

BIOLOGY

Chapter 9: Strategies for Enhancement in Food Production



Strategies For Enhancement in Food Production

Animal husbandry:

Animal husbandry is the agricultural practice of breeding and raising livestock. Animal husbandry deals with the care and breeding of livestock like buffaloes, cows, pigs, horses, cattle, sheep, camel goat etc. It includes poultry farming and fisheries. Fisheries include rearing, catching, selling, etc., of fish, molluscs (shell-fish) and crustaceans (prawns, crabs, etc.) More than 70% of livestock population of the livestock live in India and China.

Management of Farm and Farm Animals:

A professional approach of farm management have increased the food production many folds. Some of the management procedures applied in various livestock are as follows:

Dairy farm management:

Dairying is the management of animals for its milk and its product for human consumption. In dairy farm management, we deal with processes and systems that increase yield and improve quality of milk.

Selection of good breeds having high yielding potential, combined with resistance to diseases is very important.

Cattle have to be housed well, should have proper water and be maintained disease free.

The feeding of cattle should be carried out in a scientific manner (quality and quantity of fodder).

Strict cleanliness and hygiene are importance while milking, storage and transport of the milk and its products.

Poultry Farm Management:

Poultry is the class of domesticated birds used for food or for their eggs. It mainly includes chicken and ducks and with turkey and geese.

Important components of poultry farm management includes:

- Selection of disease free and suitable breeds.
- Proper and safe farm condition.
- Proper feed and water.
- Hygiene and health care.

Animal Breeding:

It aims at increasing yields of animals and improving the desirable qualities of the product. A breed is a group of animals related by descent and similar in most of characters like general appearance, features, size, configuration etc. There are two kinds of breeding.

Inbreeding: A process that occurs between the members of closely related individuals within the same breed for about 4 to 6 generations is known as inbreeding. Here, first of all, males and females with superior traits are identified and then mated in pairs. Generally, it is the cow that carried the superior desired trait-like increased milk production and the superior male is the bull that can give superior progeny. Inbreeding results in increased homozygosity. This is harmful as it can lead to the expression of harmful recessive alleles. Superior traits can be eliminated. Continued inbreeding leads to inbreeding depression. Inbreeding depression is the loss of desired traits due to successive inbreeding. This affects both productivity and fertility.

Outbreeding: Outbreeding is the breeding among unrelated animals. For outbreeding such animals are chosen who do not have common ancestors for 5 to 6 generations.

Cross-breeding: Cross-breeding involves breeding between a superior male of one breed and a superior female of another breed. The desired trait can be obtained through cross-breeding. The animals or the offspring obtained is known as a hybrid. From both the parents, the animal produce has both the desired trait.

Interspecific hybridisation: Interspecific hybridisation male and female animals of two different species are mated. The progeny may combine desirable features of both and parents. Ex- mule.

Artificial Insemination: Controlled breeding experiments are carried out using artificial insemination. The semen is collected from the male that is chosen as a parent and injected into the reproductive tract of the selected female by the breeder.

Multiple Ovulation Embryo Transfer Technology (MOET):

Multiple Ovulation Embryo Transfer Technology (MOET) is used to increase the success rate of artificial insemination. In this method, a cow is administered hormones (FSH) to induce follicular maturation and super ovulation, instead of one egg; they produce 6-8 eggs. The fertilised eggs 8-32 cells stages, are recovered non-surgically and transferred to surrogate mothers. The genetic mother is available for another round of super ovulation.

Bee-keeping:

Bee-keeping or apiculture is the maintenance of hives of honeybees for the production of honey. Honey is a food of high nutritive value and also finds use in the indigenous systems of medicine. It also produces beeswax.

The most common species of honey bee is *Apis indica*.

The following points are important for successful bee-keeping:

- Knowledge of the nature and habits of bees.
- Selection of suitable location for keeping the beehives.
- Catching and hiving of swarms.
- Management of beehives during different seasons.
- Handling and collection of honey and of beeswax.
- Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the yield.

Fisheries:

Fishery is an industry devoted to catching, processing or selling of fish, shellfish or other aquatic animals.

Fresh water fishes which are very common include catla, rohu and common carp. Common marine fishes are Hilsa, sardines, mackerel and pomfrets.

