

Agriculture-6

(For Sixth Class)



ਪੜ੍ਹੋ ਸਾਰੇ ਵਧੋ ਸਾਰੇ

ਸਿੱਖਿਆ ਅਤੇ ਭਲਾਈ ਵਿਭਾਗ, ਪੰਜਾਬ ਦਾ ਸਾਂਝਾ ਉਪਰਾਲਾ



Punjab School Education Board

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Foreword

The Punjab School Education Board since its inception has been constantly putting its efforts for re-designing lessons and preparing books according to the needs of national educational view point and occupational requirements of the state.

The present textbook has been prepared in the light of National Curriculum Framework 2005 and Punjab Curriculum Framework 2013. Accordingly, it has been felt that more emphasis should be laid on vocational courses. India is mainly an agrarian economy and Punjab is considered as food bowl of the country. This book contains information about agricultural economic development of the country, some common tips about agriculture and information about agriculture based supplementary enterprises and industrial occupations so that students can be made aware to adopt it.

This book prepared by experts of Punjab Agricultural University, Ludhiana will prove helpful for students and teachers.

Suggestions from field are welcome for making the book better.

Chairman

Punjab School Education Board

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Chapter 1

STATUS OF PUNJAB AGRICULTURE

Punjab is an agrarian state with almost two-third people directly or indirectly depending on agriculture. Agriculture is the backbone of Punjab's economy and it contributes 21% of the total income of the state. In Punjab, 41.34 lakh hectare area is under agriculture which is 1.5% of the country's total cultivable area. Of this, 80% area is under wheat in *Rabi* season and 60 % under rice cultivation in *Kharif* season. Punjab produces 22% of total wheat produced in India and 11 % of the total rice in the country. In the last four decades, Punjab has been contributing 22-60% rice and 33-75% wheat in the central pool of India. Besides wheat and rice, cotton is also one of the important crops of South-Western Punjab.

When Punjab Agricultural University was established in Punjab in 1962, Green Revolution paved way for Punjab agriculture and the State became self sufficient first in wheat and then in rice production. This became possible because of factors such as high yielding varieties, chemical fertilizers, pesticides, good irrigation facilities, easy loan facilities, agricultural policies in the form of minimum support price and assured marketing, farmers hardwork and contributions of scientists and extension personnel. All this increased the income of the farmers in Punjab and wheat-rice cultivation became their first choice. But in the subsequent years, Punjab was caught in the vicious circle of this monoculture of wheat-rice crop rotation. Today 98% of area in Punjab is irrigated and almost 250 kg/ha of chemical fertilizers are being used in agriculture. Apart from crops, dairy as a subsidiary occupation has also contributed to the economic growth of Punjab state. Majority of rural households in the state have milch animals, which are not only fulfilling the household requirements of milk but also supplementing the farmer's income. Punjab is at fourth place in milk production in India. Presently, MILKFED (a dairy cooperative) and other private agencies are procuring milk from the doorsteps of farmers and giving them an assured market for milk. This paved way for the White Revolution in Punjab state. On commercial scale, poultry farming, mushroom cultivation, bee keeping and fish farming are also some of the major subsidiary occupations being practiced by the farmers of Punjab.

Monocropping of wheat-rice in the last four decades has affected the natural resources of Punjab especially in terms of over use of water and soil. Punjab, which was known as the land of five rivers earlier is now facing the shortage of water. The water level and the fertility of soil have decreased to a great extent in Punjab. Under these conditions, the sustainability of Punjab agriculture is at stake. Agricultural Growth rate in Punjab in 1980 was 4.6% which decreased to 2.3% in the year 2000. It remained even less than 2% in the past. The water level has gone down by 20 metres in more than 50% of area in Punjab and this forced the farmers to install deep tubewells and submersible pumps for irrigation. This has further increased their energy requirements and expenditure on the same. The provision of free electricity to the farmers has also increased the financial burden on the state government.

Apart from this, on-farm burning of paddy straw has not only led to the burning of nutrients in soil but also a large amount of pollution in air. Because of this, a lot of health hazards are being faced by human beings, animals and other organisms. It is equally important to check the unabated use of chemical fertilizers and pesticides on crops. This non-judicious use of chemicals is harming the environment and also increasing the expenditure of farmers thus

leading to heavy debts on them which is one of the major factors behind farmer suicides in Punjab.

There is an utmost need to diversify Punjab agriculture in order to save its natural resources. Motivating farmers to replace some area under rice-wheat cultivation with pulses, oilseeds, vegetables and fruits is the need of the hour. In the present scenario, there is a lot of demand for fruits and vegetables. Thus farmers need to be encouraged to adopt these crops but this is only possible if farmers are trained in the cultivation, value addition and marketing of these enterprises.

To stop the unabated use of chemicals, farmers need to be trained in Integrated Pest Management and Integrated Nutrient Management. Also in the present times, they need to be trained in marketing. Besides wheat-rice, marketing of all other crops is a big problem in Punjab. This problem can be solved if farmers unite together and form their commodity interest groups, self-help groups, cooperatives, farmer producer's organizations etc. Overall, it can be said that Punjab is a state with fertile land, assured irrigation facilities and hardworking farmers but with the passage of time there is a need to look at the things from a different perspective i.e. from production to marketing so as to make agriculture in Punjab sustainable for a long time.

Exercise

A. Answer in 1 to 2 words:

1. What percentage of total income of Punjab comes from agriculture?
2. How much area in Punjab is under cultivation?
3. In which region of Punjab, cotton is cultivated?
4. What gave a new direction to Punjab agriculture?
5. How much area in Punjab is irrigated?
6. What is the position of Punjab in India in terms of milk production?
7. What is the percentage of people depending on agriculture in Punjab?
8. How much chemical fertilizer is used per hectare in Punjab?
9. What is essentially required to save the natural resources of Punjab?
10. What percentage of total area of Punjab is under rice cultivation?

B. Answer in 1 to 2 sentences:

1. What is the contribution of Punjab in terms of food grains in the central pool of India since last four decades?
2. What is the most important factor responsible for stagnation in Punjab agriculture?
3. Why are farmers dependent upon deep tubewells and submersible pumps for irrigation in Punjab?
4. What is making the soil degraded?
5. What is essentially important to save the natural resources of Punjab?
6. What is responsible for poor financial condition of Punjab farmers?
7. What are the major subsidiary occupations of Punjab?
8. What are the ill effects of paddy straw burning in Punjab?
9. How can we solve the problem of marketing in Punjab?
10. Why are farmers under debt in Punjab?

C. Answer in 5 to 6 sentences:

1. Who owns the credit of Green Revolution in Punjab?
2. What do you know about the marketing of milk in Punjab?
3. What is agricultural diversification?
4. In what area should Punjab farmers be trained?
5. What is the threat to the natural resources of Punjab?

Chapter-2

SOIL

Soil may be defined as a dynamic natural body on the surface of earth in which plants grow. It is composed of minerals, organic and inorganic materials. Soil is a very important layer of earth as it serves as a medium for the growth and development of plants. Soil formation is a continuous process. Many factors like types of rocks and weathering processes play a role in its formation.

Factors affecting soil formation:

Variations in the soils in different regions are the result of various factors like precipitation, air, temperature and humidity. A soil profile is an important tool to explore the characteristics of soil. Different layers of soil profile are called Soil Horizons. These layers are different from each other on the basis of their colour, texture and chemical properties. For example the “A” horizon is often referred as “ploughed layer” in the cultivated soil. It is a dark coloured layer and contains humus and large amount of minerals. It is a soft layer and has greater water holding capacity.

The soils may be classified into three types viz:- sandy soil, loamy soil and clay soil depending upon the size of soil particles present in it.

- a) **Sandy soils:** Sand is a naturally occurring granular material composed of finely divided rocks and mineral particles which are of bigger size. Being of bigger size, they are filled with air. Water quickly seeps into these soils, thus, resulting in their low water holding capacity. The soil which contains more than 85 % of sand sized particles is called Sandy soil. These are also called light textured soils.
- b) **Clay soils:** Clay is the fine-grained rock or soil material. The soils rich in clay particles are called clay soils. These particles are of smaller size and hence contain lesser amount of air. These soils have a greater water holding capacity for a longer time. The clay soils are also called “heavy soils”.
- c) **Loamy Soils:** Medium textured soils are called loamy soils. These are made up of mixed particles of sand, clay and silt. These are best suitable for cultivation as these can have an optimum water holding capacity.

