livelihoods, migration, and food security

4.2.3.3 Government Initiatives to Combat Land Degradation

The Government of India has taken proactive steps to combat land degradation and desertification. In 2001, India developed the National Action Plan to Combat Desertification (NAPCD), becoming the first country globally to introduce such a comprehensive plan. This plan is now being updated and revised to integrate regional and thematic strategies and align them at the national level. The goal is to achieve land degradation neutrality and address challenges like biodiversity loss and climate change in the long term.

- India updates plan to combat desertification

Another key initiative is the Desertification and Land Degradation Atlas of India, published by the Space Applications Centre (SAC) of the Indian Space Research Organisation (ISRO). This atlas provides detailed data on the extent of degraded and desertified land in the country, which was estimated to be 97.84 million hectares in 2018-19. It also offers state-wise data, helping in planning and implementing restoration programmes using this valuable technical information.

- ISRO's atlas maps India's land degradation extent

To improve accessibility, an online portal has been developed with the help of SAC, Ahmedabad. This portal allows users to view degraded land areas and understand the processes causing degradation. The government has also proposed a Centre of Excellence at the Indian Council for Forestry

- India establishes centre for sustainable land management

Research and Education (ICFRE) in Dehradun. This centre will promote South-South Cooperation by sharing knowledge, best practices, and India's experience in cost-effective and sustainable land management strategies. It will also develop innovative projects and train stakeholders for better land restoration.

- India pledges to restore 26 million hectares

On the global front, India is actively participating in international efforts to combat land degradation. Under the Bonn Challenge, a global initiative, India pledged at the 2015 UN Climate Change Conference (COP21) in Paris to restore 13 million hectares of degraded land by 2020 and an additional 8 million hectares by 2030. This target was later increased to 26 million hectares during COP14 of the United Nations Convention to Combat Desertification (UNCCD) in 2019. Progress on these pledges is regularly reported to the International Union for Conservation of Nature (IUCN).

The Twenty Point Programme also reports afforestation efforts, which have covered approximately 18.94 million hectares from 2011-12 to 2021-22. This includes contributions from state and central government schemes, showcasing a united effort toward land restoration.

- Afforestation and coastal habitat restoration efforts continue

A remarkable example of afforestation can be found in Tamil Nadu. In Tamil Nadu, efforts are underway to rehabilitate coastal habitats through the creation of a bio-shield from 2023-24 to 2025-26. This initiative focuses on eco-restoration of 11.25 sq. km of existing mangrove ecosystems and new mangrove plantations over 3.28 sq. km in districts like Thanjavur, Mayiladuthurai, and Nagapattinam. The programme also involves planting tree species like Casuarinas, Cashew, Palmyrah, and various mangroves, which serve as protective shields. Additionally, the scheme emphasises training, awareness, and community involvement to ensure its success.

Land degradation in India is a multifaceted issue requiring coordinated efforts at local, regional, and national levels. Through sustainable practices, effective policies, and active community participation, India can combat this challenge.

4.2.4 Farmers Distress

Farmers are the backbone of India's economy, often referred to as 'Annadatas' or providers of food. The agricultural

- Farmers are vital to India's economy and food security

sector contributes about 16% of the country's GDP for FY24 (Provisional Estimate) at current prices and provides support to around 46.1% of the population. About 54.8% of India's land area, around 328.7 million hectares, is used for agriculture, with a cropping intensity of 155.4%. This means farmers are not just growing crops but are key to rural development and food security. Their hard work and innovation drive the nation's economy and ensure millions of livelihoods. However, despite their critical role, farmers face numerous challenges that put their welfare at risk.

- Indian farmers face climate and institutional challenges

Farmers in India face numerous challenges, primarily driven by nature and systemic issues. They often endure the devastating effects of droughts, unseasonal rainfall, and heavy downpours, which extensively damage crops. Additionally, small farmers struggle due to weak institutional support. For instance, poor storage facilities lead to spoilage of up to 30% of fruits and vegetables.

- Rising costs and debt burden farmers heavily

The cost of production often exceeds the minimum support price due to the rising prices of diesel and other inputs. The declining capital formation in agriculture over the decades has severely impacted irrigation and rural infrastructure. These challenges have led to increasing indebtedness among farmers, with 55% of farming households in debt, according to the 59th NSS survey. Tragically, these factors have contributed to an alarming rise in farmer suicides, particularly in regions like Vidarbha in Maharashtra.

4.2.4.1 Causes of Poor Economic Condition of Farmers

Low Social Status: Most agricultural workers belong to marginalised communities that have been historically neglected. This social disadvantage limits their ability to assert their rights and demand better conditions.

Unorganised Labour: Agricultural workers are spread across rural areas and lack organisation, making it difficult for them to form unions and negotiate for better wages and working conditions.

Seasonal Employment: The nature of agricultural work is seasonal, providing employment only during certain times of the year. This leads to periods of unemployment and underemployment, causing income instability.

Lack of Non-Agricultural Jobs: There are few non-agricultural employment opportunities in rural areas. This oversupply of labour in agriculture drives down wages and keeps the economic conditions of farm workers poor.

- Farmers struggle with debt, low wages, and instability

Rural Indebtedness: Many farm labourers are indebted to landowners and moneylenders, often resulting in bonded labour. This indebtedness diminishes their economic freedom and perpetuates poverty.