Different techniques have been applied to increase production like aquaculture and pisciculture. Blue Revolution is implemented to increase fish production.

Pisciculture: It is a process of growing fish and selling it or using its products for domestic or commercial use. Fish can be grown both in salt water and fresh water.

Aquaculture: It is a process of growing any aquatic animals and selling them for commercial purposes. It involves feeding, harvesting and many other processes. The most popular one's grown under controlled environments are shrimps, crab, fish, lobster, and few others.

Plant Breeding:

Plant Breeding is the purposeful manipulation of plant species in order to create desired plant species in order to create desired plant types that are better suited for cultivation, give better yields and are disease resistant.

Classical plant breeding involves crossing or hybridization of pure lines, followed by artificial selection to produce plants with desirable traits of higher yield, nutrition and resistance to disease.

The main steps in plant breeding are:

- Collection of variability is the collection and preservation of all the different wild varieties, species and relatives of the cultivated species. The entire collection having all the diverse alleles for all genes in a given crop is called germplasm collection.
- Evaluation and selection of parents is the identification of plants with desirable

combination of characters. The selected plants are multiplied and used in the process of hybridization.

- Cross hybridization among the selected parents to obtain desired crop characters for example high protein quality of one parent may need to be combined with disease resistance from another parent. This is possible by cross hybridizing the two parents to produce hybrids that genetically combine the desired characters in one plant.
- Selection and testing of superior recombinants -The selection process is crucial to the success of the breeding objective and requires careful scientific evaluation of the progeny. This step yields plants that are superior to both of the parents.
- Testing, releasing and commercialization of new cultivars -The newly selected lines are evaluated for their yield and other agronomic traits of quality, disease resistance, etc.

Wheat and Rice:

- Production of wheat and rice increased tremendously between 1960-2000 due to introduction of semi-dwarf varieties of rice and wheat.
- In 1963, several varieties such as Sonalika and Kalyan Sona, which were high yielding and disease resistant were introduced all over the wheat growing field of India.
- Semi-dwarf rice varieties were derived from IR-8, and Taichung Native-1 were introduced in 1966. Later better-yielding semi-dwarf varieties Jaya and Ratna were developed in India.

Sugar cane:

- *Saccharum barberi* and *Saccharum officinarum* were crossed to get the desirable qualities of high yield, thick stems, high sugar and ability to grow in the sugar cane areas of north India.
- **Millet:** Hybrid maize, jowar and bajra are developed in India. These varieties are high yielding and resistant to water stress.

Plant Breeding for Disease Resistance:

Several fungal, bacterial and viral pathogens affect the yield and quality of plant products. To minimise this loss disease resistant varieties were developed. Breeding is carried out by conventional method or by mutation breeding.

Steps for breeding disease resistant plants:

- Selection of genome with disease resistant traits.
- Mating of the selected parents.
- Selection of superior hybrids.

- Testing of the hybrid for superior variety.
- Release of the new variety.

Crop	Variety	Resistance to diseases
<i>Wheat</i>	<i>Himgiri</i>	<i>Leaf and stripe rust, hill bunt</i>
<i>Brassica</i>	<i>Pusa swarnim (Karan rai)</i>	<i>White rust</i>
<i>Cauliflower</i>	<i>Pusa Shubhra, Pusa Snowball K-1</i>	<i>Black rot and Curl blight black rot</i>
<i>Cowpea</i>	<i>Pusa Komal</i>	<i>Bacterial blight</i>
<i>Chilli</i>	<i>Pusa Sadabahar</i>	<i>Chilly mosaic virus, Tobacco mosaic virus and Leaf curl</i>

Mutation:

Mutation is the process by which genetic variations are created through changes in the base sequence within genes resulting in the creation of a new character or trait not found in the parental types. It is done by using mutants like chemicals or radiations. This process is called mutation breeding. e.g. Mung bean resistance to yellow mosaic virus and powdery mildew were induced by mutation.

Resistance to yellow mosaic virus in bhindi (*Abelmoschus esculentus*) was transferred from a wild species and resulted in a new variety of *A. esculentus* called Parbhani kranti.

Plant breeding for Developing Resistance to Insect Pests:

Crop plant and crop products are destructed by insects and pests on large scale. To prevent this loss new varieties resistance to them are developed.