Different type of soils found in India:

1. **Alluvial Soils:** These are formed by deposition of sediments by rivers. These are rich in humus and are very fertile. These are found in almost 45 % of the country's area which covers the Great Northern plains, including Punjab, Haryana, Uttar Pradesh, Bihar and Northern Gujarat. These are best suited for growing rice, maize, sugarcane, cotton etc.
2. **Laterite Soils:** These are formed as a result of intense leaching because of excessive precipitation. These are found in high rainfall areas such as Kerala, Tamil Nadu, Southern Maharashtra, Assam, West Bengal, Odisha etc. These are best suited for crops like coconut, tea etc.
3. **Black Soils:** These soils are also called “Cotton soils” because these are best suitable for

growing cotton crop. These are made up of volcanic rocks and lava flow. These are found in Maharashtra, Gujarat, Karnataka and West Bengal. These are found in 16.6 % of country's area. These are black in colour as they contain a high amount of humus and salts. These are rich in lime, iron, magnesium and potash but lack in nitrogen and phosphorus content.

4. **Red soils:** These are derived from weathering of metamorphic rocks of Deccan Plateau. These are rich in iron content. These are found in low rainfall areas such as parts of Karnataka, Eastern Andhra Pradesh and parts of Odisha. These are suitable for growing wheat, cotton, rice, tobacco etc.
5. **Mountainous Soils:** These are mostly found in dry and cold regions of Northern India covering the Himalayan regions of the country. These are suitable for growing bajra, fruit crops, tea and cocoa plants etc.
6. **Desert Soils:** These are found in Rajasthan and its adjoining parts of Punjab and Haryana. Wheat, maize, barley and cotton are mainly grown in these soils.

Punjab can be divided broadly into three different zones on the basis of soil types:

1. **South-Western Punjab:** This region covers the districts of Fazilka, Sri Muktsar Sahib, Bathinda, Mansa and some parts of Ferozepur. Soils of this zone are mainly sandy soils. These are low in nitrogen, phosphorus and potash. Previously, soil erosion, as a result of wind, was a main problem in these areas. Nowadays, water logging is the main problem in this belt. Wheat, rice and cotton are the main crops of this zone.
2. **Central Punjab:** All the central districts of Punjab i.e. Ludhiana, Jalandhar, Patiala, Kapurthala, Sangrur etc. are covered under this zone. Texture of these soils varies from sandy loam to clay loam. Problems of salinity and alkalinity are acute in some areas, especially in Amritsar and Sangrur districts. Main crops of this zone are wheat, rice and vegetables.
3. **Eastern Punjab:** This zone consists of sub-mountainous areas like eastern parts of Gurdaspur, Hoshiarpur and Rupnagar where loam and clay soils are found. Soil erosion as a result of water is the main problem of these areas. Main crops are wheat, rice, maize and fruit crops.

Different problems related to soils are emerging with time in Punjab like decline in soil fertility, soil erosion, water logging etc. This excessive and unbalanced use of chemical fertilizers and insecticides has also increased the harmful and poisonous substances in the soil. So there is a need to judiciously and carefully use this precious natural resource so that its fertility can be sustained for a longer time.

Exercise

A. Answer in 1 to 2 words:

1. In which kind of soil, crops requiring less water can be grown?
2. Which soil is formed by deposition of sediments from rivers and streams?
3. In which area of Punjab, water logging is mainly observed?
4. Which soils are called cotton soils?
5. Which soils have more water holding capacity?

6. Which layer of earth supports plant growth?
7. What is the uppermost layer of Earth called?
8. Which soils have more large sized particles in its composition?
9. Which soil is formed due to excessive leaching?
10. In which regions of Punjab, water logging, alkalinity & salinity are the common problems?

B. Answer in 1 to 2 sentences:

1. Define soil.
2. Which factors are responsible for soil formation?
3. What are the factors affecting soil formation?
4. Explain in brief about different layers of Earth.
5. Differentiate between sandy and clayey soils.
6. Define humus.
7. On what basis can the different layers of soil profile be differentiated?
8. Why the uppermost horizon has dark colour?
9. Why loamy soils are best suited for cultivation?
10. What are the different problems related to soil emerging with time?

C. Answer in 5 to 6 sentences:

1. Classify the soils on the basis of their texture.
2. Describe the type of soils in different zones of Punjab.
3. Describe the different types of soils found in India.
4. What are the major problems related to soils that are emerging over time in Punjab?
5. Mention the crops grown in different types of soils found in India.

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Chapter-3

CLASSIFICATION OF CROPS

The plants whose economic or commercial values are known and are grown in community for a specific purpose are called crops e.g. when plants of wheat are grown in a field for grains then they are known as wheat crop.

Classification of crops:

Field crops are classified in different groups based on various considerations for easy understanding, planning, production, protection and utilization.

1. Classification based on seasons:

- a) **Kharif season crops:** These are sown during June - July or on the onset of monsoon and are harvested in October - November e.g. maize, rice, cotton, jowar, bajra, moong (green gram), sabut mah (black gram), arhar, groundnut, sesame and soybean etc.
- b) **Rabi season crops:** These crops are sown in October - November and are harvested in March - April e.g. wheat, barley, oats, berseem, sarson, gram, toria, taramira, linseed and sunflower etc.

2. Botanical classification:

It is based upon the similarity of different plant parts of crops and therefore the crops are grouped into different families. Some important families of crops are:

- a) **Gramineae or grass family:** This family includes crops that resemble grass e.g. wheat, rice, barley, maize etc. This is also called cereal family.
- b) **Leguminosae or peas or pulse family:** The crop plants of this family have high protein content in their grains and plants are able to fix the atmospheric nitrogen into the soil e.g. peas, soybean, gram, arhar (red gram), sunnhemp, moong etc.
- c) **Cruciferae or mustard family:** This family includes vegetable and oilseed crops e.g. cabbage, cauliflower, radish, sarson, toria, raya, taramira etc.
- d) **Malvaceae or cotton family:** This family includes cotton and okra (Lady finger).

3. Agronomic classification or classification on the basis of economic uses:

- a) **Cereals or grain crops:** A cereal may be defined as a grass grown for its edible grain. The term cereal may be applied to either the grain or the plant as a whole. The six great cereals of the world are wheat, oats, raya, barley, corn and rice. Jowar and bajra also come under cereals. Cereals are low in lysine and threonine.
- b) **Legumes or pulses:** These include the pulse crops and plants are able to fix the atmospheric nitrogen with the help of nodules on their roots. Legume seeds have high protein content e.g. arhar, mah, moong and pea. Legumes are low in cysteine and methionine.
- c) **Forage crops:** Forage may be defined as vegetative matter, fresh or preserved, to be utilized as feed for animals e.g. grasses like maize, jowar, oats, barley, bajra etc. and legumes like lucerne, cowpea, berseem etc.
- d) **Oilseed crops:** The crops from which oil is obtained e.g. groundnut, toria, sarson, raya, taramira, soybean etc.
- e) **Vegetable crops:** These are the edible plants which store up food in their roots,

leaves, flowers and fruits. The common Indian vegetables are potato, tomato, carrot, radish, cauliflower, cabbage, brinjal, okra etc.

- f) **Fibre crops:** They are grown for their fibre which is used in making textiles, ropes etc. The main fibre crops are cotton, sunnhemp (*san*), jute (*patsan*).
- g) **Sugar crops:** They are grown for obtaining sugar e.g. sugarcane and sugar beet.
- h) **Starch crops:** They are grown for obtaining starch e.g. potato, sweet potato, buckwheat.
- i) **Spices:** These are the crops which are used as spices e.g. coriander, ginger, turmeric, garlic, chilli, pepper etc.

4. Classification based on life cycle or life span:

- a) **Annuals:** These crop plants grow, mature and die in the course of one year or one season e.g. wheat, barley, maize etc.
- b) **Biennials:** These crop plants require two years or seasons to complete their life cycle. During first year/season, they grow vegetatively and flower during the second year/season e.g. wild carrot, sugar beet and onion.
- c) **Perennials:** These are the crops that grow from year to year. They may flower and bear seeds every year. They can be kept as ratoons e.g. sugarcane, lucerne etc.

5. Special purpose classification:

- a) **Green manure crops:** These are legume crops which fix atmospheric nitrogen in the soil. These are grown to be ploughed into the soil to increase its productivity e.g. guara, sunnhemp, dhaincha.
- b) **Catch or emergency crops:** These are quick growing crops that are grown between the period of harvest of one major crop and the sowing of the next major crop or when main crop fails on account of some unfavourable conditions e.g. toria, sathi maize, sathi moong etc.
- c) **Silage crops:** These are the crops that can be preserved in a succulent condition by partial fermentation in air tight container (pit) in order to feed the animals particularly during the days of shortage of green fodder e.g. maize, sorghum and oats. Non-legumes are better for silage making than legumes on account of less moisture content and more dry matter.
- d) **Inter crops:** These are the crops that are sown in-between the rows of a main crop e.g. groundnut in castor, mah or moong in cotton. The objective is to increase the per unit land productivity.
- e) **Border crops:** These are the crops which are grown on the border of the main crop, usually for providing shelter to the main crop and also for some additional income e.g. arhar or *jantar* (dhaincha) around sugarcane and bajra around maize.
- f) **Trap crops:** These are the crops which are planted in or around a crop to attract certain insect-pests of main crop e.g. maize in sugarcane, okra in cotton. They are ploughed or destroyed once they have served their purpose.