4.2.4.2 Five-Point Action Plan

The National Commission on Farmers, under the chairmanship of Dr.M.S Swaminathan in 2004, has proposed a concise action plan to revive agriculture. They are as follows.

Enhance Soil Health: Focus on improving soil quality through integrated measures involving nutrients and organic content.

Promote Water Harvesting: Empower local communities to manage water resources efficiently and promote sustainable practices in rain-fed areas.

Reform Credit Systems: Make loans more affordable, introduce gender-sensitive credit delivery, and extend repayment cycles in drought-prone regions.

- Proposed five-point action plan to revive agriculture

Bridge Knowledge Gaps: Train farmers in scientific methods and post-harvest techniques through programs like Krishi Vigyan Kendras.

Minimise Risk and Ensure Fair Prices: Create a Risk Stabilisation Fund and implement a farmer-centric Minimum Support Price scheme to stabilise incomes.

4.2.4.3 Government Measures Pertaining to Agricultural Labour

Abolition of Agrarian Slavery: The Indian Constitution prohibits serfdom, and legal measures have been taken to abolish bonded labour, though its practical elimination is still ongoing.

Minimum Wages Act: Enacted in 1948, this act mandates the fixation of minimum wages for agricultural labour by state governments, considering local living costs. Effective

enforcement of this act remains a challenge. As of 2024, the national floor-level minimum wage is around ₹178 per day.

Land Redistribution: Laws have been passed to abolish the Zamindari system and redistribute land to landless labourers, aiming to reduce economic disparities.

- Government efforts to improve agricultural labour conditions

Promotion of Labour Cooperatives: Government projects have encouraged the formation of labour cooperatives, providing employment and reducing dependency on landlords.

Employment Guarantee Schemes: Programmes like the Employment Guarantee Scheme ensure that rural labourers are provided with work or compensation, which helps to stabilise their income during off-seasons.

- Government initiatives support farmers with finance, insurance, infrastructure

The government of India has recently introduced several initiatives to support farmers and the agricultural sector, aiming to address various challenges. Programmes like PM-KISAN, PMFBY (Pradhan Mantri Fasal Bima Yojana), PM-KMY (Pradhan Mantri Kisan Maandhan Yojana), along with schemes like the Modified Interest Subvention Scheme (MISS), Kisan Credit Card (KCC), and Agriculture Infrastructure Fund (AIF), provide financial assistance, insurance, affordable credit, and infrastructure development. In the financial year 2025-26, the government has allocated ₹1,37,757 crore to the Ministry of Agriculture and Farmers Welfare, which accounts for 2.7% of the total Union Budget.

4.2.5 Adaptive Agricultural Practices

- Adaptive practices build resilient, sustainable, and productive farming

Adaptive agricultural practices are methods that farmers use to cope with changes in the environment, climate, economy, and society. These practices aim to make farming systems more resilient to challenges like droughts, floods, or market fluctuations while also increasing productivity and sustainability. Focusing on conserving natural resources, reducing greenhouse gas emissions, and maintaining soil health are methods that help minimise damage to ecosystems. Examples include using climate-smart agriculture techniques like crop rotation and agroforestry, managing water efficiently through drip irrigation and rainwater harvesting, and adopting soil conservation methods like mulching and no-till farming. Farmers also grow resilient crop varieties, diversify crops, and use integrated pest management.

The government of India has introduced several initiatives to help farmers adapt to the changing climate, with a particular focus on improving water use, food security, and the resilience of agriculture. These initiatives are part of a broader strategy to mitigate the impact of climate change on Indian agriculture and ensure that farming remains sustainable in the long term.

One of the key programmes aimed at achieving this goal is the National Mission for Sustainable Agriculture (NMSA). NMSA is a part of the National Action Plan on Climate Change (NAPCC), which seeks to develop and implement strategies to make Indian agriculture more resilient to climate change. One of the major components under NMSA is the Per Drop More Crop initiative. This programme focuses on improving water use efficiency on farms by promoting the adoption of precision irrigation and other water-saving technologies. These methods not only help to conserve water but also improve agricultural productivity, as farmers are encouraged to use irrigation systems like drip and sprinkler irrigation. To support the adoption of these technologies, the government provides subsidies to farmers, making it easier for them to invest in micro-irrigation systems. This approach helps to increase the area under efficient irrigation, leading to higher yields with less water.

- NMSA promotes efficient irrigation for climate-resilient agriculture

In addition to improving water efficiency, the government is also promoting organic farming across the country. Since 2015-16, two significant schemes have been introduced to support organic agriculture, viz; the Paramparagat Krishi Vikas Yojana (PKVY) and the Mission Organic Value Chain Development for the North Eastern Region (MOVCDNER). Both schemes aim to support farmers transitioning to organic farming by providing end-to-end support, including training, certification, and market access. This comprehensive approach helps farmers produce, process, and sell organic products, ensuring that they can achieve financial benefits while contributing to environmental sustainability. Furthermore, Direct Benefit Transfer (DBT) is provided to farmers who use organic fertilisers. While PKVY is implemented across the country (excluding the North East), MOVCDNER is specifically designed for the North Eastern states for promoting organic farming in these regions.

- Government supports organic farming through PKVY and MOVCDNER

To further enhance the adoption of traditional and sustainable practices, the government has also launched the Bharatiya

- BPKP promotes traditional farming for soil health

Prakritik Krishi Paddhati Programme (BPKP) in 2019. This scheme focuses on promoting indigenous farming practices that have been tried and tested over generations. BPKP aims to raise awareness among farmers about the benefits of these traditional methods and encourages their use to improve soil health and sustainability.

