Chapter 8. Strategies for Enhancement in Food Production

Animal Husbandry

1 Mark Questions

1. Write a professional approach at genetic level that can help the farmer to improve the milk yield of low milk producing cows in his farm.
[Delhi 2013C]

Ans. Out-crossing is the professional approach which will help the farmer to improve milk yield of low milk producing cows.

2. Write the name of the following
(i)The most common species of bees suitable for apiculture.
(ii) An improved breed of chicken. [All India 2012]

Ans. (i) Apis indica is the most common species of bees for apiculture.

(ii) Leghorn is an improved chicken breed.

3. Which one of the following is used in apiculture Hilsa, Apis indica, Sonalika? [Foreign 2009]
Ans. Apis indica.

4.Mention the strategy used to increase homozygosity in cattle for desired traits. [All India 2009]

Ans. Inbreeding is the strategy used to increase homozygosity. It refers to mating of more closely related individuals of the same breed for 4-6 generations.

5. List any two economically important products for human obtained from Apis indica. [Delhi 2008]

Ans. Honey and beewax are two economically important products obtained from Apis indica.

2 Marks Questions

6. State the disadvantage of inbreeding among cattle. How it can be overcome? [Delhi 2014]

Ans. Continued inbreeding among cattles reduces their fertility as well as productivity, resulting in inbreeding depression.It can be overcome by a single outcross, done by mating of cattle within the same breed, having no common ancestors of their pedigree upto 4-6 generations.

7. Explain the importance of inbreeding in cattle. [2014c]

Ans. The importance of inbreeding in cattle are:

(i) It increases homozygosity and evolve a pureline.

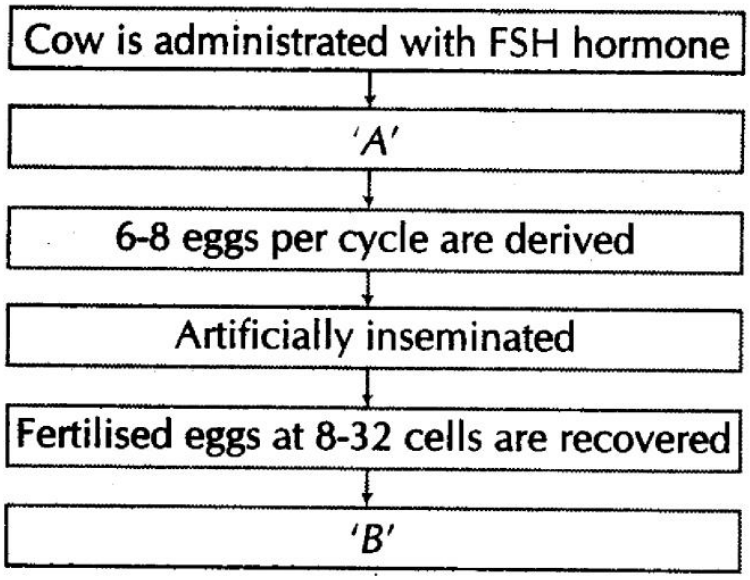
(ii) Accumulation of superior genes and elimination of less desirable genes by selection.

8. Differentiate between out-crossing and cross-breeding. [2014c]

Ans. Differentiate between out-crossing and cross-breeding.

Out-crossing	Out-breeding
This refers to the mating of animals within the same breed, but having no common ancestors on either side of their pedigree up to 4-6 generation.	In this method superior males of one breed are mated with superior females of another breed.
Helps to overcome inbreeding depression.	Develop new stable superior breeds.

9. Study the flow chart given below:



- **Identify the events that take place at stages A'and 'B',**
- **State the importance of the technology explained above.**

[Foreign 2011]

Ans. (i) (A) The hormone induces follicular maturation and **superovulation**, i.e. production of 6-8 eggs per cycle.

(B) Fertilised eggs are recovered and are **transferred to surrogate mother.**

(ii) The technology is called MOET that is used to increase the herd size by mating high milk yielding breed of females with high quality meat yielding bulls.

10. How is a pureline in an animal raised? Explain. [Delhi 2011c]

Ans. Pureline in an animal is raised by inbreeding as it increases homozygosity.

(i) Mating of more closely related individuals within same breed for 4-6 generations is called inbreeding.

(ii) In this process, superior males and superior females of same breed are identified and mated in pairs.

(iii) The progeny obtained from such matings are evaluated and superior males and females among them are identified for further matings.