6. Classification based on climatic adaption:

- i) **Tropical crops:** Those crops which are grown in warm climates where freezing rarely occurs e.g. sugarcane, cotton, rice, moong, mah etc.
- ii) **Temperate crops:** Those crops which are grown in a marked winter season, typically with a considerable freezing period e.g. wheat, barley etc.

7. Classification based on source of water:

- a) **Rainfed crops:** Crops which are fully dependent on rain water for their water requirement. As the crops grown in Rajasthan.
- b) **Irrigated crops:** Crops which are grown with the help of irrigation water. As the Crops grown in Punjab.

8. Classification on the basis of economic importance:

- a) **Cash crops:** Crops which are grown for earning money e.g. cotton, sugarcane, coffee, tea etc.
- b) **Food crops:** Crops which are grown for food, feed and fodder e.g. rice, wheat, maize etc.

Exercise

A. Answer in 1 to 2 words:

1. Name the family of radish.
2. Name two fodder crops.
3. Name two sugar crops.
4. Name two *kharif* season crops.
5. Name two *rabi* season crops.
6. Name the family of the crop plants which fix atmospheric nitrogen in soil.
7. The crop plants of which family has the highest protein content in its seeds?
8. Which crops are incorporated into the soil as green manure?
9. Name two tropical crops.
10. What name is given to the crops which are sown in between the harvesting and sowing time of two major crops?

B. Answer in 1 to 2 sentences:

1. What is a crop?
2. What is the need of crop classification?
3. What do you know about the Pulse or Leguminosae family?
4. What are inter crops?
5. What are the trap crops?
6. What is the difference between annual and perennial crops?
7. What are the emergency crops?
8. In which industry the fibre crops are used? Give examples of fibre crops.
9. Which crops are suitable for border planting?
10. Give examples of tropical and temperate crops.

C. Answer in 5 to 6 sentences:

1. Discuss in detail the Pulse or Leguminosae family.
2. Write a note on green manure crops.
3. Which crops are suitable for silage making and why?
4. What are rainfed crops?
5. Write a note on classification of crops on the basis of seasons.

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Chapter-4

IMPORTANCE OF IRRIGATION IN AGRICULTURE

Water is a precious gift of nature without which life is not possible. In addition to its importance for living, it is also used for many other purposes. In India, 70 % of total available water is used in agriculture, 20-22 % in industry and 8 % for domestic use. India, being an agrarian country, uses maximum amount of water for meeting the following crop requirements:

- Ninety percent of the green plants are water.
- It is required for the germination of seeds, as seeds do not germinate in dry soil because of lack of appropriate moisture.
- Water plays an important role in the growth and development of plants and is also important for flower, fruit and seed formation and development.
- The entry of water in plants is through the roots. Water plays important role in uptake of minerals in solution through roots and distribution in different plant parts.
- Water protects plants from frost and hot desiccating winds.
- For proper development of the crops, maintenance of proper moisture content in the soil is required and to maintain that, irrigation is required.

Irrigation:

Irrigation is the artificial application of water to supplement rainfall for crop production. The crops, weather and soil type determine when to irrigate and how much water to apply. The crops like wheat, oilseed crops, pulses etc. require less number of irrigations as compared to rice, maize and sugarcane crops. The winter crops require less number of irrigations and summer crops require more amount of water. In summer, more water is required because of more evapo-transpirational losses from both soil and leaves. In light textured soils (sandy soils) more number of irrigations are required as compared to heavy textured soils (clayey soils) as rate of absorption and leaching of water is higher in light as compared to heavy textured soils.

The optimum moisture content is very important at the time of sowing of crops, so heavy pre-sowing irrigation (*rauni*) is provided. All the crops are sown after pre-sowing irrigation except rice in which water is allowed to stand in the field by doing puddling. The field preparation in standing water is called puddling. Nowadays, direct seeded rice is also becoming popular because of the lowering of the water table.

Sources of irrigation:

The various sources of irrigation are wells, tubewells, ponds, rivers, dams, canals etc. In the past, animals were used to draw water from the wells, ponds etc. which was very time consuming and less effective method. Nowadays, pumps are used to lift water. Diesel, Biogas, electricity and solar energy can be used in these pumps. The tubewells and canals are the main sources of irrigation in Punjab. The lowering of the water table is a major cause of concern in Punjab and is mainly because of rice-wheat cropping system. The number of the tubewells has increased from 6 lakh in 1980 to more than 14 lakh at present. Under the scenario of lowering water table, the centrifugal pumps are being replaced by the submersible pumps which can draw water from more depths, where centrifugal pumps fail to lift water. These pumps are more costly and also consume more electricity.

Methods of irrigation: The principal methods of irrigation are as follows:

1. **Surface Irrigation:** It is also called flood irrigation. In this method the field is divided

into plots surrounded by ridges and water is applied through water channels, e.g. wheat, pulses, rice etc. Variable ring basins are used to irrigate fruit trees where size of the plot to be irrigated is very small. In case of crops sown on ridges like potato, maize, sugarcane etc. water is applied through furrows.

2. Sub-Surface Irrigation: At some places water is quite near the soil surface and can be easily taken up by the plants. For example the cultivation of vegetables at Dal Lake, Kashmir is done by using this method.

3. Sprinkler Irrigation: Water is sprayed into air and allowed to fall on plants or land surface in a uniform pattern with rates lesser than the infiltration rate of the soil. This technique is very effective for areas with irregular topography. This method can be used to mitigate frost and high temperature effects also.

4. Drip Irrigation: The irrigation is provided near the base of the crops, drop by drop. Thus, irrigation is provided as per needs of the plant without any wastage. This irrigation technique is very effective in case of areas where water is highly deficit.

Exercise

A. Answer in 1 to 2 words:

1. How much percentage of water is contained in green plants?
2. Name the term used for artificial application of water for crop production.
3. Name two irrigation methods used for maximum water saving.
4. Which substances are translocated in plants along with irrigation water?
5. How much water is used in agriculture in India out of total available water?
6. What is puddling?
7. Which crop is sown after puddling?
8. Name the main sources of irrigation in Punjab.
9. Which method of irrigation is used to protect the crop from frost and high temperature stress?
10. Which irrigation technique is beneficial in water deficient areas?

B. Answer in 1 to 2 sentences:

1. What is irrigation?
2. What is the importance of pre-sowing irrigation (*rauni*) in crops?
3. What are the different sources of irrigation?
4. How the numbers of irrigations depend upon the crops?
5. Why puddling is done in case of rice?
6. Why the soil moisture is to be maintained in soil?
7. Why more irrigations are required in sandy soils as compared to the clayey soils?
8. Why submersible pumps are replacing centrifugal pumps?
9. Why more water is required by the crops in summer season?
10. What can be used as source of energy for the water lifting pumps?

C. Answer in 5 to 6 sentences:

1. What is the importance of water in the life of plants?
2. What are different factors on which the number of irrigations depend and how?
3. What are the different methods of irrigation? Write in detail about the sprinkler method of irrigation.
4. How water can be saved by drip irrigation?
5. How surface irrigation method is used to irrigate different crops?

Chapter-5

FERTILIZERS

Plants absorb carbon, hydrogen and oxygen from air and water, nutrients from the soil and thus prepare their food through photosynthesis. Plants need seventeen different types of nutrients to grow and prepare their food. But in the last few decades, as a result of high cropping intensity and cultivation of high yielding varieties of rice, wheat and maize, the nutrients in the Punjab soil have decreased to a great extent and the soil is showing the symptoms of micro and macro nutrient deficiency. Wheat, rice and maize are high nutrient requiring crops. So the farmers need to apply these nutrients through an outside source i.e. manures and chemical fertilizers. The substances which are incorporated from outside to supplement the nutrient requirements of crops are known as fertilizers. Some fertilizers are incorporated before sowing of the crops while some are incorporated after sowing the crops. There are two kinds of fertilizers:

1. **Organic fertilizers (Manures)**
2. **Inorganic chemical fertilizers**

Manures:

Manure is a natural substance obtained from decomposition of cattle dung, human waste and plant waste. These contain organic compounds and all the other nutrients, but the quantity of nutrients is less in them. Manures add plenty of humus to soil which allows the fertility of soil to be sustained for a longer time. In addition, water holding capacity of soils can be increased by adding manures to the soil. Farmyard Manure (FYM) and Green-manure are the most important and widely used manures. These have to be applied in large quantities. FYM is the decomposed mixture of dung and urine of farm animals along with litter. Well rotten 100 kg FYM contains nitrogen content equal to 1 kg of urea and phosphorus content equal to 1.5 kg superphosphate. The compost prepared from mixture of plant residues and dung with the help of earthworms is called Vermicompost. Various species of earthworms are used for the preparation of vermicompost. Green manuring is the on-field ploughing and incorporation of crops such as jantar/dhaincha, sunnhemp, cowpea etc. in the soil while they are standing green or soon after they flower in the field. These manures also help in improving physical properties of the soil.