- MIDH, agroforestry, and bamboo mission promote resilient farming systems

In addition to these programmes, the Mission for Integrated Development of Horticulture (MIDH), Agroforestry, and the National Bamboo Mission are also working to increase the climate resilience of Indian agriculture. These missions promote practices like agroforestry, where trees are integrated with crops, and the cultivation of bamboo, having environmental and economic benefits. These initiatives not only enhance the resilience of farming systems to climate change but also provide additional sources of income for farmers through the sale of timber, fruits, and other products.

- PMFBY provides crop insurance against climate risks

Another important government initiative is the Pradhan Mantri Fasal Bhima Yojana (PMFBY), which provides crop insurance to protect farmers from the financial impact of natural calamities. Under this scheme, farmers are insured against crop losses due to events like droughts, floods, and other extreme weather conditions. This insurance helps farmers recover from unforeseen losses and ensures that they do not face economic distress due to unpredictable climate events.

- DA&FW promotes climate-resilient, nutritious millets production

The Department of Agriculture and Farmers Welfare (DA&FW) has also implemented a Sub-Mission on Nutri-Cereals (Millets) under the National Food Security Mission (NFSM). This initiative is aimed at promoting the production of nutritious cereals like millet, which are more resilient to climate change than traditional crops like wheat and rice. Farmers are incentivised to grow these crops through subsidies for crop production and protection technologies, the distribution of certified seeds, and the promotion of Integrated Nutrient and Pest Management techniques. Additionally, training and capacity building for farmers are key components of the programme, which helps them to improve their knowledge and skills to enhance productivity and sustainability.

- Resource-saving technologies empower farmers for sustainable livelihoods

Finally, the promotion of resource conservation technologies, such as improved farm implements, water-saving devices, and machinery, is an integral part of these initiatives. These tools help farmers adopt more efficient farming methods, reduce costs, and improve productivity while conserving

natural resources like water and soil. Through these combined efforts, the government is ensuring that farmers have the tools, knowledge, and support needed to adapt to the changing climate and secure their livelihoods in the long term.

- NICRA researches and develops climate-resilient agricultural technologies

The Indian Council of Agricultural Research (ICAR), under the Ministry of Agriculture and Farmers Welfare, Government of India, has launched a major project called National Innovations in Climate Resilient Agriculture (NICRA). The goal of this project is to study how climate change impacts different sectors of agriculture, including crops, livestock, horticulture, and fisheries. It focuses on developing and promoting technologies that can help to make agriculture more resilient to climate change. These technologies are particularly useful for regions vulnerable to extreme weather events like droughts, floods, heatwaves, and frosts.

Some of the key achievements of ICAR under this project are as follows.

1. **Development of Climate-Resilient Varieties:** Over the past 10 years (2014-2024), ICAR has developed and released 2,593 new varieties of crops. Out of these, 2,177 varieties have been found to be resistant to one or more biotic (pests and diseases) and abiotic (drought, salinity, etc.) stresses, making them more resilient to climate change impacts.
2. **Risk and Vulnerability Assessment:** ICAR has conducted a district-level assessment of the risks and vulnerabilities of agriculture to climate change. This assessment, done according to the Intergovernmental Panel on Climate Change (IPCC) protocols, covers 651 agricultural districts across India. It identifies 109 districts as 'very high' vulnerability and 201 districts as 'highly' vulnerable to climate change impacts.
3. **District Agriculture Contingency Plans (DACPs):** In response to these assessments, ICAR has developed District Agriculture Contingency Plans for the identified districts. These plans provide solutions for weather-related issues like droughts, floods, unseasonal rains, heatwaves, frost, and cyclones. The plans recommend specific climate-resilient crops, varieties, and management practices tailored to the needs of each district.
4. **Climate Resilient Villages (CRVs):** As part of NICRA, ICAR has introduced the concept of 'Climate Resilient

Villages' (CRVs). Under this initiative, 448 CRVs in 151 vulnerable districts have been developed to showcase climate-resilient technologies. These technologies include climate-smart practices that farmers can adopt to cope with the changing climate.

- ICAR develops climate-resilient varieties

5. **Capacity Building and Awareness:** ICAR has been working to create awareness about the impact of climate change on agriculture. Through capacity-building programmes, farmers are being educated about climate change and are introduced to various climate-resilient technologies to improve their agricultural practices.
6. **Demonstration of Climate Resilient Technologies:** ICAR has developed and demonstrated a range of climate-resilient agricultural practices, which includes the following.

- Resilient intercropping systems that diversify crops to reduce risk.
- Conservation agriculture to preserve soil and water.
- Crop diversification, such as shifting from water-intensive crops like rice to more drought-resistant crops like pulses and oilseeds.
- Agroforestry systems that integrate trees with crops to improve resilience.
- Alternate rice cultivation methods like System of Rice Intensification (SRI), aerobic rice, and direct-seeded rice.
- Techniques for improving soil health, such as green manuring and integrated nutrient management.
- Integrated pest management to reduce pesticide use and improve sustainability.
- In-situ moisture conservation to retain water in the soil.
- Protective irrigation using harvested rainwater in farm ponds and micro-irrigation systems like drip and sprinkler irrigation to optimise water use.
- Zero-till sowing of wheat to reduce heat stress at the end of the growing season.
- Raised-bed planting and cropping intensification us-

- ICAR showcases diverse climate-resilient farming technologies

ing harvested water, especially in the North-Eastern States of India.