Crop	Variety	Insect Pests
<i>Brassica</i> (rapeseed mustard)	<i>Pusa Gaurav</i>	<i>Aphids</i>
<i>Flat bean</i>	<i>Pusa Sem 2,</i> <i>Pusa Sem 3</i>	<i>Jassids, aphids and</i> <i>fruit borer</i>
<i>Okra (Bhindi)</i>	<i>Pusa Sawani</i> <i>Pusa A-4</i>	<i>Shoot and Fruit borer</i>

Bio-fortification:

Breeding crops with higher levels of vitamins and minerals, or higher protein and healthier fats. Breeding for improved nutritional qualities have following objectives of improving.

- Protein content and quality.
- Oil content and quality.
- Vitamin content.
- Micronutrient and mineral content.

Atlas 66, having a high protein content, has been used as a donor for improving cultivated wheat.

IARI, New Delhi have released many varieties of vegetables crops rich in vitamins and minerals like vitamin A enriched carrot, spinach and pumpkin and vitamin C enriched bitter guard, bathua, mustard, iron and calcium enriched spinach and bathua; and protein enriched beans – broad, lablab, French and garden peas.

Single Cell Protein (SCP):

Alternate source of protein for animal and human nutrition. Microbes are grown on industrial scale as a source of good protein.

Microbes like spirulina can be grown easily on materials like wastewater from potato processing plants having starch, molasses, animal manure and even sewage to produce large quantities and can serve as food rich in protein, minerals, fats, carbohydrates and vitamins.

Methylophilus methylotrophus has high rate of biomass production and growth, it can be expected to produce 25 tonnes of protein by 250 g of microorganism.

Tissue Culture:

The capacity to generate whole plants from any cell/explant is called totipotency. Thousands of plants can be produced from explants in short interval of time using suitable nutrient

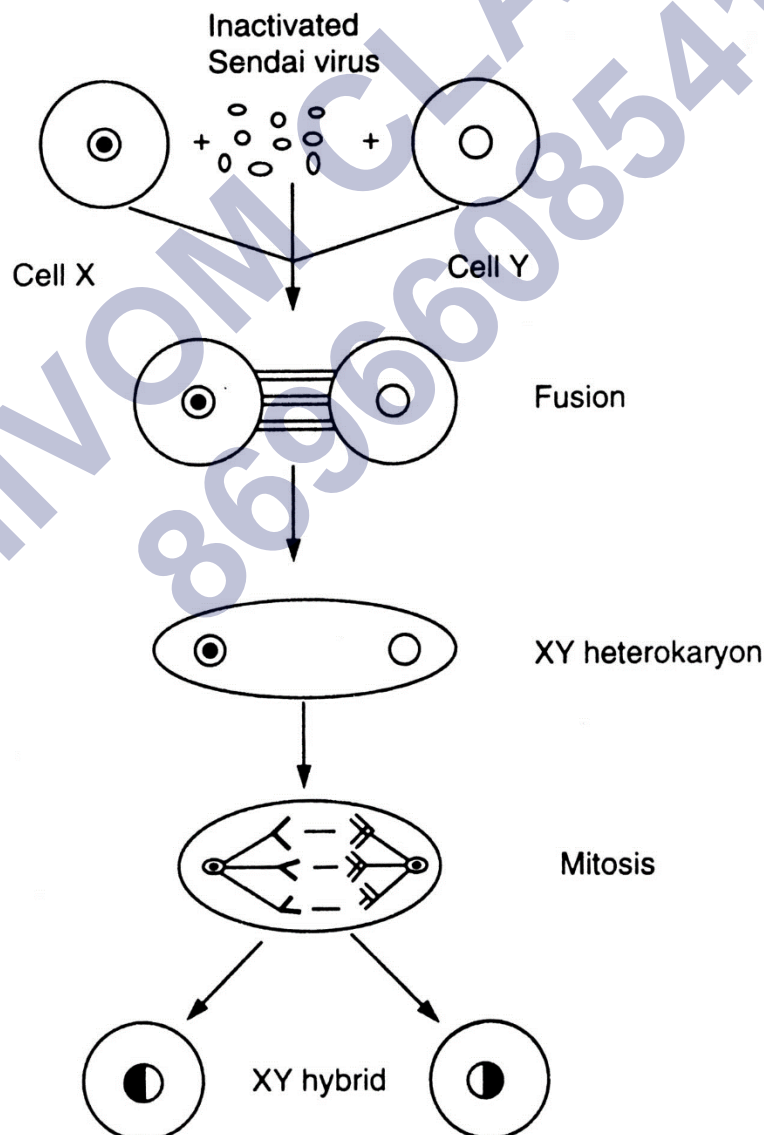
medium, aseptic condition and use of phytohormones. This method of producing thousands of plant is called micropropagation. Each of these plants will be genetically identical to the original plant from which they were grown, i.e., they are soma clones. Many important food plants like tomato, banana, apple.