Chemical Fertilizers:

Chemical fertilizer is a mineral or chemical compound prepared by human being in the factories. These are the chemicals used as an outside source of nutrients for growing crops. The demand for fertilizers has increased in Punjab after Green Revolution. Generally nutrients like nitrogen, phosphorous and potassium are supplemented in the crops using chemical fertilizers like Urea, Diammonium Phosphate, Muriate of Potash etc. These are inorganic in nature. These contain more amounts of specific nutrients than manures. The nutrients in these chemical fertilizers are easily soluble in water and hence readily available to the plants. If the soil is deficit of a particular nutrient, then the chemical fertilizer with that particular nutrient can be used to increase the crop yield in that soil. These inorganic fertilizers do not contribute to the addition of humus in the soil. So the farmers must efficiently balance the use of chemical (inorganic) fertilizer and manures (Organic fertilizers).

Types of chemical fertilizers:

Nitrogenous Fertilizers:

Atmosphere contains 78% nitrogen in the form of gas. But plants cannot use this nitrogen for fulfilling their nutrient requirements except leguminous crops. Thus, various nitrogen containing chemical fertilizers are prepared from this atmospheric nitrogen such as Urea. It contains 46 % nitrogen i.e. 100 kg of urea fertilizer contains 46 kg of nitrogen. Deficiency of nitrogen in crops can be first seen on lower leaves which turn yellow. This yellowing of leaves gradually moves upwards and then the whole plant gives a yellowish look.

Phosphatic Fertilizers:

Phosphorous is the second important nutrient after nitrogen. Single Super Phosphate (SSP) and Diammonium Phosphate (DAP) are the chemical fertilizers used to supplement phosphorus in crops. The SSP contains 16 % phosphorous and DAP contains 18 % nitrogen and 46 % phosphorous content. These are prepared from Rock phosphate mineral.

Potassic Fertilizers:

Potassium is also very important for growth and development of plants. Plants take up this nutrient in the same amount as that of nitrogen but under Punjab conditions, use of these fertilizers is very less because this nutrient is already present in Punjab soils in large quantities. This nutrient should be supplemented on the basis of soil test if required. Generally potash is applied more in the potato crop. Its deficiency is noticed only in 5-10 % of soils in Punjab. Muriate of Potash (MoP) is used to supplement potash where it is deficient and recommended. It contains 60 % potassium.

Excessive use of chemical fertilizers has its own disadvantages. Excessive use of nitrogenous fertilizers can increase the acidic contents in the soil. These also account for additional expenditure of farmers. Moreover, these chemicals being water-soluble can contaminate the natural water reservoirs like ponds, lakes, rivers and canals which can further increase the growth of unwanted plants like algae and Water hyacinth. When population of these plants is increased excessively, then these hinder the water flow and decrease the oxygen from the water reservoirs. So farmers should use the chemical fertilizers after getting their soils tested for different nutrients and maintain a balance in the use of manures and chemical fertilizers for long term soil health sustainability. Farmers should also use the 'Soil Health Card' scheme to maintain the soil health.

Exercise

A. Answer in 1 to 2 words

1. How many nutrients are required for growth and development of plants?
2. Name the two types of fertilizers.
3. Name the crops which can fix atmospheric nitrogen into their roots.
4. What is the change in soil with excessive use of nitrogenous fertilizers?
5. What percent of nitrogen is present in atmosphere in the form of gas?
6. What percent of phosphorus is present in 100 kg of DAP?
7. What is the main source of phosphorus content?

8. What are the nutrients present in 100 kg FYM?
9. Potassium is generally applied in which crop in Punjab?
10. What percent of nitrogen is present in 100 kg urea?

B. Answer in 1 to 2 sentences:

1. What are manures?
2. What do you understand by green manuring?
3. How do organic fertilizers sustain the soil fertility for a longer time?
4. Which fertilizers are used more commonly under Punjab conditions?
5. How is Urea fertilizer prepared?
6. Which mineral is used to obtain Phosphorous?
7. How Farmyard Manure is beneficial to soil?
8. What are the symptoms of Nitrogen deficiency in crops?
9. How are chemical fertilizers useful for plants?
10. How is vermicompost prepared?

C. Answer in 5 to 6 sentences:

1. What do you understand by fertilizers? Explain.
2. Write a short note on chemical fertilizers.
3. Write a short note on harmful effect of chemical fertilizers on soil.
4. What measures should be taken to maintain the fertility of soils?
5. What is the importance of farmyard manure?

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Chapter 6

FARM MACHINERY AND EQUIPMENTS

Farm Mechanization

Farm mechanization is the application of engineering & technology in agricultural operations to do a job in a better way to improve the productivity. Various types of agricultural operations performed on a farm can be broadly divided into:

- i) **Ttractive work:** For example, seed bed preparation, tillage, sowing, planting, transplanting, harvesting and threshing operations.
- ii) **Stationary work:** For example, forage cutting, feed grinding, threshing, winnowing and lifting of water for irrigation.

These operations are done by different sources of power e.g. human, animal, mechanical, electrical and renewable power. Animal power is a reliable and popular source of farm power in India. Bullocks, buffaloes, camels, horses, mules and donkeys are the major animal powers used for farm operations. Renewable energy is the energy obtained from biomass, sun and wind and can be used in agricultural and domestic purposes with suitable devices. It can be used for lighting, cooking, water pumping, electricity generation and other stationary farm operations. Electrical and mechanical power is another major source to operate tractors, oil engines and electrical motors. In recent years, diesel engines and tractors have gained considerable popularity in agricultural operations.

1. Tractor:

Tractors are the most frequently used mechanical power available in the range of 20 HP to 90 HP. Many farm operations such as seed bed preparation, tillage, sowing, lifting of water from the earth etc. are done by tractor. There are about 4.76 lakh tractors in Punjab.



Tractor



Diesel engine

2. Diesel engines:

Diesel engines are smaller machines than tractors. These can be used for operating tube wells, chaff cutters, seed extractors etc. The expenditure on diesel for operating these engines and repairing them is very less compared to the tractor. Preference should be given to the diesel engines where lesser power is required.

3. Electric power:

Nowadays electricity has become a very important source of power on farms. Electric power is used for pumping underground water, dairy industries, poultry industries, cold storage, farm produce processing and other similar operations. At present there are about 11.5 lakh electric motors in Punjab.



Electric Motor

1. Farm equipments for Tillage (Land /Seed bed preparation)

Tillage is a mechanical manipulation of soil to provide favourable conditions of crop production. Tillage operation is highly labour consuming and difficult as compared to all subsequent farm operations in the field. The major objectives of tillage are:

- a) To obtain deep seed bed for sowing/ planting of different crops.
- b) To pulverize the soil.
- c) To destroy insects, pests and weeds.
- d) To aerate the soil for proper growth of crops.
- e) To increase the water absorbing capacity of soil.

1.1 Indigenous plough

The bullock driven plough is made of wood. It penetrates into the soil and breaks it open. The functional components include share, body, shoe, handle and beam. It can be used for dry land, garden land and wetland ploughing operations.

1.2 Cultivator/Tiller

It is an implement used for seed-bed preparation and for sowing with seeding attachment. The tines may have provision for vertical adjustments also. Depending upon the type of soil and crop, shovels are chosen for use on the cultivators. Usually tractor drawn cultivators are of two types depending upon the flexibility and rigidity of tines (i) Cultivator with spring loaded tines (ii) Cultivator with rigid tines.



Plough



Tiller

1.3 Disc Harrow:

Harrow is a secondary tillage implement that cuts the soil to a shallow depth for smoothing and pulverizing the soil, cut the weeds, mix the materials with the soil, conserve moisture in the soil and prevents evapotranspiration. Disc harrow performs the

harrowing operation by means of a set, or a number of sets of rotating discs, each set being mounted on a common shaft. Disc harrow is found very suitable for hard ground, full of stalks and grasses. It breaks the soil clods, stirs the soil and destroys the weeds.



Disc Harrow

1.4 Mould-board plough

Mould board plough cuts, loosens, inverts the furrow slice and provides a deep seed bed of good structure for seed bed preparation. Only one plough can be pulled with the help of bullocks while in the tractor driven mould board ploughs, there are 3 to 6 ploughs operating at the same time. If there is enough time between harvesting of first crop and sowing of second crop then the leftovers of the first crop can be buried into the soil using this plough. Also, the harmful organisms buried in the soil are eliminated by the heat generated from the sun.



