

**Question 1:**

Explain in brief the role of animal husbandry in human welfare.

Answer

Animal husbandry deals with the scientific management of livestock. It includes various aspects such as feeding, breeding, and control diseases to raise the population of animal livestock. Animal husbandry usually includes animals such as cattle, pig, sheep, poultry, and fish which are useful for humans in various ways. These animals are managed for the production of commercially important products such as milk, meat, wool, egg, honey, silk, etc. The increase in human population has increased the demand of these products. Hence, it is necessary to improve the management of livestock scientifically.

**Question 2:**

If your family owned a dairy farm, what measures would you undertake to improve the quality and quantity of milk production?

Answer

Dairy farm management deals with processes which aim at improving the quality and quantity of milk production. Milk production is primarily dependent on choosing improved cattle breeds, provision of proper feed for cattle, maintaining proper shelter facilities, and regular cleaning of cattle. Choosing improved cattle breeds is an important factor of cattle management. Hybrid cattle breeds are produced for improved productivity. Therefore, it is essential that hybrid cattle breeds should have a combination of various desirable genes such as high milk production and high resistance to diseases. Cattle should also be given healthy and nutritious food consisting



of roughage, fibre concentrates, and high levels of proteins and other nutrients.

Cattle's should be housed in proper cattle-houses and should be kept in well ventilated roofs to prevent them from harsh weather conditions such as heat, cold, and rain. Regular baths and proper brushing should be ensured to control diseases. Also, time-to-time check ups by a veterinary doctor for symptoms of various diseases should be undertaken.

**Question 3:**

What is meant by the term 'breed'? What are the objectives of animal breeding?

Answer

A breed is a special variety of animals within a species. It is similar in most characters such as general appearance, size, configuration, and features with other members of the same species. Jersey and Brown Swiss are examples of foreign breeds of cattle. These two varieties of cattle have the ability to produce abundant quantities of milk. This milk is very nutritious with high protein content.

**Objectives of animal breeding:**

- (i) To increase the yield of animals.
- (ii) To improve the desirable qualities of the animal produce.
- (iii) To produce disease-resistant varieties of animals.

**Question 4:**

Name the methods employed in animal breeding. According to you which one of the methods is best? Why?

Answer



Animal breeding is the method of mating closely related individuals. There are several methods employed in animals breeding, which can be classified into the following categories:

**(A)** Natural methods of breeding include inbreeding and out-breeding. Breeding between animals of the same breed is known as inbreeding, while breeding between animals of different breeds is known as out-breeding. Out-breeding of animals is of three types:

**(a).** Out-crossing: In this type of out-breeding, the mating of animals occurs within the same breed. Thus, they have no common ancestors up to the last 4-5 generations.

**(b).** Cross-breeding: In this type of out-breeding, the mating occurs between different breeds of the same species, thereby producing a hybrid.

**(c).** Interspecific hybridization: In this type of out-breeding, the mating occurs between different species.

**(B)** Artificial methods of breeding include modern techniques of breeding. It involves controlled breeding experiments, which are of two types:-

**(a).** Artificial insemination: It is a process of introducing the semen (collected from the male) into the oviduct or the uterus of the female body by the breeder. This method of breeding helps the breeder overcome certain problems faced in abnormal mating.

**(b).** Multiple ovulation embryo technology (MOET): It is a technique for cattle improvement in which super-ovulation is induced by a hormone injection. Then, fertilization is achieved by artificial insemination and early embryos are collected. Each of these embryos are then transplanted into the surrogate mother for further development of the embryo.

The best method to carry out animal breeding is the artificial method of breeding, which includes artificial insemination and MOET technology. These



technologies are scientific in nature. They help overcome problems of normal mating and have a high success rate of crossing between mature males and females. Also, it ensures the production of hybrids with the desired qualities. This method is highly economical as a small amount of semen from the male can be used to inseminate several cattle.

**Question 5:**

What is apiculture? How is it important in our lives?

Answer

Apiculture is the practice of bee-keeping for the production of various products such as honey, bee's wax, etc. Honey is a highly nutritious food source and is used as an indigenous system of medicines. It is useful in the treatment of many disorders such as cold, flu, and dysentery. Other commercial products obtained from honey bees include bee's wax and bee pollen. Bee's wax is used for making cosmetics, polishes, and is even used in several medicinal preparations. Therefore, to meet the increasing demand of honey, people have started practicing bee-keeping on a large scale. It has become an income generating activity for farmers since it requires a low investment and is labour intensive.