Meristem Culture:

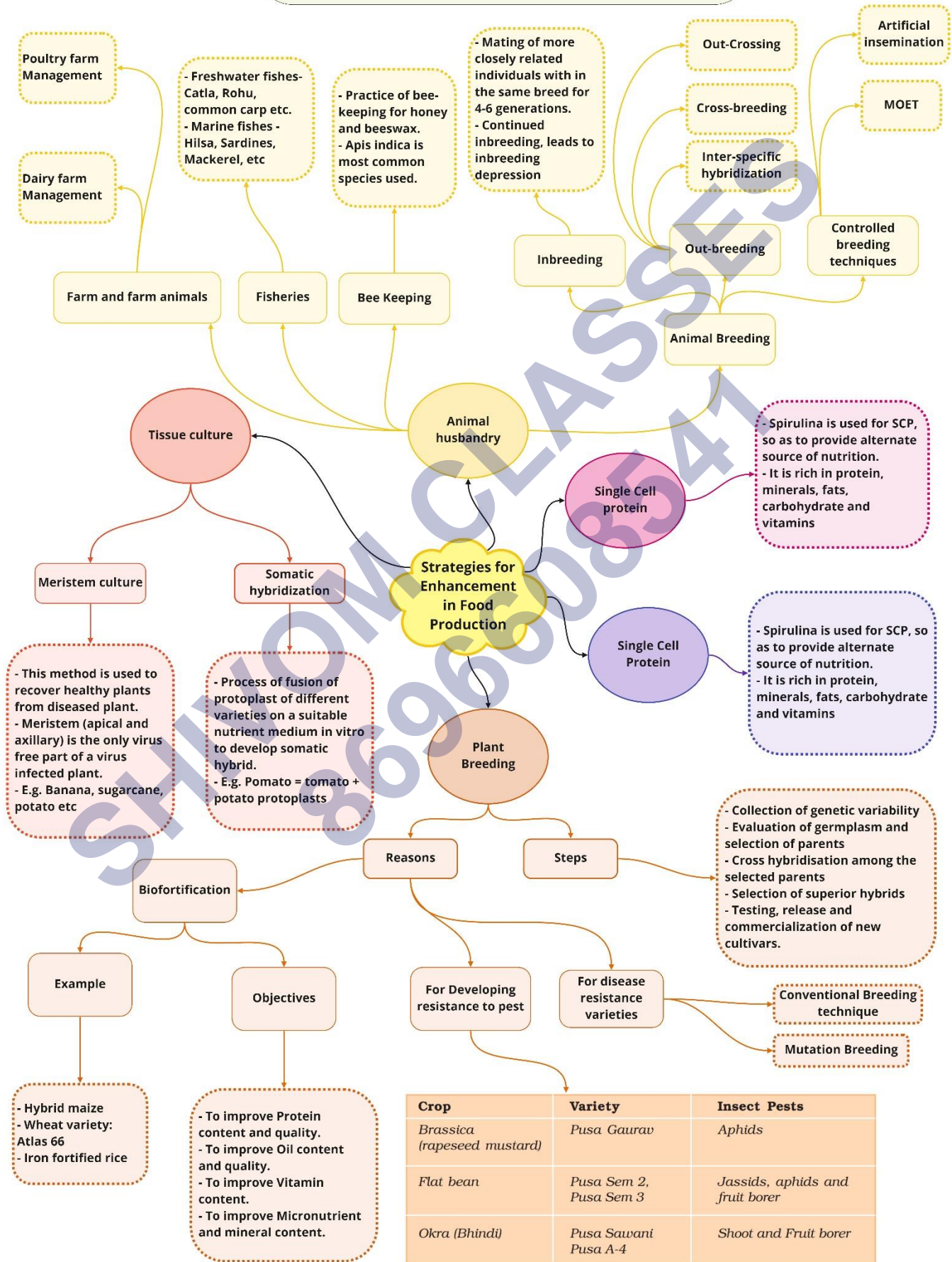
The recovery of healthy plants from diseased plants can be done by meristem culture. Although the plant is infected with a virus, the meristem (apical and axillary) is free of virus. Hence, one can remove the meristem and grow it in vitro to obtain virus-free plants.