11. How does inbreeding depression set in? Mention the procedure you would suggest to reverse this. [All India 2011C]

Ans. Inbreeding depression sets in when there iscontinued and close inbreeding. It reduces fertility and productivity. Whenever, this becomes a problem, selected animals of breeding population should be mated with unrelated superior animals of the same breed. This out cross helps in restoring fertility and yield and overcome inbreeding depression.

12. Honey collection improves, when beehives are kept in crop-fields during flowering season. Explain. [Delhi 2010]

Ans. During flowering season, the honeybees visit a number of flowers in search of edible pollen and nectar. Since, they collect nectar from a large number and variety of flowers, honey collection improves both in quality and quantity.

13. MOET programme has helped in increasing the herd size of the desired variety of cattle. List the steps involved in conducting the programme. [All India 2009]

Ans. Steps involved in MOET programme ere:

(i) A cow is administered hormones with ` FSH-like activity to induce follicular maturation and superovulation.

(ii) The cow produces 6-8 eggs instead of one egg produced normally.

(iii) Mating is done either with an elite bull or artificial insemination is carried out.

(iv) When the fertilised eggs attain 8-32 celled stage, they are non-surgically removed and transferred to a surrogate mother.

(v) The genetic mother can be again superovulated now.

14. List any four important components of poultry farm management. [Delhi 2009]

Ans. Important components of poultry farm management are:

(i) Selection of disease-free and suitable breeds.

(ii) Proper and safe conditions of farm.

(iii) Proper food (feed) and water should be provided.

(iv) Hygiene and health care of birds is mandatory.

15. Give the scientific name of mostcommon species of honeybee reared in India. Why is it advantageous to keep beehives in crop-fields during flowering periods. [Delhi 2009c]

Ans. Most common honeybee species reared in India-Apis indica.

During flowering season, the honeybees visit a number of flowers in search of edible pollen and nectar. Since, they collect nectar from a large number and variety of flowers, honey collection improves both in quality and quantity.

3 Marks Questions

16. Why are beehives kept in a crop field during flowering period? Name any two crop fields where this is practised. [Delhi 2014]

Ans. During flowering period, beehives are kept in a crop field so as to increase the efficiency of pollination since, bees are pollinators. It also improves the yield and quality of honey and crops as well as, honeybees visit and collect nectar from a large number and variety of flowers.
The two Crop-fields, where bee-keeping is practised are those of Brassica and apple.

17. (i) What is the programme called, that is involved in improving success rate of production of desired hybrid and herd size of cattle?
(ii) Explain the method used for carrying this programme for cows.
[All India 2012]
or
Describe the technology that has successfully increased the herd size of cattle in a short time to meet the increasing demands of growing human population. [All India 2011]

Ans.(I) Multiple Ovulation Embryo Transfer (MOET) Technology.

(II) Steps involved in MOET programme ere:

(i) A cow is administered hormones with ' FSH-like activity to induce follicular maturation and superovulation.

(ii) The cow produces 6-8 eggs instead of one egg produced normally.

(iii) Mating is done either with an elite bull or artificial insemination is carried out.

(iv) When the fertilised eggs attain 8-32 celled stage, they are non-surgically removed and transferred to a surrogate mother.

(v) The genetic mother can be again superovulated now.

18. What is inbreeding depression and how is it caused in organism? Write any two advantages of inbreeding.[Delhi 2011]

Ans. Inbreeding refers to mating between closely
related individuals within the same breed for p 4-6 generations. It usually results in reductionof fertility and productivity, when continued for longer time. This is called **inbreeding depression.**

Advantages of inbreeding are:

(i) Increases and evolves a pureline.

(ii) Recessive genes are exposed by inbreeding which can then be eliminated by selection.

19. (i) Write the scientific name of most common species of honey bee reared.
(ii)Mention the kind of areas that are suitable for bee-keeping practices.
(iii) Mention any two uses of beewax. [Delhi 2011C]

Ans. (i) Apis indica.

(ii) It can be practiced in any area, where there are sufficient bee pastures of some wild shrubs, fruit, orchards and cultivated crops.

(iii) Beewax is used in the preparation of cosmetics and polishes of various kinds.

20. What is 'blue revolution'? Name two freshwater and two marine edible fishs. [All India 2011C]

Ans.'Blue revolution' is the movement launched to increase the production of fish and fish products.

Freshwater fishes are Rohu and catla.