**Question 6:**

Discuss the role of fishery in enhancement of food production.

Answer

Fishery is an industry which deals with catching, processing, and marketing of fishes and other aquatic animals that have a high economic value. Some commercially important aquatic animals are prawns crabs, oysters, lobsters, and octopus. Fisheries play an important role in the Indian economy. This is



because a large part of the Indian population is dependent on fishes as a source of food, which is both cheap and high in animal protein. A Fishery is an employment generating industry especially for people staying in the coastal areas. Both fresh water fishes (such as Catla, Rohu, etc) and marine fishes (such as tuna, mackerel pomfret, etc.) are of high economic value.

**Question 7:**

Briefly describe various steps involved in plant breeding.

Answer

Plant breeding is the process in which two genetically dissimilar varieties are purposely crossed to produce a new hybrid variety. As a result, characteristics from both parents can be obtained in the hybrid plant variety. Thus, it involves the production of a new variety with the desired characteristics such as resistance to diseases, climatic adaptability, and better productivity. The various steps involved in plant breeding are as follows:

**(a).** Collection of genetic variability: Genetic variability from various wild relatives of the cultivated species are collected to maintain the genetic diversity of a species. The entire collection of the diverse alleles of a gene in a crop is called the germplasm collection.

**(b).** Evaluation of germplasm and selection of parents: The germplasm collected is then evaluated for the desirable genes. The selected plants with the desired genes are then used as parents in plant breeding experiments and are multiplied by the process of hybridization.

**(c).** Cross-hybridization between selected parents: The next step in plant breeding is to combine the desirable characters present in two different parents to produce hybrids. It is a tedious job as one has to ensure that the



pollen grains collected from the male parent reach the stigma of the female parent.

**(d).** Selection of superior hybrids: The progenies of the hybrids having the desired characteristics are selected through scientific evaluation. The selected progenies are then self-pollinated for several generations to ensure homozygosity.

**(e).** Testing, release, and commercialization of new cultivars: The selected progenies are evaluated for characters such as yield, resistance to diseases, performance, etc. by growing them in research fields for at least three growing seasons in different parts of the country. After thorough testing and evaluation, the selected varieties are given to the farmers for growing in fields for a large-scale production.

#### Question 8:

Explain what is meant by biofortification.

Answer

Biofortification is a process of breeding crops with higher levels of vitamins, minerals, proteins, and fat content. This method is employed to improve public health. Breeding of crops with improved nutritional quality is undertaken to improve the content of proteins, oil, vitamins, minerals, and micro-nutrients in crops. It is also undertaken to upgrade the quality of oil and proteins. An example of this is a wheat variety known as Atlas 66, which has high protein content in comparison to the existing wheat. In addition, there are several other improved varieties of crop plants such as rice, carrots, spinach etc. which have more nutritious value and more nutrients than the existing varieties.

**Question 9:**

Which part of the plant is best suited for making virus-free plants and why?

Answer

Apical and axillary meristems of plants is used for making virus-free plants. In a diseased plant, only this region is not infected by the virus as compared to the rest of the plant region. Hence, the scientists remove axillary and apical meristems of the diseased plant and grow it *in vitro* to obtain a disease-free and healthy plant.

Virus-free plants of banana, sugarcane, and potato have been obtained using this method by scientists.

**Question 10:**

What is the major advantage of producing plants by micropropagation?

Answer

Micropropagation is a method of producing new plants in a short duration using plant tissue culture.

Some major advantages of micropropagation are as follows:

- (a)** Micropropagation helps in the propagation of a large number of plants in a short span of time.
- (b)** The plants produced are identical to the mother plant.
- (c)** It leads to the production of healthier plantlets, which exhibit better disease-resisting powers.

**Question 11:**

Find out what the various components of the medium used for propagation of explants *in vitro* are?

Answer



The major components of medium used for propagation of explants *in vitro* are carbon sources such as sucrose, inorganic salts, vitamins, amino acids, water, *agar-agar*, and certain growth hormones such as auxins and gibberellins.

**Question 12:**

Name any five hybrid varieties of crop plants which have been developed in India.