Mould-board plough

1.5 Planker

It is a wooden plank used for smoothening the soil. It is also used for breaking clods, packing and levelling the ploughed soil and to crush the weeds. It is made of a wooden plank with a number of curved steel hooks bolted to a steel angle section, which is fixed or hinged to the rear side of the plank. The animal driven plankers are six feet in length while the tractor driven plankers have a length of ten feet.



Planker

1.6 Bund maker

It is used for making bunds or ridges by collecting the soil. Bunds are required to hold water in the soil, thereby conserving moisture and preventing run-off. Both manually operated and tractor operated bund makers are available.



Bund maker

1.7 Rotavator (Rotary tiller)

It is a cultivator with tines or blades mounted on a power driven horizontal shaft. Primarily it is used for the first and second ploughing. It is used for preparing seed bed, puddling, mixing fertilizer or green manuring in soil and orchard tilling.



Rotavator

1.8 Laser land leveler

Laser leveling is a laser guided leveling technique used for achieving fine leveling of the desired grade on the agricultural field. The laser leveler equipment includes laser emitter with tripod stand and laser receiver which gives information regarding the upper surface of the field. Through this information the tractor scraps the soil from the raised area to a lower area and levels the field.



Laser land leveler



Seed-cum-Fertilizer drill

2. Sowing and planting operations

Sowing and planting is an art of placing seeds in well prepared soil at desired spacing and depth in moist zone favorable for seed germination and plant growth. The recommended row to row spacing, seed rate, plant to plant spacing, plant population and depth of seed placement vary from crop to crop and with different agro-climatic conditions to achieve optimum yield. Some crops are sown with the help of broadcasting and others with seed-cum-fertilizer drill such as wheat, gram, mustard, moong, cowpea etc. while some crops are transplanted with the help of transplanting machines such as rice. Similarly for other crops such as groundnut, maize etc. different sowing machines are used.

Advanced machinery for sowing:

For wheat sowing zero till, bed planters and happy seeder have been devised. Cotton planters, potato planters, sugarcane planters and vegetable planters are used for planting cotton, potatoes, sugarcane and vegetables respectively.

2.1 Zero till drill

After harvesting of rice, wheat is sown in the same field without tillage operations. This helps in preventing air and soil pollution which occurs as a result of burning paddy straw. This machine covers one acre in about one hour and allows the sowing of wheat one to two weeks ahead of time.



Zero till drill

2.2 Bed planter:

This machine has been developed for water deficit areas. In this, beds are prepared and wheat is sown in two or three lines. This technique saves both water and time.



Bed planter

2.3 Roto-till drill:

There is a Rotavator attached to this machine on the front side which helps in clearing and preparing the fields before sowing. The seed and fertilizer rate can be controlled as required in this machine.

2.4 Happy Seeder:

The Happy seeder machine was developed to sow wheat through direct drilling without removing or burning the paddy straw from the field. This machine is very useful for managing crop residues, for conserving soil moisture, soil temperature, micro-nutrients and controlling weeds. This machine completes 5 acres of wheat sowing in one day and runs with a 45-50 horse power tractor.



Happy Seeder

2.5. Transplanting Operations:

Transplanting consists of preparing seedlings of specific age in a nursery and then planting these seedlings in well prepared fields. It is commonly used for paddy, vegetables and flower crops.



Transplanting Operations



Vegetable transplanter

3. Intercultural operations

To uproot the weeds from the field is known as intercultural operation. This is done manually and mechanically. Manual weeding is done by sickle, *khurpi*, *kasaula*, *trifali*, wheel hand hoe, etc.



Kasaula



Khurpi



Trifali

3.1 Wheel Hand Hoe:

It is generally used for weeding in standing crops. It is operated by one person by pushing from back. There are 3-6 blades on the wheel.

Mechanical weeding is done by tractor operated rotary weeder and self-propelled power weeder.



Wheel Hand Hoe



Rotary weeder

3.2 Tractor operated weeders:

In these machines, cultivator is mainly used and they uproot the weeds. These are used to remove weeds and retain moisture in the soil. These are used on the hard and rocky soils and according to the crop and field conditions various types of blades are used in these machines.

3.3 Self-propelled power weeder:

These machines are driven by engine, which is installed on the machine. One person holds the handle and walks behind the machine. The function of this machine is to uproot the weeds in between the row crops.

4. Spraying equipments for plant protection

Sprayers are generally used for applying chemicals to control diseases, insects and weeds. The main objective of spraying operation is to protect the plants:



Manual knapsack Sprayer

4.1. Types of sprayers:

Various pesticides, fungicides and other chemicals are used to protect the crops from harmful insect-pests and diseases. Different types of sprayers have been developed for different types of applications and field and crop conditions. Manual operated sprayers are knapsack sprayer, foot sprayer, rocker sprayer, hand compression sprayers. Tractor operated sprayers are boom sprayer, aero blast sprayer etc.

4.2. Power sprayers

Tractor operated sprayers are operated by tractor and used to spray chemicals in the form of very fine droplets. Other power sprayers are aero blast sprayer, boom sprayer and air assisted sprayer. These are used for large farms, tall crops, horticultural crops and trees.



Aero blast sprayer

5. Harvesting operation:

Crops are harvested after normal maturity. There are various types of tools and equipment used for harvesting and threshing the crops.

5.1 Manual harvesting

The harvesting of crops is traditionally done by manual methods. Harvesting of major cereals, pulse and oilseed crops are done by using sickle followed by manual/machine threshing and then followed by winnowing.



Sickle

5.2 Mechanical harvesting



Reaper

I) Reapers

Harvesting can be done mechanically by a reaper, which can be self-propelled or tractor operated. Reaper cum binders are used for cutting the crop and conveyed vertically to the binding mechanism and released to the ground in the form of bundles.

ii) Combine Harvester

The Combine Harvester is a machine designed for harvesting, threshing, separating, cleaning and collecting the grain in a single operation. The present day combine harvesters are being mostly used for harvesting two major crops namely wheat and paddy. Other crops that can also be harvested with combines are sunflower, maize, soybean, pulses etc. with slight modifications in the combine. These save time thus preventing losses from climatic hazards such as rain, storms, fire etc.

Based on the sources of power the combine harvesters may be classified as i) Self-propelled combine harvester. ii) Tractor operated combine harvester.



Self propelled combine harvester



Tractor mounted combine harvester

iii) **Root crop harvesters/Diggers**

The tractor operated root crop harvesters/diggers are used for uprooting the root crops i.e. potato, onion, garlic and carrot. For uprooting of groundnut crop, groundnut digger is used.



Root crop Harvester

6. **Threshing operation**

Threshing is the most critical post-harvest operation in the crop production process to detach/separate the grain/seed/cob/pod from the ear heads/plant without any damage. Crop threshing is generally done by

- i) Manual threshing
- ii) Mechanical threshing

6.1 **Manual Threshing:**

Manual Threshing is involved in separating the grain from the panicle by hand beating, foot threshing and animal trampling etc. followed by winnowing. Winnowing is the removal of lighter materials such as unfilled grains, chaff, weed seeds, and straw by using a blower, air fan or by wind.



Paddy Thresher



Hadamba thresher with safety gadgets

6.2 **Mechanical threshing:**

These threshers involve removal of the grains/seeds from the ear heads, cob or pod of the plant by beating & rubbing between the threshing drums & concave screen of a thresher.



Mechanical Thresher

7. Chaff cutter

Almost every rural household in Punjab has milch animals and these chaff cutters are used in every household for cutting fodder into small pieces before being fed to these milch animals. This machine can be operated manually or through electric motors and diesel engines.



Manual chaff cutter



Electric chaff cutter

8. Machinery for residue management

Farmers are burning the paddy straw after harvesting paddy which burns the nutrients in the soil and harm our natural resources. Apart from organic carbon approximately 25% of nitrogen and phosphorus, 50% Sulphur and 75% potassium is left in the paddy straw when it is burnt. Burning of paddy straw releases poisonous gases viz. carbondioxide, carbon monoxide, methane and nitrous oxide etc. The smoke released in the atmosphere as a result of burning paddy straw not only harms the environment but also leads to health hazards among the human beings and animals. Happy Seeder can be used to manage paddy straw (already covered under sowing and planting operations).

8.1 Wheat straw combine/ Straw reaper

Wheat straw combine is a machine, which cuts and bruises the left over wheat stubbles after combine operations and collects the bruised wheat straw into a moving trolley attached behind straw combine. This trolley is covered with a wire mesh net.



Wheat straw combine



Baler

8.2 Baler

Straw baler is a machine for collection of the paddy residue. It picks up the loose residue, compresses it into bales of uniform sizes, ties them with wire and discharges it in the field from the back of the machine. These bales can be used as fuel as well as for cardboard making, for compost making and power generation. These machines collect the loose residue only.