Marine water fishes are Hilsa and Sardines

21. Explain the efforts, which must be put in, to improve health, hygiene and milk yield of cattle in dairy farm. [Delhi 2010]

Ans. To improve health, hygiene and milk yield of cattle in dairy farm

(i) They have to be housed well in proper, well-ventilated sheds.

(ii) Cleanliness and hygiene of both the cattle and the handlers are important.

(iii) Regular visit of veterinary doctor is necessary.

(iv) The feeding should be carried out in a scientific manner with special emphasis on quality and quantity of fodder.

(v) Breeding may be necessary for improving the milk yield and to make it disease resistance.

22. List any three outbreeding practices carried out to breed domestic animals. Explain the importance of each one listed. [Delhi 2010c]

Ans. Out breeding refers to the crosses between different breeds.
It is of following types:

(i) Out-crossing It is a practice of mating of animals of same breeds, having no common ancestors on either side of their pedigree for 4-6 generations.
A single out cross helps to overcome inbreeding depressions.

(ii) Cross-breeding In this method, superior male of one breed are mated with superior females of another breed.
This helps in combining the desirable qualities of two different breeds into the progeny.

(iii) Interspecific hybridisation In this method, male and female animals of two different related species are mated to combine the desirable features of both the parents into one, e.g. Mule is produced by a cross between male donkey and female horse.

23. (i) Inbreeding is advantageous as well as disadvantageous. Explain.
(ii) Differentiate between inbreeding and outbreeding. [Delhi 2010c]

Ans. Advantages of inbreeding are:

(a) It increases and evolves a pureline.

(b) Recessive genes are exposed by inbreeding, which are then eliminated by selection.

(c) Superior genes can be accumulated by inbreeding and thereby eliminating undesirable genes.

(d) By selection at every step, productivity of inbreed population is increased. Disadvantage of inbreeding is that close inbreeding leads to the reduction of fertility and productivity. This is due to inbreeding depression.

(ii) Difference between inbreeding and outbreeding is:

Inbreeding	Outbreeding
It refers to the mating of closely related individuals within the same breed for 4-6 generations.	It refers to breeding of unrelated animals either of the same breed with no common ancestor or between different breeds or different species.

24. Explain the advantages of inbreeding in cattle population. What effect does inbreeding depression have on cattle population and how is it overcome?[Foreign 2008]

Ans. Advantages of inbreeding in cattle population are:

(i) It increases homozygosity, hence evolve a pureline.

(ii) It helps in the accumulation of superior genes and elimination of less desirable genes.

(iii) It exposes harmful recessive genes and their elimination by selection.

Effects of inbreeding depression are:

(i) When continued over a long period of time, it reduces the fertility and over productivity of animals.

(ii) Inbreeding depression can be overcome by out-crossing, i.e. mating of selected animals with unrelated superior animals of same breed. It helps to restore the fertility and yield in the cattle.

25. Out-crossing and cross-breeding are two breeding practices in animal husbandry. How are the two practices different from each other and what advantages are they do to the breeders? Explain. [All India 2008C]

Ans. Differentiate between out-crossing and cross-breeding.

Out-crossing	Out-breeding
This refers to the mating of animals within the same breed, but having no common ancestors on either side of their pedigree up to 4-6 generation.	In this method superior males of one breed are mated with superior females of another breed.
Helps to overcome inbreeding depression.	Develop new stable superior breeds.

Advantages of out-crossing

(i) It is the best method for animals that are below average in productivity in milk production, growth rate, etc. It helps to overcome inbreeding depression.

Advantages of cross-breeding

(i) It allows the desirable qualities of two different breeds to be combined in a single progeny.

(ii) Progeny may be used for commercial production.

(iii) Many new breeds have been developed by this approach, i.e. Hisardale.

5 Marks Question

26. (i) State the objective of animal breeding.
(ii) List the importance and limitations of inbreeding. How can the limitations be overcome?
(iii) Give an example of a new breed each of cattle and poultry.
[All India 2014]

Ans.(i) The main objective of animal breedingis to increase the yield of animals and improve the desirable and superior qualities in both the animals and theirproducts.

(ii) Importance of Inbreeding-
Differentiate between out-crossing and cross-breeding.

Out-crossing	Out-breeding
This refers to the mating of animals within the same breed, but having no common ancestors on either side of their pedigree up to 4-6 generation.	In this method superior males of one breed are mated with superior females of another breed.
Helps to overcome inbreeding depression.	Develop new stable superior breeds.

