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:

Disc Harrow

Harrow is a secondary tillage implement that cuts the soil to a shallow depth for smoothening 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, stir the soil and destroy the weeds.

1.4 Mould-board plough

Mould-board plough

Mould board plough cuts, loosen, invert the furrow slice and provide 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 leftover 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.

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 crushing 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 leveller

Laser levelling is a laser guided levelling technique used for achieving fine levelling of the desired grade on the agricultural field. The laser leveller 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 leveller

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.

Seed-cum-Fertilizer drill

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.

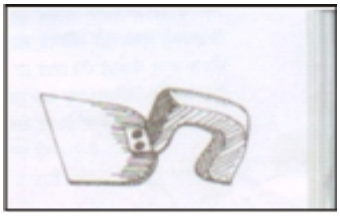
Transplanting Operations

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, kasula, 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.

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.

Rotary weeder

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.

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.

Manual knapsack Sprayer

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

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.

Reaper

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 can also be harvested with combines like, 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 and ii) tractor operated combine harvester.

Tractor mountted combine harvester

Self propelled 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 and 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.

Paddy Thresher

Hadamba thresher with safety gadgets

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.

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 release 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 being 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

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 discharge 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.

Baler

8.3 Paddy straw Chopper:

The machine in a single operation harvest the paddy stubbles left after combining, chop 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 decayed 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. Write down the horse power range of tractors?
2. How many tractors are there in Punjab?
3. What is the name of machine for sowing of seed and fertilizer?
4. Write the name of equipment used for making bunds in the field?
5. Write the name of machine for levelling the field?
6. Which machine/ equipment is used for spraying herbicide and pesticides?

7. Name the machine used for groundnut harvesting.
8. Name the machine used for spraying chemicals in orchards.
9. Which machine can chop the paddy straw into small pieces and spread on the ground?
10. Write down the name of machine which is used for direct drilling of wheat seed in the combine harvested paddy residue mulched field.

B. Answer in 1 to 2 sentences:

1. What are the major sources of power for doing various farm operations?
2. Define tillage?
3. What are the advantages of mould board plough?
4. Name the machines used for transplanting operation.
5. What do you understand by intercultural operation?
6. What do you understand by spraying operation? What are the major types of sprayers?
7. How does a Happy Seeder works?
8. Name the types of combine harvesters.
9. How many types of threshers are used in our country?
10. Name the machines used for residue management.

C. Answer in 5 to 6 sentences:

1. What are the objectives of tillage operation?
2. Describe in detail the major methods of sowing and planting of seed.
3. Write a note on the laser land leveller.
4. Describe in detail the machines for residue management.
5. Write a note on the mechanical harvesting.

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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, Ferozpur, Fazilka, Faridkot, Muktsar and Bathinda. Kinnow is planted in the month of Feb-March and Sept-Oct.

Guava:

Guava ranks second after citrus. As compare 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 ie 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 ampapad while ripe fruits are used to prepare juice, murraba and squash. Mango is commercially grown in submountainous districts of Punjab like Hoshiarpur, Shaheed Bhagat Singh Nagar, Gurdaspur, Fatehgarh Sahib and union territory of Chandigarh. Alphonso, Dusehari 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 Ferozpur 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 increase 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, Roopnagar, SAS 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 Seedless late 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 TaranTaran, 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-i-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
   a) Vitamin C b) Calcium c) Protein
   d) Vitamin A e) Vitamin B f) Potassium
   g) 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. Why is the quality of rainy guava poor?
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 nutritive value of following fruits:
   a) Guava b) Kinnow c) Mango d) Pear e) Karonda
4. Write short notes on cultivation of following fruit crops.
   a) Kinnow b) Ber c) Litchi d) Peach
   e) Guava f) Mango g) Pear
5. What is the general planting time of fruit crops in Punjab? Also enlist the cultivars of these fruit crops.