Somatic Hybridisation:

Isolation of single cells from their plants and after digesting their cell wall fusing the cytoplasm's of two different varieties is called somatic hybridisation and these hybrids are called somatic hybrids.



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Important Questions

➤ Multiple Choice Questions:

1. The chances of contracting bird flu from a properly cooked (above 100°C) chicken and egg are:
 - (a) very high
 - (b) high
 - (c) moderate
 - (d) none.
2. A group of animals which are related by descent and share many similarities are referred to as:
 - (a) breed
 - (b) race
 - (c) variety
 - (d) species.
3. Inbreeding is carried out in animal husbandry because it:
 - (a) increases vigour
 - (b) improves the breed
 - (c) increases heterozygosity
 - (d) increases homozygosity.
4. Question 4. Which one of the following is a marine fish?
 - (a) Rohu
 - (b) Hilsa
 - (c) Catla
 - (d) Common carp.
5. Which one of the following products of apiculture is used in cosmetics and polishes?
 - (a) Honey
 - (b) Oil
 - (c) Wax
 - (d) Royal jelly.
6. More than 70 percent of livestock population is in:
 - (a) Denmark

- (b) India
(c) China
(d) India and China.
7. The agriculture sector of India employs:
(a) 60 per cent of the population
(b) 70 per cent of the population
(c) 30 per cent of the population
(d) 62 per cent of the population
8. 33 per cent of India's Gross Domestic Product comes from
(a) industry
(b) agriculture
(c) export
(d) small-scale cottage industries.
9. Sonalika and Kalyan Sona are varieties of:
(a) wheat
(b) rice
(c) millet
(d) tobacco.
10. Which one of the following is not a fungal disease?
(a) Rust of wheat
(b) Smut of Bajra
(c) Black rot of crucifers
(d) Red rot of sugarcane.
11. In virus-infected plants the meristematic tissues in both apical and axillary buds are free of virus because:
(a) the dividing cells are virus resistant
(b) meristems have anti-viral compounds
(c) the cell division of meristems is faster than the rate of viral multiplication
(d) viruses cannot multiply within meristem cell (s).
12. Several South Indian states raise 2-3 crops of rice annually. The agronomic feature that makes this possible is because of:
(a) shorter rice plant

- (b) better irrigation facilities
 - (c) early yielding rice variety
 - (d) disease-resistant rice variety.
13. Which one of the following combinations would a sugarcane farmer look for in the sugarcane crop?
- (a) Thick stem, long internodes, high sugar content and disease resistant
 - (b) Thick stem, high sugar content and profuse flowering
 - (c) Thick stem, short internodes, high sugar content, disease resistant
 - (d) Thick stem, low sugar, content, disease resistant.
14. Fungicides and antibiotics are chemicals that:
- (a) enhance yield and disease resistance
 - (b) kill pathogenic fungi and bacteria, respectively
 - (c) kill all pathogenic microbes
 - (d) kill pathogenic bacteria and fungi respectively.
15. Use of certain chemicals and radiation to change the base sequences of genes of crop plants is termed:
- (a) recombinant DNA technology
 - (b) transgenic mechanism
 - (c) mutation breeding
 - (d) gene therapy.