Limitations of Inbreeding Thecontinued inbreeding in animals forsubsequent generations reduces theirfertility and productivity, resulting in condition called inbreeding depression.
The inbreeng depression can be overcome by a single outcross, i.e. mating between animals of same breed having no common ancestors up to 4-6 generations.

(iii) An example of new breed of cattle is Hisardale and that of poultry is new hampshire.

Plant Breeding

1 Mark Questions

1. Write an alternate source of protein for animal and human nutrition. [All India 2014]

Ans. Single cell protein derived from microbes acts one of the alternate source of protein for animal and human nutrition.

2. What are 'true breeding lines' that are used to study inheritance pattern of traits in plants? [Delhi 2014]

Ans. 'The breeding lines' used to study inheritance pattern of traits in plants are actually the pure homozygous plants for a particular trait, obtained through classical plant breeding, self-hybridisation and selection.

3. Identify the two correct statements from the following
(i) Apiculture means apical meristem culture.
(ii) Spinach is iron enriched.
(iii) Green revolution has resulted in improved pulse yields.
(iv) Aphids cannot infest rapeseed mustard. [All India 2014C]

Ans. The two correct statements identified are:

(i) Spinach is iron-enriched.

(ii) Aphids cannot infest rapeseed mustard.

4. Name any two diseases the 'Himgiri' variety of wheat is resistant to. [All India 2013]

Ans. Stripe rust and leaf rust are the two diseases that are resistant to 'Himgiri' variety of wheat.

5. Name the following

- **The semi-dwarf variety of wheat, which is high-yielding and disease resistant?**
- **Any one interspecific hybrid mammal. [Delhi 2012]**

Ans. (i) Sonalika and Kalyan Sona are the semi-dwarf varieties of wheat that are high-yielding and disease resistant.

(ii) Mule is an interspecific hybrid mammal.

6. Write the names of the semi-dwarf and high-yielding rice varieties developed in India after 1966. [Delhi 2012]

Ans. Jaya and Ratna are two semi-dwarf and high yielding rice varieties developed in India after 1966.

7. Why is the South Indian sugarcane preferred by agriculturists? [Foreign 2012]
Ans. The South Indian sugarcane has thick stemswith high sugar content, that is why it is preferred by agriculturists.

8. State the importance of biofortification. [All India 2011]

Ans. Biofortification improves the nutritional quality of food materials by breeding crops with higher vitamins, minerals or proteins content and is the most practical means to improve public health.

9. Name the organism commercially used for the production of single cell protein. [Delhi 2009]

Ans. Spirulina is used for the production of SCP.

10. How are the two following varieties of sugarcane different from each other?
(i) Saccharum barberi
(ii) Saccharum ofiicinarum [Delhi 2009]

Ans. (i) Saccharum barberi grows in North India. It has poor sugar content and yield. (ii) Saccharum officinarum grows in South India. It has thicker stems, more sugar content and yield.

11. Which of the following is the semi-dwarf wheat that is high-yielding and disease resistant?
Pusa Shubra, Kalyan Sona, Ratna [Foreign 2009]

Ans. Kalyan Sona is a semi-dwarf wheat variety.

12. Which of the foUowing produces single cell proteins?Sonalika, Spirulina, Saccharomyces. [Foreign 2009]

Ans. Spirulina produces single cell protein.

13. What is the economic value of Spirulina? [All India 2008]

Ans. Spirulina is rich in protein, minerals, vitamins, fats and carbohydrates. It is thus employed in the commercial production of single cell protein, so as to provide alternate source of nutrition.

14. What is the economic value of Saccharum officinarum'? [Foreign 2008]

Ans. Saccharum officinarum has thicker stems and higher sugar content and yield. It is crossed with S. barberi to get varieties of high yield.

2 Marks Questions

15. How can healthy potato plants beobtained from a desired potato variety which is viral infected? Explain. [Delhi 2014]
or
A potato plant is infected with a virus name and explain a method to obtain virus-free potato plants from it. [2014C]

Ans. The healthy potato plants can be obtained through meristem culture of viral infected plants. Since, meristematic tissues are free from virus and other infections. They are used as explants and cultured under in vitro conditions to produce new healthy potato plants, by micropropagation or tissue culture.