8.3 Paddy straw Chopper:

The machine in a single operation harvests the paddy stubbles left after combining, chops into small pieces and spreads on the ground. The chopped straw stubbles are easily buried in the soil by the use of single operation of Rotavator or disc harrow and decay after irrigation. Subsequently, wheat sowing is done as usual by the use of zero till drill.



Straw Chopper

Exercise

A. Answer in 1 to 2 words:

1. Which machine is used for threshing?
2. What is the name of machine used for cutting fodder?
3. What is the name of equipment used for smoothening and breaking clads?
4. Write the name of equipment used for making bunds in the field.
5. Name any two machines used for weeding.
6. Which machine/equipment is used for spraying herbicide and pesticides?
7. Name the machine used for sowing of seeds.
8. Name any two machines used in agricultural operations.
9. What is the range of mechanical power of tractors?
10. Why we use laser leveler?

B. Answer in 1 to 2 sentences:

1. What is the significance of diesel engine in agricultural operations?
2. Define mould board plough. What are the advantages of mould board plough?
3. How the weeds are controlled?
4. What do you understand by chaff cutter? What is the purpose of using chaff cutting?
5. Describe the equipments used for tillage.
6. Describe the equipments used for weeding.
7. What is tiller used for?
8. What is disc harrow used for?
9. How does a Happy Seeder work?
10. Name the types of combine harvesters.

C. Answer in 5 to 6 sentences:

1. Write a note on the importance of farm machinery in modern agriculture.
2. Define mould board plough. How is it different from other plough?
3. Describe in detail the machines for residue management.
4. Which main machines are used for sowing of seeds?
5. Describe the main function of combine harvester.

Chapter-7

MAJOR FRUIT CROPS OF PUNJAB

Fruits are a delicious source of nutrients that play an important role in maintaining proper health of human beings. Fruits are rich source of vitamins, minerals, pigments and antioxidants which protect the body from various diseases. Balanced diet of a healthy person should include 100g of fruits per day. Fruits contain high amount of vitamins like vitamin A (mango, papaya), vitamin C (amla, guava, citrus fruits, ber), proteins (cashewnut, almond and walnut) and minerals like calcium (litchi and karonda), iron (karonda, fig and date) and potassium (banana). Kinnow, guava, mango, sweet orange, pear, ber, litchi and peach are the major fruits of Punjab while lime/lemon, galgal, grapes, plum, amla, loquat, pomegranate, papaya, chikoo and phalsa are the minor fruits grown in the region. Area under fruits in Punjab is about 76 thousand hectares and maximum area is under citrus fruits i.e. nearly 50 thousand hectares.

Citrus Fruits:

Citrus fruits comprise of kinnow, sweet orange, lime, lemon (galgal) and grapefruit. Kinnow ranks first in terms of area in Punjab and is a good source of antioxidants that fight against cancer. Kinnow is mainly grown in the districts of Hoshiarpur, Ferozepur, Fazilka, Faridkot, Sri Muktsar Sahib and Bathinda. Kinnow is planted in the month of Feb-March and Sept-Oct.

Guava:

Guava ranks second after citrus. As compared to other fruits, cost of cultivation is less in guava. Guava is grown in almost all the districts of Punjab. Guava is a rich source of vitamin C which is 2-5 times more than orange and 10 times more than tomato. In addition to it, Guava is a good source of calcium, phosphorous and iron. Guava fruits also contain antioxidants that help in reducing high blood pressure. Punjab Pink, Sardar and Allahabad Safeda are the cultivars of Guava. Guava is planted twice in a year i.e. Feb-March and Aug-Sept. Quality of winter guava is better than rainy guava. Rainy guava is severely attacked by fruit fly which spoils the fruit and makes them unfit for consumption.

Mango:

Mango is known as the king of fruits and occupies third position in Punjab. Apart from other vitamins, it is a rich source of vitamin A. Mango is consumed at all the stages i.e. raw in the form of chutney, pickle, amchur and aam papad while ripe fruits are used to prepare juice, murraba and squash. Mango is commercially grown in submountaneous districts of Punjab like Hoshiarpur, Shaheed Bhagat Singh Nagar, Gurdaspur, Fatehgarh Sahib and union territory of Chandigarh. Alphonso, Dashehari and Langra are the cultivars of mango. The best planting time of mango is Feb-March and Sept-Oct.

Pear:

Pear is successfully grown in the districts of Amritsar, Gurdaspur and Jalandhar. It is a good source of proteins, Vitamin A, Vitamin B and minerals like calcium, phosphorous and iron. The planting of pear is done till mid February before the start of new growth. Patharnakh, Punjab Beauty, Baggugosha and Punjab Soft are the cultivars of pear.

Ber:

Ber is one of the ancient and common fruits of Punjab. The districts of Sangrur, Patiala, Mansa, Bathinda, Fazilka and Ferozepur are famous for ber cultivation. Ber is a good source of vitamin C, proteins and minerals like calcium, phosphorous and iron. Ber purifies the blood and increases the digestion of food. Recommended cultivars of ber are Umran, Sanaur-2 and *Wallaiti*. The budded plants are usually transplanted during Feb-March and Aug-Sept.

Litchi:

Litchi is grown in the districts of Hoshiarpur, Gurdaspur, Rupnagar, S.A.S. Nagar (Mohali) and some parts of Patiala. Litchi is a good source of vitamin C, calcium, phosphorous and potassium. Litchi is beneficial to cure breast cancer in women. Dehradun, Calcuttia and late Seedless are the recommended cultivars of Litchi. Litchi should be planted towards the end of rainy season i.e. in Sept.

Peach:

Peach is a temperate fruit but some low chilling cultivars are grown in Punjab. It is successfully grown in Tarn-Taran, Jalandhar, Patiala, Shaheed Bhagat Singh Nagar and Gurdaspur. Peach is a good source of proteins, vitamin A, vitamin B and minerals. One year old healthy nursery plants of peach can be planted till middle of January before new growth starts. Recommended cultivars of peach are Partap, Shan-e-Punjab, Prabhat, Sharbati and Punjab nectarine.

Generally one metre deep and one metre wide round pits should be dug for each fruit plant. The pits are refilled with a mixture of top soil and farmyard manure in equal parts. To each pit, 15ml of chloropyriphos mixed in about 2 kg soil is added to control white ants. The refilled pits need to be watered a few days before planting the fruit plants.

Exercise

A. Answer in 1 to 2 words:

1. What is the area under fruit cultivation in Punjab?
2. Name the districts where kinnow is commercially grown in Punjab.
3. What is the planting time of kinnow nursery?
4. Which vitamin is found in guava fruit?
5. Which fruit is known as king of fruits?
6. Name the districts where mango is commercially grown.
7. Name the areas where pear is grown.
8. Name the cultivars of Litchi.
9. What is planting time of peach?
10. What should be the daily fruit intake in the balanced diet of a healthy person?

B. Answer in 1 or 2 sentences:

1. Name the fruits in which the following nutrients are found in larger amounts:
 - Vitamin C ● Calcium ● Protein
 - Vitamin A ● Vitamin B ● Potassium
 - Iron
2. Why fruits are important for our health?
3. Name the major fruits of Punjab.
4. Which fruits are included in citrus fruits?
5. Name the cultivars of Pear.
6. Name the cultivars of Peach.
7. How is Kinnow beneficial to our health?
8. How is Ber beneficial to our health?
9. Name the districts where Pear, Ber, Likhri and Peach are grown in Punjab.
10. Name the processed products prepared from mango.

C. Answer in 5 to 6 sentences:

1. Write the major fruits grown in Punjab, their nutritive value, cultivars, area under cultivation and planting time.
2. What do you know about Kinnow cultivation in Punjab?
3. Write the nutrients present in following fruits:
 - Guava ● Kinnow ● Mango ● Pear
4. Write short notes on cultivation of following fruit crops:
 - Kinnow ● Ber ● Litchi ● Peach ● Guava
 - Mango ● Pear
5. What is the general planting time of fruit crops in Punjab? Also enlist the cultivars of these fruit crops.

XXXXXXXXXXXX

Chapter-8

MAJOR VEGETABLES OF PUNJAB

Vegetables are an integral part of human diet. These are also known as 'protective food' as these are the good sources of proteins, vitamins, minerals etc. and thus play an important role in nutritional security. Monoculture of wheat and rice can be broken with the cultivation of vegetable crops. According to the health specialists, one adult should consume minimum three hundred grams of vegetables per day. In India, the cultivation of vegetables is done according to season, region and consumer preference. The main vegetables of Punjab include potato, onion, cauliflower, tomato, chilli, carrot, pea and cucurbits (bottle gourd, bittergourd, cucumber, muskmelon, watermelon etc.). The successful vegetable cultivation depends on the prevailing weather. In Punjab nearly two lakh hectares area is under vegetable cultivation.