Through these initiatives, ICAR is equipping farmers with the knowledge and tools they need to tackle the challenges posed by climate change. The goal is not only to improve productivity but also to ensure that agriculture in India becomes more sustainable and resilient to the changing climate, which is crucial for food security and rural livelihoods.

Summarised Overview

Climate change threatens Indian agriculture, reducing crop yields and food security. The government launched initiatives like the National Mission for Sustainable Agriculture (NMSA) and NICRA to develop climate-resilient technologies. Biodiversity loss, driven by habitat destruction, invasive species, and climate change, affects ecosystems and the economy. India implements conservation efforts through the Biodiversity Act, the National Biodiversity Authority (NBA), and protected areas. Biodiversity supports agriculture, forestry, and climate regulation, linking to SDGs. Sustainable management strategies include conservation, community participation, organic farming, and invasive species control to ensure long-term environmental and economic benefits.

India, covering 328.73 million hectares, faces severe land degradation due to erosion, deforestation, and overuse, impacting 29.77% of its area. This threatens agriculture, livelihoods, and GDP. Government efforts include the NAPCD, ISRO's Desertification Atlas, afforestation, and global commitments like restoring 26 million hectares.

Farmers are vital to India's economy but face challenges like climate risks, debt, and low wages. Government measures, including PM-KISAN, PMFBY, and NMSA, support them through financial aid, insurance, and sustainable practices. ICAR's NICRA initiative promotes climate-resilient technologies, ensuring long-term agricultural sustainability and food security amidst changing environmental conditions.

Assignments

1. What are the major climate issues affecting Indian agriculture?
2. How does the loss of biodiversity impact farming and food security?
3. What are the main causes of land degradation in agricultural areas?
4. Why do Indian farmers face economic distress despite their importance to the economy?
5. What are some adaptive agricultural practices that help farmers cope with climate change?

Suggested Reading

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

UNIT 3 Agricultural Storage, Financial and Credit Support for Farmers

Learning Outcomes

After completing this unit, the learner will be able to:

- know the importance of warehousing
- describe agricultural transportation initiatives
- identify the benefits of PM Kisan and KISAN Card
- recognise the role of soil health card

Background

Agriculture is the lifeline of our economy, yet farmers face major challenges that make their lives difficult. Imagine growing a great harvest but having no proper storage-what happens next? Many farmers are forced to sell their crops at low prices due to a lack of warehousing facilities. And what about transportation? Farmers often struggle to reach distant markets because of poor connectivity. Without proper roads and transport networks, their produce may not fetch the best prices. Now, here is something exciting from Budget 2025. Did you know the Kisan Credit Card (KCC) scheme just got a big boost? The Finance Minister announced that the subsidised short-term loan limit has been raised from ₹3 lakh to ₹5 lakh. But how will this help farmers? Can it solve their financial struggles? To tackle these challenges, the government has launched several transformative initiatives like KCC. The National Warehousing Facility, Krishi Udan, Kisan Rail, PM Kisan, Soil Health Card, and KISAN Card-each play a vital role in empowering farmers and strengthening India's agriculture.

Keywords

National Ware Housing Facility, Krishi Udan, Kisan Rail, PM Kisan, Soil Health Card, KISAN Card

Discussion

4.3.1 Agricultural Storage: National Warehousing Facility

- Warehousing key for India's economy, agriculture, and trade

Warehousing in India plays a key role in supporting the economy, particularly in agriculture, trade, and industry. Warehouses provide safe storage facilities to prevent losses from defective storage. Recognising the importance of warehousing, the All-India Rural Credit Survey Committee (1954) recommended a three-tier system at the national, state, and rural levels. This led to the establishment of key institutions like the Central Warehousing Corporation (CWC) and State Warehousing Corporations (SWCs) across states.

- FCI CWC SWCs manage storage, ensuring food security

Today, warehousing in India is managed by public sector entities like the Food Corporation of India (FCI), CWC, and SWCs, which provide storage facilities for food grains, fertilisers, and other essential goods. These warehousing facilities are essential for reducing post-harvest losses and ensuring food security. They also help to facilitate trade by offering logistics solutions and providing efficient storage for e-commerce, industrial goods, and agricultural produce.

- CWC Mini Ratna CPSE provides warehousing and logistics

The Central Warehousing Corporation (CWC) is a Schedule 'A' Mini Ratna, Category-1 Central Public Sector Enterprise (CPSE), established under 'The Warehousing Corporations Act, 1962'. It provides reliable, cost-effective, and integrated warehousing and logistics solutions, focusing on being socially responsible and environmentally friendly. As of July 31, 2024, the Central Warehousing Corporation (CWC) operates 564 warehouses across India through 14 Regional Offices and 4 Satellite Offices, with a total storage capacity of 128.65 lakh metric tonnes (MT). These warehouses serve various purposes, including 18 Custom Bonded Warehouses for storing imported goods before customs clearance, 20 Container Freight Stations (CFSs)/Inland Container Depots (ICDs) for handling export-

import cargo, 3 Private Freight Terminals (PFTs) for efficient railway freight movement, 25 Rail Side Warehouses (RWCs) to store goods transported by rail, 1 Accompanied Baggage Warehouse (ABW) for storing personal baggage at transit points, and three temperature-controlled/cold storage units for preserving perishable goods. The average capacity utilisation during the financial year 2023-24 stood at 87.36%, indicating efficient use of available storage space.