16. List two steps that are essential for carrying out artificial hybridisation in crop plants and why? [Foreign 2014]

Ans. The two steps are essential for carrying out artificial hybridisation in crop plants, as it is mandatory to prevent both self-pollination as well as unwanted cross-pollination. This is achieved by

(i) **Emasculation** Removal of anthers or stamens from bisexual flowers, in developing stage only.

(ii) **Bagging** The emasculated bisexual and unisexual flowers are covered with bag, i.e. butter paper so as to prevent any kind of unwanted pollination

17. How does culturing of Spirulina solve the food problems of the growing population? [Foreign 2012]

Ans. Culturing of Spirulina can solve the food problem of growing population by producing single cell protein. Because, it can be grown easily on wastewater animal manure and even sewage and obtained in large quantities. It can serve as source of food rich in minerals, vitamins, carbohydrates and proteins.

18. How is it possible to recover healthy banana plants from a diseased but desirable quality banana plant? Explain. [Foreign 2012]

Ans. Healthy plant is obtained from diseased plant by meristem culture.
In infected plant, meristems are free from viruses and it is excised and grown in test tubes or petriplate under sterile conditions, on suitable growth medium. By this method, a number of plant can be produced in a short duration and the process is called micropropogation.

19.How are biofortified maize and wheat considered nutritionally improved? [Foreign 2012]

Ans. Biofortified maize variety has twice the amount of amino acids, lysine and tryptophan, as compared to normal varieties. While biofortified wheat variety is very rich in protein content.

20. Explain the advantage of cross-breeding of two species of sugarcane in India. [Delhi 2011]

Ans. Sugarcane grown in North India, i.e. Saccharum barber/ has poor sugar content and low yield while, the sugarcane grown in South India, i.e. Saccharum officinarum has thicker stems and higher content of sugar, but cannot grown in North Indian climatic conditions.

The hybrid produced by cross breeding these two species has the following desirable traits :

(i) High-yield (ii) Thick stems (iii) High sugar content
(iv) Ability to grow in North Indian sugarcane fields.

21.Enumerate, in sequential order, the four steps that a plant breeder should follow to obtain a disease resistant Crop. [Delhi 2009C]

Ans. Steps to be followed by a plant breeder to get disease-resistant crops are:

(i) Screening germplasm for resistance.

(ii) Hybridisation of selected parents.

(iii) Selection and evaluation of the hybrids.

(iv) Testing and release of new varieties.

22. (i) What is micropropagation? Why are the plants produced by micropropagation called somaclones?
(ii) Name the techniques by which healthy plants can be recovered from diseased plants. [Foreign 2008]
Ans.(i) Micropropagation is a method of producing thousands of plants through tissue culture. Each plant will be genetically identical to the original plant from which they were grown. So, they are called somaclones.

(ii) Healthy plants can be recovered from diseased plants by meristem culture because meristems are free from viruses in diseased plant.

23. (i) Mention two ways of inducing artificial mutation in a crop field.
(ii) List two steps that help in introducing the desired mutation into the crop. [All India 2009C]

Ans. (i) Artificial mutation in a crop field can be induced by

(a) Use of chemicals.

(b) Use of radiations like gamma radiation.

(ii) After inducing mutations they can be introduced into crop, by these two steps:

(a) Selection of plants having desirable character as a source for breeding.
Hybridisation of the selected plants

24. List any four objective that you would recommend for biofortification.
[Delhi 2008C]
Ans. Objectives of biofortification are to increase

(i) Protein content and quality.

(ii) Oil content and quality.

(iii) Vitamin content.

(iv) Micronutrient and mineral content

25. How somaclones are produced? How are they different from somatic hybrids?
[Delhi 2008C]

Ans. Somaclones are produced through micropropagation and tissue culture.
They are different from somatic hybrids in following ways:

Crop	Variety	Insect Pest
Brassica (rapeseed mustard)	Pusa Gaurav	Aphids
Flat bean	Pusa Sem 2 Pusa Sem 3	Jassids, aphids and fruit borer
Okra (bhindi)	Pusa Sawani Pusa A-4	Shoot and fruit borer

3

Marks Questions
26. What is 'biofortification'? Write its importance. Mention the contribution of Indian Agricultural Research Institute towards it with the help of two examples.[Foreign 2014]

Ans. (i) Biofortification improves the nutritional quality of food materials by breeding crops with higher vitamins, minerals or proteins content and is the most practical means to improve public health.

