CHAPTER 9

# STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

## POINTS TO REMEMBER

**Apiculture :** Rearing of honeybees for the production of honey, beewax, 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 in 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-plam 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.*

**Disease of plants -**

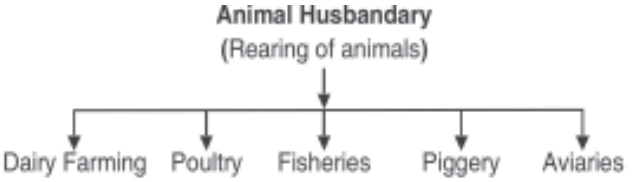
(i) **Viral -** Tobacco mosaic, turnip mosaic

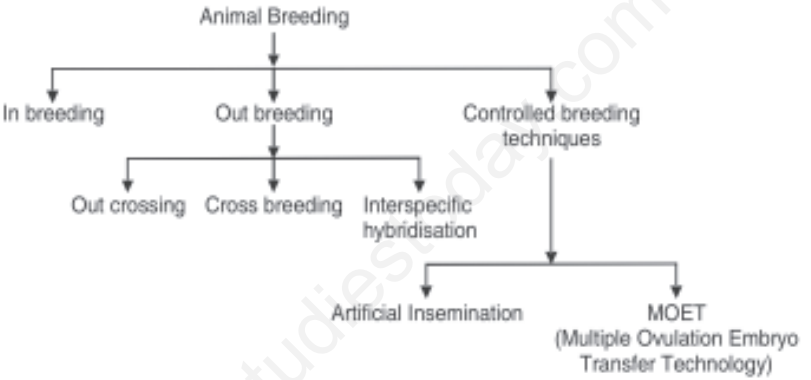
(ii) **Bacterial -** Black rot of crucifers, Blight of rice

(iii) **Fungal -** Rust of wheat, red rot of sugarcane, late blight of potato.

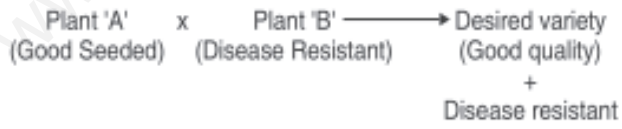
**Germplasm** - The sum total of all the alleles of the genes present in an individual organism and its related species

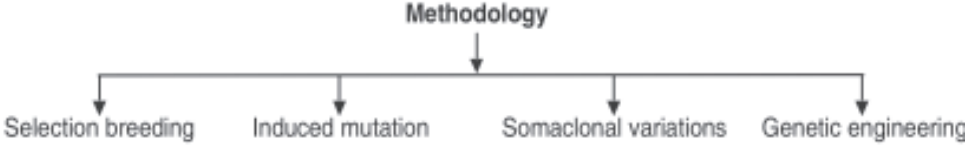
**Explant -** A plant part excised from a specific location in a plant to be used for initiating a culture.



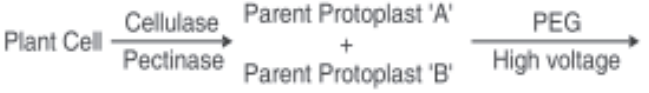




**Plant Breeding for Developing Disease Resistant Varieties**




**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.

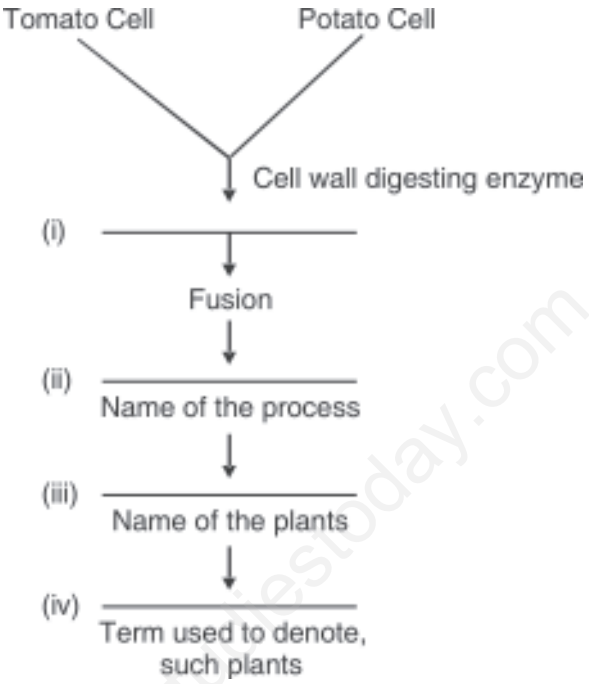
## SA-II (2 MARKS)

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

| ***S.No.*** | | ***Crop Variety*** | ***Resistant to Disease*** |
|---|---|---|---|
| 1. | Wheat | *Himgiri* | (A) |
| 2. | *Brassica* | (B) | White rust |
| 3. | (C) | *Pusa Komal* | Bacterial blight |
| 4. | Chilli | (D) | Chilly mosaic Virus, Tobacco mosaic 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 aminal 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 products 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, 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 variaties.

    ❑ 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, heigher 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 characterstics 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 beewax 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 msot common species whch 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.