- CWC serves diverse clients, operates nationwide, holds certifications

CWC's diverse clients include government organisations, private companies, public sector undertakings (PSUs), retailers, traders, exporters, importers, e-commerce companies (like Amazon, Flipkart, and Big Basket), cold chain operators, and farmers. It is certified under ISO 9001:2015 for Quality Management, ISO 14001:2015 for Environmental Management, and ISO 18001:2007 for Occupational Health and Safety. Notably, it is the first PSU to receive the Anti-Bribery Management System (ABMS) certification.

- CWC enhances operations with technology and diversification

CWC is continuously enhancing its operations by adopting advanced technologies and automation. Its initiatives include modern high-rise warehouses, advanced cold storage facilities, Warehouse Management Solutions (WMS), e-trading platforms, and value-added services. It has diversified into areas like e-commerce, industrial warehousing, and third-party logistics, which has significantly increased its revenue in recent years.

- CWC works with State Warehousing Corporations 19 SWCs

CWC also works with 19 State Warehousing Corporations (SWCs), holding a 50% equity share in these entities, with a total investment of ₹62.73 crore as of March 31, 2024. The SWCs operate 2,205 warehouses with a total storage capacity of 504.01 lakh MT.

4.3.2 Krishi Udan

- Boosts farmers' income through air transport

The Krishi Udan Scheme, launched in August 2020, focuses on using air transport to help farmers move their agricultural products efficiently within India and internationally. This initiative aims to improve the farmer's income from their produce by ensuring faster, more cost-effective, and reliable transportation, especially for farmers in Northeast India, hilly regions, and tribal areas.

Key Objectives of the Scheme

- **Increasing Air Transport for Agriculture:** The scheme aims to boost the use of air transport in moving agricultural products like horticulture crops, fishery items, livestock, and processed products. This helps to improve the modal mix, which refers to the combination of different transportation modes like air, road, and rail for better logistics efficiency.
- **Developing Sustainable Agri-Value Chains**: It promotes coordination between Central and State Government schemes, private sector investments, and various agencies to strengthen agricultural supply chains. A sustainable supply chain ensures that products reach markets quickly, reducing wastage and improving farmers' incomes.
- **Improving Air Cargo Infrastructure:** The scheme encourages the development of better facilities at airports for handling agricultural products, such as cold storage and processing centers. Off-airport facilities, such as warehouses and distribution centers, are also being improved to make the supply chain more efficient.
- **Focusing on Special Produce:** Special attention is given to the air transport of organic and natural produce from the Northeast region, tribal areas, and hilly districts. These products are in high demand both domestically and internationally.
- **Market Mapping and Export Support:** The scheme connects production areas with domestic and global markets, which ensures the timely delivery of products to meet demand. It promotes the adoption of quarantine measures (plant and animal health checks) and other regulatory requirements for exporting agricultural products.
- **Digitisation and Paperless Processes:** The scheme emphasises the use of digital platforms for seamless coordination among stakeholders, reducing paperwork and enhancing efficiency. Integration with existing e-platforms helps to track supply chains and ensures transparency in operations.

- Krishi UDAN enhances air transport for agriculture logistics

4.3.2.1 Krishi Udan Scheme 2.0

The Krishi Udan Scheme 2.0, announced on 27 October 2021, builds on the original scheme to further enhance air transport for perishable agricultural products, particularly from hilly

areas, North-Eastern States, and tribal regions. This scheme aims to improve farmers' value realisation by enabling faster and more efficient movement of products like horticulture produce, fishery items, livestock, and processed products.

- Air transport for perishables

To incentivise air transport, the Airports Authority of India (AAI) provides full waivers on landing, parking, Terminal Navigational Landing Charges (TNLC) and Route Navigation Facility Charges (RNFC) for Indian freighters and converted passenger-to-cargo (P2C) aircraft. The scheme initially covered 53 airports during a six-month pilot project, later expanding to 58 airports, including those in key regions like the Northeast, hilly, and tribal areas, as well as other parts of the country.

- AAI waives charges for cargo aircraft at airports

The scheme works as a convergence initiative where eight government ministries and departments, including the Ministry of Civil Aviation, Department of Agriculture & Farmers' Welfare, and Ministry of Tribal Affairs, pool their resources from existing schemes to strengthen logistics for transporting agricultural produce. Importantly, there is no separate budget allocation for Krishi Udan 2.0, as it relies on leveraging these existing schemes.

- Krishi Udan 2.0 uses existing funds

The main objective of Krishi Udan 2.0 is to increase the share of air transportation in the modal mix, improving the logistics chain for agricultural products and reducing transit time. This helps to enhance the competitiveness of supply chains, ensuring cost-effective and time-bound delivery. Some notable successes under the scheme include transporting king chillies, Burmese grapes, and Assamese lemons from Guwahati, jackfruit from Tripura, and litchi from Darbhanga.

- Boosts agri-product air transport

The scheme thus focuses on seamless air connectivity, improving logistics infrastructure, and providing critical support for transporting perishable products, benefiting farmers and producers in remote regions by linking them to domestic and international markets.