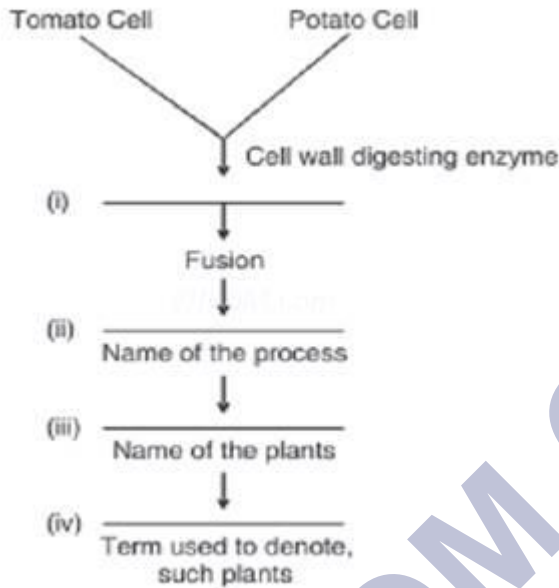
➤ **Very Short Question:**

1. Why is inbreeding necessary in animal husbandary?
2. Name two fungal diseases of Crop plants.
3. Which product of Apiculture is used in cosmetics and polishes?
4. Semi-dwarf varieties of a crop plant were derived from IR-8. Name that crop.
5. Write two qualities of Saccharum officinarum (Sugarcane) grown in South India.
6. Name any two semi – dwarf varieties of wheat introduced into all wheat growing places of India?
7. What is Biofortification?
8. Give an example where mutation breeding has been Successfully carried out for introducing disease resistance.
9. Name two better yielding varieties of rice developed in India?

10. Name the microbe that is grown for use as protein – rich food?

➤ Short Questions:

1. Why are proteins synthesized from Spirulina called Single celled Proteins? What is the significance of such a protein?
2. Differentiate between inbreeding and outbreeding in animals.
3. Observe the process of Somatic hybridisation given below and fill in the blanks. (i), (ii), (iii) and (iv)



4. What is single cell protein? What is its significance?
5. Expand MOET. How is it carried out?
6. What is germplasm? Why is it necessary to have germplasm collection?
7. What is inbreeding depression? Why do self – pollinated crops do not show the ill-effects of inbreeding depression?
8. What is interspecific hybridization. Give an example?

➤ Long Questions:

1. What is a hybrid? Explain the procedure of obtaining a hybrid.
2. “The benefits of a new variety can be achieved only if farmers grow the variety”. Explain.
3. Discuss the role of plant tissue culture in increasing food production.

➤ Assertion & Reason Questions:

1. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
 - a. Both assertion and reason are true, and reason is the correct explanation of assertion.

- b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
- c. Assertion is true, but reason is false.
- d. Both assertion and reason are false.

Assertion: Fish meal is a rich source of protein for cattle and poultry.

Reason: Fish meal is produced from non-edible parts of fishes like fins, tail etc.

2. For two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
 - a. Both assertion and reason are true, and reason is the correct explanation of assertion.
 - b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
 - c. Assertion is true, but reason is false.
 - d. Both assertion and reason are false.

Assertion: In case of vegetatively propagated crops, pure-line selection is not required.

Reason: Hybrid vigour is mostly used in vegetatively propagated plants.

➤ Case Study Questions:

1. Read the following and answer any four questions from (i) to (v) given below:

Dairying is the management of animals for milk and its products for human consumption. Can you list the animals that you would expect to find in a dairy? What are different kinds of products that can be made with milk from a dairy farm? In dairy farm management, we deal with processes and systems that increase yield and improve quality of milk. Milk yield is primarily dependent on the quality of breeds in the farm. Selection of good breeds having high yielding potential (under the climatic conditions of the area), combined with resistance to diseases is very important. For the yield potential to be realised the cattle have to be well looked after – they have to be housed well, should have adequate water and be maintained disease free. The feeding of cattle should be carried out in a scientific manner – with special emphasis on the quality and quantity of fodder. Besides, stringent cleanliness and hygiene (both of the cattle and the handlers) are of paramount importance while milking, storage and transport of the milk and its products. Nowadays, of course, much of these processes have become mechanised, which reduces chance of direct contact of the produce with the handler. Ensuring these stringent measures would of course, require regular inspections, with proper record keeping.

It would also help to identify and rectify the problems as early as possible. Regular visits by a veterinary doctor would be mandatory. You would probably find it interesting if you were to prepare a questionnaire on diverse aspects of dairy keeping and then follow it up with a visit to a dairy farm in your locality and seek answers to the questions.