According to season, vegetable crops can be divided into two categories:

1. **Summer Vegetables:** Those vegetables which require high temperature for their growth and development like cucurbits, okra, chilli, tomato, brinjal etc.
2. **Winter Vegetables:** Those vegetables which require cool climate for their growth and development. For example pea, cauliflower, spinach, radish, carrot etc.

The cultivation of main vegetables under Punjab conditions are as follows:

Potato:

Potato is a cool climate loving crop. This crop can be grown on various types of soils. Kufri Pukhraj, Kufri Joyti, Kufri Sandhuri and Kufri Badshah are the main varieties of potato grown in Punjab. For one acre planting of potato, about 8-12 quintal seed is required. The recommended time of planting is September-October. Planting can be done manually or mechanically. It yields about 100-140 quintals (q) per acre.

Chilli :

Chilli is used almost in every kitchen. Chilli is cultivated on 7.67 thousand hectares area in Punjab. CH-1, CH-3, Punjab Tez and Punjab Surkh are the main varieties. This crop loves hot and humid climate. About 200 gm seed is required for one acre nursery. One marla is sufficient for nursery growing for one acre. End October to mid November is the suitable time for sowing of nursery and month of February-March are suitable for transplanting.

Tomato :

Tomato is a warm season crop and is used usually in cooking vegetables, chutney, *salad* and processing purposes. It's sowing should be done in October and transplanting in November-December. Punjab *Ratta*, Punjab Varkha Bahar-1, Punjab Varkha Bahar-2, Punjab Chhuara and T.H.-1 are the main varieties of tomato recommended for Punjab. About 100 gm seed is required for the nursery of one acre crop.

Cucurbits :

Bottle Gourd, Bitter Gourd, Muskmelon, Watermelon, Spring Gourd, Ash Gourd, Cucumber, Squash Melon, Pumpkin etc. are the major cucurbitaceous vegetable crops. These crops are mainly sown in the month of February-March. On an average, 2 kg of seed is required

for one acre. Most of the cucurbit crops take 2-3 months for harvesting except Ash Gourd.

Okra :

This crop is a warm climate loving crop. Punjab-7 and Punjab-8 are the improved varieties of the Okra. Okra crop can be sown in the month of February-March and June-July. It gives an average yield of 50 quintals per acre.

Brinjal :

Brinjal crop can be grown throughout the year. It gives four crops in a year. BH-2, Punjab Sadabahar, PBH-3 and Punjab Nagina are the recommended varieties of the brinjal crop. This crop is grown in a nursery and then transplanted in the field.

Cauliflower:

This is one of the important winter season crops. Pusa Snowball-1 and Pusa Snowball K-1 are the recommended varieties of cauliflower. It takes about 90-100 days for harvesting. For one acre nursery, 250-550 gm of seed is sufficient. The normal sowing time of this crop is September-October.

Pea :

Pea is a legume crop. It helps to improve soil fertility because it has the ability to fix nitrogen from air and get enhanced available form of nitrogen in the soil. Punjab-88 and *Mithi phalli* are the main varieties of pea crop. The average pod yield of these varieties is 55-75 q/acre. The sowing of pea is done in mid October to mid November. For one acre, 30-45 kg of seed is required. Before sowing, treat the seed with Rhizobium for quick growth and high yield. This culture is available in the Punjab Agricultural University, Ludhiana.

Onion :

Onion is an important winter vegetable crop. This is used in almost every vegetable for cooking. This is also used for chutney and paste making. PRO-6, Punjab Naroya and Punjab White are improved varieties of onion. Nursery of onion is sown in the month of October-November and transplanting is done in December-January. For one acre, 4-5 kg of seed is sufficient.

Root Vegetables:

Carrot, radish and turnip are the root vegetable crops. PC-34 and Punjab Black Beauty for carrot, Punjab Pasand and Pusa Chetki for radish and L-1 for turnip are the recommended varieties to be grown in Punjab. Sowing of these crops is done in September-October. For carrot and radish, 4-5 kg of seed is sufficient for one acre while for turnip 2-3 kg seed is used for one acre.

Leafy Vegetables:

Coriander, palak, kasuri methi etc. are the important leafy vegetables which are important sources of beneficial nutrients for the human beings. The cultivation of leafy vegetables is mainly done in winter season. Mostly these vegetables are grown in kitchen garden for household purposes.

Besides the above mentioned vegetables, there are many minor vegetables like arbi, sweet potato, black carrot, long melon etc. Which are cultivated for domestic purposes in the kitchen gardens only.

Exercise

A. Answer in 1 to 2 words :

1. What should be the daily vegetable intake for an adult?
2. Mention the total area under vegetable crops in Punjab.
3. Name two summer vegetable crops.
4. How much seed of potato is required for one acre?
5. Name two varieties of chilli.
6. What is the sowing time of tomato?
7. What is the average yield of okra per acre?
8. Name two cucurbit crops.
9. Name two root vegetables.
10. What is the seed rate of chilli crop per acre?

B. Answer in 1 to 2 sentences :

1. Why the vegetables are known as protective food?
2. Categorize the vegetables according to the climate requirement.
3. What do you mean by balanced diet?
4. Name four summer and winter vegetable crops each.
5. Mention the nutrients present in vegetable crops.
6. Name the recommended varieties of potato.
7. Name the leafy vegetables and also mention their sowing time.
8. What is the sowing time for chilli nursery?
9. How does the pea crop improve soil health?
10. Discuss the winter vegetables briefly?

C. Answer in 5 to 6 sentences :

1. Write short notes on the following vegetables:
 - Chilli
 - Onion
 - Potato
 - Okra
2. “Vegetables are an integral part of human diet.” Comment on the statement.
3. Why is the inoculation of culture recommended in pea?
4. Name the root crops along with their varieties and sowing time.
5. Discuss the cucurbitaceous crops.

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Chapter-9

ORNAMENTAL PLANTS AND FLOWERS OF PUNJAB

Flowers play an important part in our lives as these are used at many occasions like marriage, birthday and other ceremonies. Flowers convey us the message of love and patience. Flowers of different colours give peace to our mind and their fragrance makes our surroundings very pleasant. Seasonal flowers like Rose, Gladiolus, Chrysanthemum, Marigold etc. are planted in the flower beds, and are used for making bouquets and for interior decoration in the houses. Some flowers like Rose, Jasmine, Tube Rose etc. are used for oil extraction. The petals of roses are also used to make gulkand. During the ancient era, flower petals, roots, bark etc. were used for medicinal purposes and nowadays they are used as herbal medicines.

Ornamental plants also help us to beautify our surroundings. Trees, shrubs and climbers etc. make our surroundings green and their flowers add beauty through different colours. They clean the environment by releasing oxygen and take in carbon dioxide. They also absorb the soil particles, harmful gases and substances and purify the air to make it clean. The trees, shrubs and climbers etc. through evaporation process increase the moisture content in air and make the environment cool.

Rose is planted in the beds during November to March and flowering occurs during December to April. Similarly, suckers and cuttings of Chrysanthemum are planted in July-August and the flowering occurs during November- December. Chrysanthemum is also known as “the autumn queen”. The winter season annual flowers like Pansy, Dog flower, Sweet Pea, Phlox, Verbena, Marigold, Paper flower, Sweet William etc. are planted through transplantation of seedlings in October–November.

Zinnia, Sunflower (ornamental), Gompherena and Kochia are summer season annuals and are planted in April. Cock's comb and Balsam are rainy season flowers and are planted in July. The seedlings of flowers are mostly planted during evening and watering is done immediately to avoid wilting of the plants. The weeding of beds should be done from time to time and seedlings should be checked against diseases and insect-pests.

Ornamental plants, their flowers and seedlings could be sold in nurseries for commercial purpose. In Punjab, African Marigold, French Marigold and Gladiolus are cultivated at commercial scale under open conditions. The cultivation of Gerbera and Rose is done under plastic and green house for high quality flower production. Seasonal flowers are also cultivated in Punjab for flower seed production and exported to foreign countries like USA, Canada and Germany etc. Ornamental flowering plants also play an important role in diversification of agriculture.