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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 protein, 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 300 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, chili, 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 hectare 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. Kuffripukhraj, Kuffrijoyti, Kuffrisandhuri and Kuffribadshah 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 quintal (q) per acre.

Chilli :

Chilli is used almost in every kitchen. Chilli is cultivated on 7.67 thousand hectare acre in Punjab. CH-1, CH-3, Punjab Tez and Punjab Surkh are the main

varieties. This crop loves hot and humid climate. About 200 g 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 months of Feburary-March are suitable for transplanting.

Tomato :

Tomato is a warm season crop and is used usually in cooking vegetables, chutney, *salad* and processing purposes. Its sowing should be done in October and transplanting is November-December. Punjab *ratta*, Punjab varkha bahar-1, Punjab varkha bahar-2, Punjab chhuara and TH1 are the main varieties of tomato recommended for Punjab. About 100 g seed is required for the nursery of one acre crop.

Cucurbits :

Bottle gourd, bittergourd, 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 months 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 Nagins are the recommended varieties of the brinjal crop. In this crop, nursery is grown 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 g 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 the household purposes.

Besides the above mentioned vegetables, there are many minor vegetables like arvi, 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, chrysanthemums, 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, Tuberose 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 now a days they are used as herbal medicines.

Ornamental plants also help us to beautify our surrounding. 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 takes 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 can 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. Annuals 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 (Gulmohr), straight (Silver oak), dropping branches (Bottle brush) etc. Depending upon the colour of flowers also, trees can be classified such as yellow (Amaltas), red (Gulmohr, 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 their flowers colours like white (Chandani, Jasmine, Murraya), yellow (Peelikaner), red (Hibiscus, Jatropha) and pink (Sawni). The foliage of some shrubs is also very beautiful eg. Hibiscus, Duranata, 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 (Lasanbel), 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), tendril (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 annuals?
2. Name the summer season annuals for planting in the parks.
3. Name any two red colour flowers.
4. What is time of planting rose?
5. Which flower is known as autumn queen?
6. What is the planting 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 annuals.
10. Which gas is released in atmosphere by the plants?

B. Answer in 1 to 2sentences:

1. Which part of climbers help them to climb along the wall? Give example.
2. Name the winter season annuals and what is their time of planting.
3. What is the planting time for summer season annuals? Name any two summer season annuals.
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. What is the exact time of plantation of trees, shrubs and climbers?
8. Describe the classification of trees on the basis of their height and canopy.

9. Which plants are grown in pots?

10. How can the ornamental plants be used commercially?

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?

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Chapter 10

AGRICULTURAL SUBSIDIARY OCCUPATIONS

Green Revolutions 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 in 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 landholding. 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 inculcate 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:

Mushroom

Mushrooms are very nutritious products that can be cultivated indoors (rooms/ sheds/thatched huts) and do not require arable land. Punjab Agricultural University (PAU) 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 per cent of the total mushroom production in the state.

2. Bee-Keeping:

Honeybee

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 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

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.

4. Vegetable cultivation:

Vegetable cultivation is a very remunerative enterprise for the farmers with small landholdings. 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 system or to the vegetables grown in the open cultivation system 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 of vegetables

5. Value addition and agro-processing:

Value addition of agricultural products

Post harvest management is essential now days 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.

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. Agro Service Centres will be very beneficial for the small and marginal farmers who cannot purchase lumpy technologies; however they can use these technologies on rental basis.

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 seed, chemicals, fertilizers, etc.

Besides these enterprises, poultry farming, piggery, sheep & goat rearing and rabbit rearing, vermicopmosting, 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 training for the Agro-Processing Complex model for the farmers?

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. How can the farmers earn higher incomes from agricultural products?
6. What kinds of facilities are provided in the agro-service centres?
7. Why should we grow vegetables at home?
8. Which breed of cows can earn greater income to farmers?
9. Why should the allied enterprises be started at small scale?
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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