- The scheme focuses on seamless air connectivity

4.3.3 Kisan Rail

The Kisan Rail project, launched in August 2020 by the Ministry of Railways, aims to provide farmers with access to a vast railway network for transporting their agricultural produce to larger, more remunerative markets. This initiative focuses on enabling the movement of perishable items like

- Kisan Rail transports farm produce to markets

fruits, vegetables, dairy, meat, poultry, and fish to reduce wastage and ensure timely delivery.

Objectives of Kisan Rail

i. To connect surplus production regions with deficit consumption regions and ensure better price realisation for farmers.

- Helps farmers to access distant markets

ii. To facilitate the speedy transportation of perishables, minimising damage during transit.

iii. To overcome the challenges faced by farmers, particularly small and marginal farmers, in accessing distant markets due to high transportation costs and logistical difficulties.

Features of Kisan Rail:-

The following are the features of Kisan Rail.

Wide Reach: The project leverages the Indian Railways' extensive network, which enables farmers from remote areas to connect with mainstream markets.

- Kisan Rail offers affordable, multi-commodity transport

Affordable Transport: Farmers receive a 50% freight subsidy for fruits and vegetables under the 'Operation Greens - TOP to Total' scheme {Tomato, Onion and Potato (TOP) to all fruits & vegetables (TOTAL)} by the Ministry of Food Processing Industries. There is no minimum quantity requirement, which benefits small farmers with limited produce.

Multi-Commodity Concept: Kisan Rail operates on a model allows multi-consignor, multi-consignee, and multi-stoppage, making it accessible to small-scale producers without involving intermediaries.

Timely Operations: Kisan Rail services run on time-tabled paths, ensuring the punctual delivery of perishables and efficient use of railway resources.

- Kisan Rail transported 7.93 lakh tonnes of perishables

The first Kisan Rail service was launched on August 7, 2020, between Devlali (Maharashtra) and Danapur (Bihar). Since then, it has become very important for moving agricultural goods. As reported by the Press Information Bureau (PIB) India, by November 15, 2023, 2,364 Kisan Rail trains had been run, carrying about 7.93 lakh tonnes of perishable goods

like fruits and vegetables. Key crops transported include oranges, onions, bananas, potatoes, mangoes, tomatoes, and other perishables like flowers, dairy products, eggs, and fish.

Benefits for Farmers

Increased Market Access: Farmers can now sell their produce in distant and high demand markets, which improves their value realisation.

- Benefits farmers with better market access

Reduced Losses: The faster transit time and improved logistics reduce post-harvest losses and wastage.

Economic Empowerment: Affordable and efficient transport enhances the profitability of small and marginal farmers.

The Kisan Rail project thus helps to strengthen the agricultural supply chain and integrate farmers into the broader economy.

4.3.4 PM Kisan

- PM-KISAN gives farmers ₹6,000 yearly in instalments

The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) is a transformative initiative introduced by the Government of India to support the agricultural sector. Launched in February 2019, this scheme aims to provide financial stability to small and marginal farmers. Under PM-KISAN, every eligible farming family receives ₹6,000 annually, disbursed in three equal instalments of ₹2,000 every four months. These payments are made directly into farmers' bank accounts through the Direct Benefit Transfer (DBT) mechanism, which ensures transparency and eliminates middlemen.

- Scheme supports farmers, reduces rural poverty

The main objective of PM-KISAN is to increase farmers' financial security and promote inclusive growth. By supporting nearly 125 million farmers, the scheme aims to uplift small and marginal farmers, thereby addressing rural poverty and promoting agricultural sustainability.

4.3.4.1 Features of the Scheme

- **Wide Reach and Digital Support:** PM-KISAN is a major initiative that uses India's advanced digital systems to help farmers. The process of signing up, verifying details, and sending money is smooth and efficient. This system makes sure that the benefits go directly to farmers, removing the need for middlemen and reducing the chances of corruption or delays.

- **Timely Financial Help:** The scheme gives ₹2,000 every four months, timed to match the farming cycle. This ensures farmers have money when they need it most, like for buying seeds, fertilisers, or taking care of crops. It helps them improve their harvest and make better investments.
- **Less Dependence on Moneylenders:** By providing regular financial assistance, PM-KISAN reduces farmers' reliance on local moneylenders, who often charge high interest rates. This support protects farmers from falling into debt, encouraging more sustainable and independent farming.

• Direct, timely financial aid to small farmers

- **Fair and Inclusive Support:** The scheme focuses on small and marginal farmers, who often miss out on financial aid. By including them, PM-KISAN helps to reduce the income gap between different types of farmers.
- **Funding:** PM-KISAN is entirely funded by the Government of India, ensuring steady financial support for farmers.
- **Beneficiary Identification:** While funding is managed by the Central Government, the responsibility of identifying beneficiaries lies with the State and Union Territory governments. They ensure that eligible farmer families receive the scheme's benefits.

Eligibility Criteria

To qualify for PM-KISAN, farmer families must meet the following conditions.

- They should be small or marginal farmers owning cultivable land.
- Beneficiaries must be Indian citizens, regardless of whether they live in rural or urban areas.

• Small, marginal Indian farmers are eligible

- However, certain categories, such as institutional landowners and taxpayers in higher income brackets, are excluded from the scheme.

4.3.4.2 Significance of PM-KISAN

• Direct financial aid empowers Indian farmers

PM-KISAN promotes inclusive development by addressing the economic vulnerabilities of farmers. By directly transferring financial support, the scheme aims to reduce income disparities, increase agricultural investments, and improve the livelihoods of India's farming community. On 5th October 2024, the Prime

Minister released the 18th instalment of the scheme, bringing the total disbursement to over ₹3.45 lakh crore. This initiative has already benefited more than 11 crore farmers across India.