The right time of planting trees, shrubs, climbers etc. is rainy season i.e. July-August and spring season i.e. February-March. Winter deciduous plants like Queen's flower, Sawni and Mulberry are planted in winter i.e. mid December-January before sprouting. Trees are classified on the basis of their height and canopy into large, medium and small trees. Small spread trees like Ashoka (Pendula) can be planted in small space in the house. Trees can also be classified on the basis of size like small canopy (Molsari), spreading type (Gulmohar), straight (Silver oak), dropping branches (Bottle brush) etc. Depending upon the colour of flowers also, trees can be classified such as yellow (Amaltas), red (Gulmohar, Bottle brush) etc. Besides trees, many shrubs can also be planted in the parks and houses because of their flower and foliage beauty. They can also be divided into different classes depending upon the colours of their flowers like white

(Chandani, Jasmine, Murraya), yellow (Peeli Kaner), red (Hibiscus, Jatropha) and pink (Sawni). The foliage of some shrubs is also very beautiful eg. Hibiscus, Duranta, Chandani etc. These shrubs are planted on the basis of their height like tall, medium and dwarf. Some climbers like orange (Golden Shower), red, purple (Lantern), foliage (Curtain Creeper) etc. can be planted along the pillars in small space in the houses. The thorns of climbers like Bougainvillea, secreting sticky substances (Indian Ivy), tendrils (Golden shower) etc. help them to climb up along the wall and pillars. For planting trees, shrubs and climbers, pits of 2-3 feet should be dug and refilling of pits is done with two parts of soil and one part of farmyard manure. Many pot plants like Palms, Money Plant, Rubber Plants etc. are kept inside the houses, corridors and offices for decoration.

Exercise

A. Answer in 1 to 2 words:

1. What is the time of planting rainy season flowers?
2. Name the autumn season plants.
3. Name any two red coloured flowers.
4. What is the time of planting rose?
5. Which flower is known as 'autumn queen'?
6. What is the flowering time for chrysanthemum?
7. Which product is made from the rose petals?
8. Name the process through which trees increase the moisture content in the air and make the environment cool.
9. Name the rainy season flowers.
10. Which gas is released in atmosphere by the plants?

B. Answer in 1 to 2 sentences:

1. Which part of climbers help them to climb along the wall? Give example.
2. Name the winter season flowers and what is their time of planting.
3. What is the planting time for autumn season plants? Name any two autumn season plants.
4. Name the shrubs having beautiful foliage and on what basis these plants are selected.
5. Describe the classification of trees on the basis of their spread.
6. Name the flowers used for oil extraction.
7. How can the ornamental plants be used commercially?
8. What is the exact time of plantation of trees, shrubs and climbers.
9. Describe the classification of trees on the basis of their height and canopy.
10. Which plants are grown in pots?

C. Answer in 5 to 6 sentences:

1. "Flowers play an important part in our lives". Comment on this statement.
2. What is the contribution of trees in cleaning the environment?
3. Describe the classification of trees on the basis of size giving suitable examples.
4. Explain the method of plantation of trees and shrubs.
5. What is the role of trees in agriculture diversification?

Chapter 10

AGRICULTURAL SUBSIDIARY OCCUPATIONS

Green Revolution gave a new direction to Punjab agriculture and made the state self sufficient in cereal crops like rice and wheat. Apart from being self sufficient, the state of Punjab became capable of contributing a large amount of cereal crops in the central pool. But, in the present scenario, Punjab agriculture is at crossroads and has become stagnant. The productivity of major crops of Punjab has decreased. About 1/3rd farmers in Punjab are small and marginal with two or less than two hectares of land holding. These small and marginal farmers cannot sustain only on crop cultivation and therefore, the subsidiary occupations can help them to supplement their income for their livelihood. It is the need of the hour that today's educated and unemployed youth can adopt these allied enterprises. At the same time, the students also need to be made aware about these allied enterprises in agriculture so that they understand the importance of learning by doing and inculcating in themselves the values of hard work and honesty. This chapter provides a brief description about subsidiary occupations such as mushroom cultivation, bee-keeping, dairy farming, vegetable cultivation, agro-processing, agro service centers etc. These will be dealt in detail in the higher classes.

1. Mushroom cultivation:

Mushrooms are very nutritious products that can be cultivated indoors (rooms/sheds/thatched huts) and do not require arable land. Punjab Agricultural University (PAU), Ludhiana has developed and recommended five different varieties of mushroom namely Button Mushroom, Oyster Mushroom and Shiitake Mushroom during the winter season from September-March and Milky Mushroom and Paddy Straw Mushroom during the summer season from April-August. In Punjab, button variety of mushroom accounts for 90 % of the total mushroom production in the state.



Mushroom

2. Bee-Keeping:

Punjab is the leading state in bee-keeping in the country with an estimated honey production of 14,000 metric tonnes. Bee-keeping is not time and labour intensive. It has



Honeybee frame

no clash with any agricultural activity. It is an enterprise which after accounting for its costs, starts giving profits in the very first year. Italian honey bee is the most prominent breed in Punjab. Besides honey, it yields many other hive products viz. pollen, bee-wax, propolis, royal jelly, bee-venom, bee brood etc. This enterprise is subsidized by National Horticulture Mission (NHM) to encourage its adoption among the farmers.

3. Dairy farming:

Dairy farming is an important subsidiary occupation of Punjab as milch animals are an important part of almost every rural household in the state. After fulfilling the requirements of milk at home, the remaining milk can be sold to earn additional income. At present, there are dairy cooperative societies in almost every village of Punjab which procure the milk from the farmers from their doorsteps and process the milk at their processing plants. Farmers can earn higher incomes from the cross-bred cows like Jersey and Holstein Friesian. For a dairy farm to be commercial and eligible for financial assistance from the government, farmers should keep at least 10 high yielding cows.



Dairy farming

4. Vegetable cultivation:

Vegetable cultivation is a very remunerative enterprise for the farmers with small land holdings. It is imperative to grow vegetables at home as it saves money and provides fresh and chemical free vegetables to the family. Protected cultivation of vegetables helps the farmers to earn almost double or more as compared to the rice-wheat crop rotation or to the vegetables grown in the open cultivation crop rotation as they can grow off-season vegetables in them. The production of off-season vegetables is possible with low tunnel or net/poly house technology.



Green house technology



Low tunnel technology for vegetables

5. Value addition and agro-processing:

Post harvest, management is essential nowadays for cereals, pulses, oilseeds and other crops. Selling them after value addition in the form of flour, oil, nuggets etc. is a better option to increase the income of farmers as compared to selling them raw. On similar lines, farmers can earn more by small scale processing of fruits and vegetables in the form of pickle, chutney, juice, squash etc. The Punjab Agricultural University, Ludhiana has given a model of Agro-Processing Complex (APC) for the young farmers who can establish these complexes and earn their livelihood. These complexes consist of small machines like mini rice mill, baby oil expeller, small and large flour grinder with scouring machine, cotton ginning machine, pulses cleaner etc.



Value addition of agricultural products

6. Agro Service Centres:

The government gives financial assistance to the educated youth to set up Agro Service Centres where they can purchase the advanced machinery used in agriculture and give the same to the farmers on rental basis. These centres can serve as a good avenue of employment for these educated youth.

7. Agri-Clinics:

These centres are established by the educated unemployed youth who specialize in the field of agriculture to help the farmers from time to time by providing the required agricultural information. Apart from this, they may also provide input services to the farmers in the form of seeds, chemicals, fertilizers etc.

Besides these enterprises, poultry farming, piggery, sheep & goat rearing and rabbit rearing, vermicomposting etc. are some of the other enterprises which can help the farmers to supplement their income. It needs to be taken care that no enterprise should be started without obtaining the required training. These trainings are conducted by PAU, Ludhiana and its Krishi Vigyan Kendras (KVKs) at district level and farmers can enroll themselves easily. At the same time, every enterprise should be started initially at a small scale to gain experience so as to avoid losses which may be faced due to lack of experience in the beginning. Slowly and gradually the enterprise can be expanded and farmers can earn greater income from them.

Exercise

A. Answer in 1 to 2 words:

1. What is the proportion of small and marginal farmers in Punjab?
2. How many varieties of mushroom are there?
3. Which breed of honey-bee is most prominent in Punjab?
4. For which enterprise National Horticulture Mission gives subsidies to farmers?
5. Which agencies procure milk from the farmers in Punjab?
6. Which variety of mushroom is most prominent in Punjab?
7. What kind of cultivation is done to obtain off-season vegetables?
8. Name the centres which provide advanced agricultural machinery to the farmers on rent.
9. Which dairy farmers get financial assistance from the government?
10. Which organization provides the Agro-Processing Complex model ?

B. Answer in 1 to 2 sentences:

1. Name the different varieties of mushroom.
2. Name the by-products obtained in bee-keeping.
3. In which form can the fruits and vegetables be processed at small scale?
4. In which season mushrooms can be grown?
5. Which breed of cows can earn greater income to farmers?
6. How can the farmers earn higher incomes from agricultural products?
7. What kinds of facilities are provided in the agro-service centres?
8. Why should the allied enterprises be started at small scale?
9. Why should be grow vegetables at home ?
10. From where can the training be obtained regarding allied enterprises?

C. Answer in 5 to 6 sentences:

1. Why is Punjab agriculture at crossroads today?
2. Why should small and marginal farmers adopt allied enterprises?
3. Describe Agro Service Centres in brief.
4. How can the farmers earn higher income from dairy farming?
5. What kinds of machineries have been recommended by PAU in the Agro-processing complexes?

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