Answer

The five hybrid varieties of crop plants which have been developed in India are:

<b>Crop plant</b>	<b>Hybrid variety</b>
Wheat	Sonalika and kalia sona
Rice	Jaya and Ratna
Cauliflower	Pusa shubra and Pusa snowball K-1
Cowpea	Pusa komal
Mustard	Pusa swarnim

**CHAPTER 9**  
**STRATEGIES FOR ENHANCEMENT IN**  
**FOOD PRODUCTION**

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**POINTS TO REMEMBER**

**Apiculture** : Rearing of honeybees for the production of honey, beeswax, royal jelly and bee Venom.

**Artificial insemination** : Introduction of semen of good quality of male into the vagina of female.

**Explant** : A part of plant excised from its original location and used for tissue culture.

**Germplasm Collection** : The entire collection having all the diverse alleles for all the genes in the given organism.

**Inbreeding depression** : Continued close inbreeding decreases the fertility and productivity.

**Inbreeding** : Inbreeding refers to the mating of more closely related individuals within the same breed for 4-6 generations.

**Out-breeding** : Out-breeding is the breeding of the unrelated animals, which may be between individuals of the same breed (but having no common ancestors), or between different breeds (cross breeding or different species (interspecific hybridisation)).

**Super Ovulation** : Stimulation of good female animal by administering hormones to produce more eggs.

**Mutation breeding** : Mutation in plants is induced artificially through use of mutagens to obtain desirable characters. These plants (as a source) are used in breeding.

**Totipotency** : The ability to generate a whole plant from any cell/explant.

**ABBREVIATIONS**

**ET** : Embryo Transfer

**IARI** : Indian Agricultural Research Institute

**IRRI** : International Rice Research Institute

**ICAR** : Indian Council of Agriculture Research

**MOET** : Multiple Ovulation Embryo Transfer

**NDRI** : National Dairy Research Institute

- **Animal Husbandry** . care and breeding of livestock, useful to human beings.
- **Poultry Farm Management** : Chicken and ducks and some times turkey and geese are included in poultry.
- **Bee-keeping (Apiculture)** *Apis indica* is the most common species of honey bee.) Maintenance of honey bee for production of honey and wax. Honey is a food of high nutritive value.
- **Management of fisheries** :
  - (i) Fresh water fishes : *Catla*, *Rohu*, common carp etc.
  - (ii) Marine fishes : *Hilsa*, Sardines. Mackerel and Pomfrets etc.
- **Aquaculture and Pisciculture** - The production of useful aquatic plants and animals (both freshwater and marine) like fishes, prawns lobsters and edible oysters is called .aquaculture. while the production of fishes only is called .pisciculture.
- Blue-revolution is associated with fish production.
- **Out crossing** : The practice of mating of animals of same breed but have no common ancestor on either side of pedigree upto 4-6 generations. A single outcross helps to overcome the inbreeding depression.
- **Cross breeding** : The method of outbreeding in which superior males of one breed are mated with the superior females of another breed of same species.

**Main steps in breeding a new genetic variety of crop:**

- (i) Germ-plasm collection or collection of variability
- (ii) Evaluation and selection of parents

- (iii) Cross breeding or hybridisation of selected parents.
- (iv) Selection and testing of superior recombinants
- (v) Testing, release and commercialisation of new cultivars.

***High yielding varieties of:***

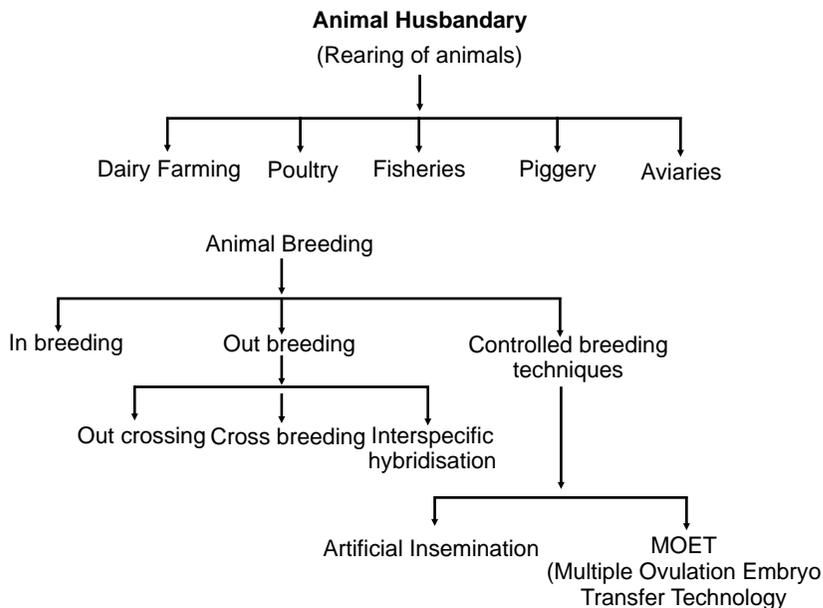
- (i) Wheat - Sonalika, kalyan sona
- (ii) Rice - IR-8, Taichung Native-1, Jaya, Ratna, Padma etc.
- (iii) Sugar Cane - A hybrid of *Saccharum barberi* and *S. officinarum*.