(ii) Importance of biofortification:

- It provides the crops with higher levels of vitamins, minerals, proteins and healthier fats.
- It helps in the improvement of public health.

(iii) Contribution of IARI towards biofortification is by developing several vegetable crops rich in vitamins and minerals.
Two examples of such crops are :

(a) Vitamin-A enriched carrots and spinach.
(b) Protein enriched beans.

27. Suggest and describe a technique through which a virus-free healthy plant can be obtained from a diseased sugarcane plant. [2014 c]

Ans. The virus-free healthy sugarcane plant can be obtained through meristem culture of diseased plant; as meristematic tissues are free from viruses they can be used as explants for

micropropagation.

Steps in Meristem Culture

(i) The shoot tip explants are grown in nutrient medium in either a test tube a pteri dish, under aseptic/sterile in vitro conditions.

(ii) The nutrient medium should essentially have a carbon source inorganic salts vitamins, amino acids and growth regulators like auxin and cytokinin in proper defined ratio.

(iii) The plantlets, thus obtained are later shifted to nurseries, under observation and finally to fields.

28. Name the prominent South Indian and North Indian species of sugarcane used for cross breeding. List the desired qualities of the hybrid that can be obtained from this cross.[Delhi 2013C]

Ans. North Indian species of sugarcane is Saccharum barberi. South Indian species of Sugarcane is Saccharum officinarum.(l) The hybrid obtained from this cross is supposed.
Sugarcane grown in North India, i.e. Saccharum barber/ has poor sugar content and low yield while, the sugarcane grown in South India, i.e. Saccharum officinarum has thicker stems and higher content of sugar, but cannot grown in North Indian climatic conditions.
The hybrid produced by cross breeding these two species has the following desirable traits :

(i) High-yield (ii) Thick stems (iii) High sugar content
(iv) Ability to grow in North Indian sugarcane fields.

29. (i) Name the Indian scientist, whose efforts brought 'Green Revolution in India'.
(ii) Mention the steps that are essentially carried out in developing a new genetic variety of crop under plant breeding programme. [Foreign 2012]
Ans. (i) MS Swaminathan brought 'Green Revolution' in India.

(ii) The steps in developing a new genetic variety of crops are:

- Collection of genetic variability or germplasm.
- Evaluation and selection of parents.
- Cross hybridisation among the selected parents.
- Selection and testing of superior recombinant or hybrids.
- Testing, release and commercialisation of new cultivars.

30. How can crop varieties be made disease resistant to overcome food crisis in India? Name one disease resistant variety in India of

- **Wheat to leaf and stripe rust.**
- **Brassicato white rust. [Delhi 2011]**

Ans. To overcome food crisis due to crop failure or disease, ways to make disease resistant crop varieties have developed

(i) By conventional breeding techniques It includes

- Screening the germplasm for the source of resistance.
- Hybridisation of selected individuals.
- Selection and evaluation of hybrids.

- Evaluation of hybrids.
- Testing and release of the variety.

(ii) By mutation breeding It involves inducing mutations artificially and then using the plants that have the desirable character as a source of disease-resistance in breeding.

- Himgiri wheat is resistant to leaf and stripe rust.
- Pusa Swarnim (Karan Rai) is resistant to white rust.

31. Mention the property of plant cells that has helped them to grow into a new plant in in vitro Explain the advantages of micropropagation. [Delhi 2011]

Ans. Plant cell has a property called 'totipotency' by which each cell can grow into a new plant under in vitro conditions.

Advantages of micropropagation are:

(i) Thousands of plants can be grown in a short period.

(ii) By culturing the meristems of virus infected plants, virus-free healthy plants can be raised.

(iii) Plants are genetically identical, so certain desirable characters can be continued through generations.

(iv) Hybrids can be produced by somatic hybridisation.

32. Scientists have succeeded in recovering healthy sugarcane plants from a diseased one

- **Name the part of the plant used as explant by scientists.**
- **Describe the procedure the scientists followed to recover the healthy parts.**
- **Name the technology used for crop improvement. [All India 2011]**

Ans. (i) Shoot tip or meristems of plant.

(ii) The virus-free healthy sugarcane plant can be obtained through meristem culture of diseased plant; as meristematic tissues are free from viruses they can be used as explants for micropropagation.

Steps in Meristem Culture

(i) The shoot tip explants are grown in nutrient medium in either a test tube a pteri dish, under aseptic/sterile in vitro conditions.