- 1) In the animals, Is the management for milk and milk products (For human consumption).
 - (a) Farming
 - (b) Breeding
 - (c) Culturing
 - (d) Dairying
 - 2) In the farm, milk yield is primarily depends on the quality of
 - (a) Breed
 - (b) Soil
 - (c) Plants
 - (d) Grass
 - 3) Selection of good breed results in
 - (a) High crop yield
 - (b) High area
 - (c) High farm
 - (d) High milk yield
 - 4) How to maintain yield potential?
 - 5) What is important during milking and transportation of milk.
2. Read the following and answer any four questions from (i) to (v) given below:

Bee-keeping or apiculture is the maintenance of hives of honeybees for the production of honey. It has been an age-old cottage industry. Honey is a food of high nutritive value and also finds use in the indigenous systems of medicine. Honeybee also produces beeswax, which finds many uses in industry, such as in the preparation of cosmetics and polishes of various kinds. The increased demand of honey has led to large-scale beekeeping practices; it has become an established income generating industry, whether practiced on a small or on a large scale. Bee-keeping can be practiced in any area where there are sufficient bee pastures of some wild shrubs, fruit orchards and cultivated crops. There are several species of honeybees which can be reared. Of these, the most common species is *Apis indica*. Beehives can be kept in one's courtyard, on the verandah of the house or even on the roof. Bee-keeping is not labour-intensive. Bee-keeping though relatively easy does require some specialised knowledge and there are several organisations that teach bee-keeping.

The following points are important for successful bee-keeping: (i) Knowledge of the nature and habits of bees, (ii) Selection of suitable location for keeping the beehives, (iii) Catching and hiving of swarms (group of bees), (iv) Management of beehives during different seasons, and (v) Handling and collection of honey and of beeswax. Bees are the pollinators of many of

our crop species (see chapter 2) such as sunflower, Brassica, apple and pear. Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the yield—beneficial both from the point of view of crop yield and honey yield

- 1) Which of the following are pollinators of pear, sunflower, Brassica, and apple like crop species?
 - (a) Bees
 - (b) Scorpions
 - (c) Spiders
 - (d) Lice
- 2) Apiculture of Bee-keeping is the process where maintenance of occurs.
 - (a) Nests
 - (b) Shells
 - (c) Hives
 - (d) None of these
- 3) A food that have high nutritive value is in the apiculture
 - (a) Curd
 - (b) Mushroom
 - (c) Honey
 - (d) Milk
- 4) Write any three successful ways of bee-keeping.
- 5) What does honey bee produce?

✓ Answer Key-

➤ Multiple Choice Answers:

1. (d) none.
2. (a) breed
3. (d) increases homozygosity.
4. (b) Hilsa
5. (c) Wax
6. (d) India and China.
7. (d) 62 per cent of the population

8. (b) agriculture
9. (a) wheat
10. (c) Black rot of crucifers
11. (c) the cell division of meristems is faster than the rate of viral multiplication
12. (c) early yielding rice variety
13. (a) Thick stem, long internodes, high sugar content and disease resistant
14. (b) kill pathogenic fungi and bacteria, respectively
15. (c) mutation breeding

➤ Very Short Answers:

1. Inbreeding increases homozygosity.
2. Brown rust of wheat, Smut of wheat, red rot of Sugar cane, Late blight of potato.
3. Beewax.
4. Paddy crop (rice)
5. Thicker stem and higher sugar content.
6. Sonalika & Kalyan sona.
7. The breeding of crops to increase the levels of vitamins, minerals & higher proteins & healthier fats content is called biofortification.
8. varieties of mung bean have been successfully developed that are resistant to yellow mosaicvirus & powdery mildew.
9. Jaya & Ratna
10. Methylophilus methylotropous.

➤ Short Answer:

1. The protein rich food produced by microbes is called as single called protein (SCP) Spirulina is a microorganisms which has more protein. It is a quick method of protein production because the growth rate of microbes is enormous. Hence, it provides a protein rich diet for human beings.
2. When breeding is between animals of the same breed, it is called inbreeding, while cross between different breeds is called out breeding.
3. Ans.
 - i. Isolation of protoplast of Tomato cell and Potato cell.
 - ii. Somatic hybridisation.
 - iii. Pomato