***Diseases of plants -***

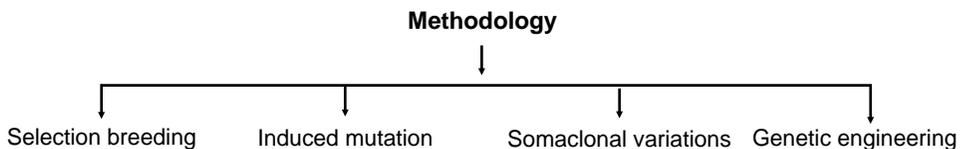
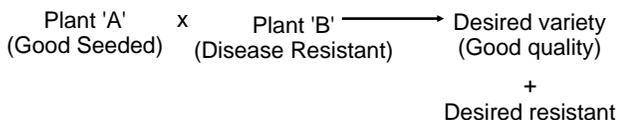
- (i) Viral - Tobacco mosaic, turnip mosaic
- (ii) Bacterial - Black rot of crucifers, Blight of rice
- (iii) Fungal - Rust of wheat, red rot of sugarcane, late blight of potato.

**Germplasm** - The sum total of all the alleles of the genes present in an individual organism and its related species

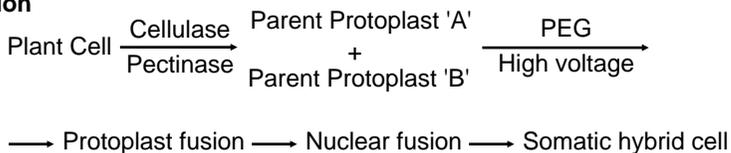
**Explant** - A plant part excised from a specific location in a plant to be used for initiating a culture.



**Plant Breeding for Developing Disease Resistant Varieties**



**Somatic Hybridisation**



## QUESTIONS

### VSA (1 MARK)

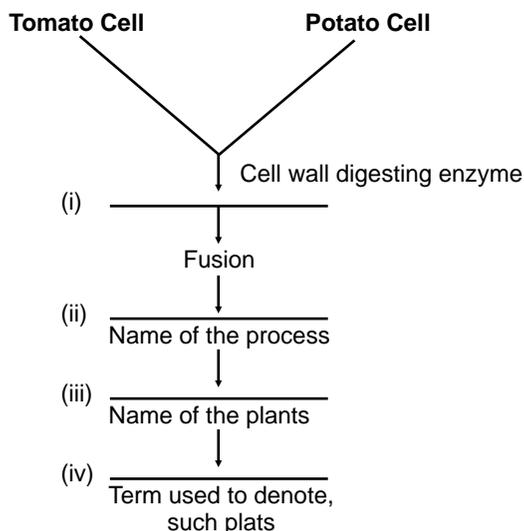
1. Why is inbreeding necessary in animal husbandary?
2. Name two fungal diseases of Crop plants.
3. Which product of Apiculture is used in cosmetics and polishes?
4. Semi-dwarf varieties of a crop plant were derived from IR-8. Name that crop.
5. Write two qualities of *Saccharum officinarum* (Sugarcane) grown in South India.

### SA-II (2 MARKS)

6. A new breed of sheep was developed in Punjab by crossing two different breeds of Sheep. Name the two breeds which were crossed and the new breed developed.
7. Study the table given below and fill in the blanks marked A, B, C and D

<b>S.No.</b>	<b>Crop Variety</b>	<b>Resistant to Disease</b>
1. Wheat	Himgiri	(A)
2. Brassica	(B)	White rust
3. (C)	Pusa Komal	Bacterial blight
4. Chilli Tobacco mosaic		(D) Chilly mosaic Virus, Virus and leaf curl

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



### SA I (3 MARKS)

11. What is micropropagation? Why are plants produced by this technique called somaclones? Name any two food plants which are produced on commercial scale using this method.
12. What is mutation? Explain the significance of mutation in plant breeding. Give an example of a disease resistant variety of cultivated plant induced by mutation.
13. How can we improve the success rate of fertilisation during artificial insemination in animal husbandary programmes?
14. Biofortification is the most practical means to improve public health. Justify the statement with examples.
15. What is meant by germplasm Collection? Describe its significance in plant breeding programmes.
16. To which product, following are related (a) Blue revolution (b) white revolution (c) Green revolution

### LA-I (5 MARKS)

17. Does apiculture offer multiple advantages to farmers? List its advantages, if it is located near a place of commercial flower cultivation. Name the most common species of bee which is reared in India.
18. What is somatic hybridisation? Describe the various steps in producing somatic hybrids from protoplasts. Mention any two uses of somatic hybridisation.