- Digital technology improves PM-KISAN efficiency, reach

The integration of advanced digital technologies has enhanced the scheme's efficiency. Tools such as Aadhaar authentication, the Public Financial Management System (PFMS), and the Indian Post Payments Bank (IPPB) have ensured secure and real-time transactions. Innovations like the Kisan e-Mitra AI chatbot and the Agri Stack framework further streamline access to resources and services, benefiting farmers across diverse linguistic and geographic regions.

4.3.5 Soil Health Card

- SHC scheme improves knowledge on soil health

The Soil Health Card (SHC) Scheme is a significant initiative launched by the Government of India on February 19, 2015, during the International Year of Soils. This scheme aims to address the nutritional deficiencies of soil across the country and promote sustainable farming practices. It is implemented through the agriculture departments of all States and Union Territories. The scheme aims to improve agricultural productivity by providing farmers with a detailed understanding of their soil's health. This will help farmers to make informed decisions about crop cultivation and land management.

- SHC reports detail 12 soil health parameters

The SHC is a printed report that provides information about the status of soil health in terms of 12 key parameters. These include macronutrients (N, P, K), secondary nutrients (S), micronutrients (Zn, Fe, Cu, Mn, Bo), and physical parameters like pH, electrical conductivity (EC), and organic carbon (OC). The report also contains recommendations for fertilisers, their dosage, and soil amendments to address deficiencies and improve soil quality.

4.3.5.1 Benefits of the Soil Health Card Scheme

- **Crop Selection and Yield Improvement**: The SHC helps farmers identify which crops are most suitable for their soil, thus increasing productivity. It also provides guidance on fertilisers and soil management practices to enhance yields.
- **Regular Monitoring:** Farmers receive updated soil health reports every three years, ensuring they are informed about any changes in soil quality due to environmental or

land-use factors.

- **Expert Assistance:** The scheme ensures that experts assist farmers in implementing corrective measures based on SHC recommendations, for better soil management practices.
- **Personalised Analysis:** Efforts are made to have the same person consistently analyse the soil for a particular farmer, and this will improve the accuracy and relevance of the reports.
- **Improved Decision-Making:** By understanding the nutrient deficiencies in their soil, farmers can invest in the right fertilisers and cultivation techniques. This will reduce input costs and maximise output.

- SHC aids crop selection, improves yields

Recently, the Government of India has introduced several technological advancements to improve the implementation and monitoring of the Soil Health Card Scheme. One significant development is the integration of the Soil Health Card portal with a Geographic Information System (GIS). This allows soil test results to be mapped geographically, making it easier to track and visualise soil health data across regions. In addition, a mobile application has been improved with several new features to streamline the process for farmers and officials. These features include restricting the sample collection region for Village Level Entrepreneurs (VLEs) or operators collecting soil samples, automatically capturing the latitude and longitude of each location, and generating a QR code for each sample. This QR code links the sample to its test results, ensuring the data is directly uploaded to the portal without manual intervention. This system, which became operational in April 2023, helps collect soil samples through the mobile app and generate soil health cards on the revamped portal.

- Technology upgrades streamline SHC data collection

Furthermore, the Soil Health Card scheme has been merged with Rashtriya Krishi Vikas Yojana (RKVY) cafeteria scheme as its one component under the name 'Soil Health & Fertility' from the year 2022-23. This integration aims to enhance the reach and impact of the scheme with broader agricultural development initiatives. These technological improvements and the integration into a larger development programme are designed to make the scheme more efficient, accessible, and beneficial for farmers.

- Scheme integrated with RKVY for wider impact

4.3.6 Kisan Credit Card

- Provides farmers easy access to credit

The Kisan Credit Card (KCC) scheme, introduced in 1998, was designed to provide farmers with easy access to credit for their agricultural needs. The aim was to help farmers secure funding for purchasing inputs like seeds, fertilisers, and pesticides, as well as for cash needs related to farming. In 2004, the scheme was expanded to include funding for investment in allied and non-farm activities. On 18 December 2020, the Prime Minister launched a revised version of the KCC scheme with the goal of offering more timely and efficient credit support to farmers.

Objectives and Purpose

The primary objective of the Kisan Credit Card scheme is to meet the financial needs of farmers throughout the various stages of farming. It offers quick and easy access to credit through a single window system, allowing farmers to manage their cultivation and other agricultural needs.

The specific objectives include the following.

Short-term Credit: For crop cultivation.

Post-harvest Expenses: Covering expenses after harvesting crops.

- Offers diverse, timely credit options for farmers

Produce Marketing Loans: Supporting the sale of produce.

Household Consumption: Meeting the consumption needs of farming families.

Working Capital: For maintaining farm assets and carrying out activities related to agriculture.

Investment Credit: Supporting investment in agricultural and allied activities, such as irrigation, farm equipment, and land development.

Eligibility Criteria

The KCC scheme is available to a wide range of farmers. Eligible farmers include the following.

Individual Farmers and Joint Borrowers: These people

own land.

Tenant Farmers, Oral Lessees, and Share Croppers: Farmers who do not own land but work on leased land.

Self Help Groups (SHGs) and Joint Liability Groups (JLGs): Groups of farmers, including tenant farmers and sharecroppers, can also benefit from the scheme.