- iv. Somatic hybrid
- 4. The production of edible proteins on a large scale from microorganisms for human beings & animals is called Single cell protein. It is important because:
 - i. It provide protein – rich supplement in diet.
 - ii. It reduces pressure on agriculture for supply of desired proteins.
 - iii. It helps to minimise environmental pollution
- 5. Moet is multiple ovulation Embryo transfer. It involves following steps:
 - i. A cow is administered hormones to induce follicular motivation & super ovulation.
 - ii. Cow is mated with a selected bull.
 - iii. Fertilized eggs at 8-32 celled stage are recovered & transferred to surrogate mother.
- 6. The sumtotal of all the alleles of the gene present in a plant & its relative is called Germplasm. Germplasm collection is very essential for effective exploitation of natural genes available in the population.
- 7. Continued inbreeding especially close inbreeding usually reduces fertility & even productivity. This is called inbreeding depression. In self – pollinated crops, since the male & female reproductive parts are of the same flower & are compatible with each other to cause fertilisation: it does not show ill – effects of inbreeding depression.
- 8. It is a method of outbreeding in which male & female animal of two different species are crossed to combine the desirable features of both the parents into one eg, mule is produced by a cross between donkey & a female horse.

➤ Long Answer:

1. Hybrid: A progeny obtained by crossing two varieties or species having desired genes thus showing required characters.

Process of hybridization: This technique involves the following steps,

- i. Removal of undehisced anthers from the bisexual flower of a plant to be used as female. This is called emasculation.
 - ii. The emasculated flowers are covered by butter paper to avoid pollination by an undesirable pollen grain. It is also termed bagging.
 - iii. Pollen grains from known seeds of desirable plants are used to pollinate these emasculated flowers.
 - iv. They are collected, multiplied and their desirable characters are determined.
2. The seed of new variety must be multiplied and made available to the farmers. In-plant breeding, seed means any plant part that is used to grow a crop. Thus 'seed' would include grains of wheat, rice, etc. tubers of the potato, stems of sugarcane, etc., provided they are used for producing new plants.

Therefore, wheat grains used as food cannot be termed as seeds, whereas those used for raising a crop are called seeds. A seed of a variety with superior traits is called an improved seed, which must be of high purity and have a high germination percentage. It must also be free from weed seeds and from diseases.

3. Applications of tissue culture technique:

- i. This technique is applied for the rapid multiplication of desirable and rare plants.
- ii. By this technique, an indefinite number of plants can be produced.
- iii. From the culturing of virus-free tissues of the shoot apex of an infected plant, it becomes possible to obtain virus-free plant in sufficient stock. The tissue culture technique has been used to obtain virus-free potatoes and sugarcane.
- iv. The technique (Embryo culture) is useful in overcoming seed dormancy, but also in producing viable plants from the crosses which normally fail due to the death of immature embryos.
- v. The technique has been applied for obtaining a large number of haploid and homozygous diploids.
- vi. Somatic hybridization helps the fusion of cells belonging to different families.

This technique is also useful for the genetic improvement of useful plants.

➤ Assertion and Reason Answers:

1) c) Assertion is true, but reason is false

Explanation:

Fish meal is prepared from the wastes of fish oil or canning industry or from the whole fish of nol-oil-type. Wastes of cod industry are known as white 'fish meal'. The protein content of this meal is highly digestible, nutritive and is of biological importance. This fish meal also contains calcium phospholipids, and iodine, fish meal is also used as major food of domestic animals like pigs, poultry and cattle.

2) b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

Explanation:

In case of vegetatively propagated crops, pure line selection is not required. Pureline selection is useful only for sexually reproducing plants. Hybrids vigour is most profitably used in vegetatively propagated crops because they do not involve sexual reproduction and hence loss of hybrid superiority

➤ Case Study:

1.

1) 1)(d) Dairying.

- 2) (a) Breed
- 3) (d) High milk yield
- 4) Cattles should be disease free, should provide adequate water, and should housed well etc., by this way yield potential is maintained.
- 5) Hygiene and cleanliness is important during milking and transportation of milk.

2.

- 1) (a) Bees.
- 2) (c) Hives.
- 3) (c) Honey.
- 4) The successful ways of bee-keeping include beehive keeping in selected suitable location, Honey and beeswax collection, catching of swarms, hiving of swarms, and proper management of hives in various seasons.
- 5) Honey bee can produce honey (Has high nutritive value) and beeswax (Useful in cosmetic).

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