**ANSWERS**  
**VSA (1 MARK)**

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.

**SA-II (2 MARKS)**

6. By crossing Bikaneri ewes and Marino rams, the new breed Hisardale was developed.
7. A – Leaf and Stripe rust, hill bunt.  
B – Pusa swarnim (Karan rai).  
C – Cowpea  
D – Pusa Sadabahar
8. 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.
9. When breeding is between animals of the same breed, it is called inbreeding, while cross between different breeds in called out breeding.
10. (i) Isolation of protoplast of Tomato cell and Potato cell.  
(ii) Somatic hybridisation.  
(iii) Pomato  
(iv) Somatic hybrid

**SA-I (3 MARKS)**

11.  The method of producing many plants through tissue culture is called micropropagation.  
 The plants produced through micropropagation will be genetically identical to the original plant from which they were grown, hence are called somaclones.

- Tomato, banana, apple are produced on commercial scale using this method.
12. **Mutation** : Sudden inheritable change in the characters of an organism due to change in the sequence of bases in the gene(s).
- Mutation results in a new character or trait which, not found in the parental type
  - It can also be induced by using mutagens like gamma radiations.
  - Such plant materials are used as such or used for breeding new varieties.
  - Mung bean resistance to yellow mosaic virus and powdery mildew.
13. The Multiple Ovulation Embryo Transfer (MOET) technology can improve the success rate of fertilisation. In the procedure, a cow is given hormonal treatment (FSH), so that more than one ova/eggs (6-8) are produced per cycle. After mating or artificial insemination the embryos at 8-32 celled stage, are transferred to different surrogate mother cows. This technology has been successfully used for cattle sheep, rabbit, mares and buffaloes.
14. Biofortification is the plant breeding programme designed to increase Vitamins, minerals, higher proteins and healthier fat content in crops. This programme improves the quality of food products. It is required to prevent hidden hunger. Some of the examples of fortified crops are:
- (i) New hybrid of maize : has twice the amount of amino acid lysine and tryptophan.
  - (ii) Wheat : Atlas 66, having a high protein content.
  - (iii) Rice : 5 times iron than the normal amount. IARI Delhi has released several crops which are rich in vitamins and minerals. Consumption of such biofortified food will vastly improve the public health.
15. The collection of all the diverse alleles of all the genes of crop plant is called germ plasm collection.
- In plant breeding programmes, the germplasm provides the entire of genes and alleles, and the characteristics which they express. The plant breeders select the most favourable characters of a particular gene and manipulate its transfer to a desirable parent.

16. (a) Fish production (b) Milk production (c) Crop production

**LA (5 MARKS)**

17. Apiculture or Bee-Keeping is the maintenance of hives of honeybees for the production of honey. Apiculture is beneficial for farmers in many ways. Honey bee also produces beeswax which is used in industries, such as in preparation of cosmetics and polishes of various kinds. If Bee keeping is practiced in any area the commercial flowers are cultivated, it will be beneficial in the following ways.

- (i) Bees are pollinators of many crop species including flowering crops such as sunflower.
- (ii) It improves the honey yield, because honeybees collect the nectar from flowers for making honey. *Apis indica* is the most common species which is reared in India.

18. **Somatic Hybridisation** : The process of fusing protoplasts of Somatic cells derived from different varieties or species of plants to produce a hybrid.

**Steps :**

- (i) Removal of cell wall of fusing cells by digestion with a combination of pectinase and cellulase to form protoplasts.
- (ii) Fusion between protoplasts of selected parents is induced by the use of poly ethylene glycol (PEG).
- (iii) The resulted product is cultured on a suitable medium to regenerate cell walls.
- (iv) The cells obtained begin to divide to produce plantlets called somatic hybrids.

**Uses/Applications :**

- (i) Somaclonal variations can be created
- (ii) Lines or varieties/species of plants which can not be sexually hybridised, they can be hybridised.
- (iii) Allopolyploids can be raised by the method.