Ease of Application

- Simplified KCC application process for farmers

To make the application process as simple as possible, the scheme uses a straightforward one-page form. This form only requires basic information, which can be fetched from existing bank records under the PM KISAN scheme. Farmers need to submit only a copy of their land records and details about the crops they have planted. The form can be obtained from leading newspapers and banks or downloaded from websites like PM KISAN and the Department of Agriculture's portal. Common Service Centres (CSC) are also authorised to assist farmers in filling out and submitting the form to the respective bank branches.

Salient Features of the KCC Scheme

- Offers flexible credit, RuPay cards, low interest

- **ATM-enabled RuPay Card:** The KCC comes with a RuPay card, which allows farmers to withdraw funds and make payments electronically.
- **Flexible Credit Limits:** The scheme offers flexibility in credit limits and allows multiple withdrawals within the sanctioned limit.
- **One-time Documentation**: Documentation requirements are kept minimal, with farmers only needing to submit relevant land records.
- **Interest Subvention:** The government provides interest subvention on short-term loans up to ₹3 lakh. In the Union Budget 2025-26, the Government of India announced an increase in the loan limit under the Modified Interest Subvention Scheme for the Kisan Credit Card (KCC) from ₹3 lakh to ₹5 lakh.

4.3.6.1 Credit Limits for Different Types of Farmers

- **Non-Marginal Farmers:** For farmers with larger land-

holdings, the credit limit is calculated by considering the scale of finance for each crop, the area of land, and additional expenses for post-harvest and maintenance costs. In subsequent years, an increase in the credit limit is allowed, taking into account inflation and increased costs.

- KCC credit limits vary by landholding size

- **Marginal Farmers:** For smaller farmers, the KCC offers a flexible credit limit ranging from ₹10,000 to ₹50,000. This amount is determined based on their landholding, crops, and additional needs like post-harvest storage, consumption requirements, and small-term loans for investment in farm equipment or livestock.

4.3.6.2 Achievements of the Kisan Credit Card Scheme

- Farmers can borrow without providing any security or asset as a guarantee

As of March 2024, India has 7.75 crore active Kisan Credit Card (KCC) accounts, with a total loan outstanding of ₹9.81 lakh crore (Economic Survey 2025). To help more farmers, the KCC scheme was expanded in 2018-19 to cover the working capital needs of those involved in fisheries and animal husbandry. Working capital refers to the money needed for day-to-day expenses like buying fish feed, medicines for livestock, or other essential supplies. Additionally, the collateral-free loan limit under KCC was increased to ₹1.6 lakh. Thus, farmers can borrow up to this amount without providing any security or asset as a guarantee.

- Targets more farmers with increased credit

By March 31, 2024, the government had issued 1.24 lakh KCCs for fisheries and 44.40 lakh KCCs for animal husbandry, which ensured better financial support for farmers engaged in these activities. This expansion of the KCC scheme has helped more farmers access credit easily, reducing their dependence on informal lenders.

- KCC provides crucial financial support to farmers

The Kisan Credit Card (KCC) scheme plays a crucial role in supporting Indian farmers by offering easy access to credit for various agricultural and household needs. With its flexible features, low-interest loans, and minimal documentation, it ensures that farmers, especially marginal and small ones, are not financially constrained when it comes to cultivating crops, investing in farm infrastructure, or covering post-harvest costs.

Summarised Overview

Warehousing in India plays a vital role in agriculture and trade, with key institutions like the Central Warehousing Corporation (CWC) and State Warehousing Corporations (SWCs) providing efficient storage solutions. The Krishi Udan Scheme enhances air transport for perishable agricultural goods, reducing transit time and improving market access. Krishi Udan 2.0 expands these benefits with incentives for air cargo operations. Kisan Rail, launched in 2020, connects farmers to distant markets via rail, ensuring affordable and timely transport of perishables.

The PM-KISAN scheme, launched in 2019, provides ₹6,000 annually to small and marginal farmers via Direct Benefit Transfer to enhance financial security. The Soil Health Card (SHC) scheme (2015) helps farmers improve soil quality through scientific analysis. The Kisan Credit Card (KCC) scheme offers easy credit access for farming and allied activities, with low-interest loans and minimal documentation.

Assignments

1. Explain the importance of the National Warehousing Facility.
2. How does the Krishi Udan scheme help in agricultural transportation?
3. What is the purpose of the Kisan Rail initiative?
4. How does the PM-KISAN scheme provide financial assistance to farmers?
5. What key information does the Soil Health Card (SHC) provide to farmers?
6. What are the main features of the Kisan Credit Card (KCC) Scheme?

Suggested Reading

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Space for Learner Engagement for Objective Questions

Learners are encouraged to develop objective questions based on the content in the paragraph as a sign of their comprehension of the content. The Learners may reflect on the recap bullets and relate their understanding with the narrative in order to frame objective questions from the given text. The University expects that 1 - 2 questions are developed for each paragraph. The space given below can be used for listing the questions.

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വിശ്വപൗരരായി മാറണം
ഗ്രഹപ്രസാദമായ് വിളങ്ങണം
ഗുരുപ്രകാശമേ നയിക്കണേ

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NO TO DRUGS തിരിച്ചിറങ്ങാൻ പ്രയാസമാണ്

ആരോഗ്യ കുടുംബക്ഷേമ വകുപ്പ്, കേരള സർക്കാർ

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