(ii) The nutrient medium should essentially have a carbon source inorganic salts vitamins, amino acids and growth regulators like auxin and cytokinin in proper defined ratio.

(iii) The plantlets, thus obtained are later shifted to nurseries, under observation and finally to fields.

(iv) Micropropagation is the technology used for crop improvement

33. IARI has released several varieties of crop plants that are biofortified. List three examples of such crops and their biofortifications. [Foreign 2011]

Ans. Biofortified crops released by IARI are:

(i) Vitamin-A enriched carrots and spinach.

(ii) Iron and calcium enriched spinach.

(iii)Protein enriched beans.

(iv) Vitamin-C enriched bitter gourd and mustard.

34. (i) Mention the property that enables the explants to regenerate into a new plant. (ii) A banana herb is virus-infected. Describe the method that will help in obtaining healthy banana plants from this diseased plant. [All India 2010]

Ans. Totipotency of cells is the property that enables the explants to regenerate into a new identical plant.

(ii) Meristem culture is the method by which healthy banana plants can be obtained from virus-infected plant. The apical and axillary meristem is free of virus. The meristem is removed from the plant and grown in vitro by micropropagation. The plants thus, produced are virus-free.

35. How are somaclones cultured from explants in in vitro conditions? Why are somaclones so called?
[Foreign 2010]
or
Why are plants obtained through micropropagation termed somaclones? Name three food plants produced on commercial scale using this method. [All India 2009C]

Ans. Somaclones cultured from explants are grown in following steps:

(i) The explant is grown in a petri dish/test tube under sterile conditions in a special nutrient medium.

(ii) The medium must contain carbon source like sugar, inorganic salts, vitamins, minerals, amino acids, growth regulators like auxins and cytokinins.

(iii) The medium should be replaced regularly to restore nutrients in it.

(iv) Because all plants (produced by tissue culture) are genetically identical to the original plant (from where they are cultured), so they are called somaclones. Three food plants produced by micropropagation are tomato, banana, apple, etc.

36. Define totipotency of a cell. List the requirements, if the objective is to produce somaclones of a tomato plant on commercial scale.[Foreign 2008]

Ans. Totipotency of a cell can be defined as the capacity of a cell/explant to grow into a whole new identical plant.

Requirements to produce somaclones of tomato plants are:

(i) Explant It is any part of a plant taken out for growing a new plant in special nutrient medium under sterile/aseptic conditions.

(ii) Nutrient medium It must have a carbon source such as sugar, inorganic salts, vitamins, amino acids, growth regulators like auxins, cytokinins, etc.

(iii) Suitable conditions of light and temperature. This is a tissue culture method by which a number of genetically similar plants called somaclones can be grown.

(iv) The plant let grown are later shifted to nurseries for further development and finally to fields.

37. (i) What is micropropagation? Why are the plants produced by micropropagation called somaclones?
(ii) Name the technique by which healthy plants can be recovered from the diseased plants. [Foreign 2008]

5 Marks Questions

38. With advancements in genetics, molecular biology and tissue culture, new traits have been incorporated into crop plants.
Explain the main steps in breeding a new genetic variety of a crop.
[All India 2014]

Ans. The major steps in breeding a new genetic variety of a crop are:

(a) **Collection of variability** Genetic variability is the root of any breeding programmes. Wild varieties of many related crops are collected for evaluation.

(b) Evaluation and selection of parents Germplasm of the identified plants are evaluated for desired characters.

(c) Cross hybridisation The desired characters are obtained by crossing the wild selected species of crops.

(d) Selection and testing of superior recombinants The superior plants after cross hybridisation are selected and tested in all respects before making it for commercialisation.

(e) Commercialisation of new variety

39. (i) Name the technology that has helped scientists to propagate on a large scale the desired crops in a short duration. List the steps carried out to propagate the crops by the said technique.
(ii) How are somatic hybrids obtained? [Delhi 2014]

Ans. (i) Tissue culture is the technique that has helped scientists to propagate plants with desirable traits on a large scale, in short duration. Since, large number of plants are propagated through this culture it is also referred to as micropropagation.
The steps involved in this technique are:

- Explants are derived from any part of plant (to be propagated), i.e. tips of carrot.
- Explants are grown in sterile conditions in special nutrient media to regenerate complete plants.
- Nutrient media must contain a carbon source (such as sucrose), organic salts, vitamins, amino acids and phytohormones, i.e. auxin and cytokinin.
- Hence, propagation is achieved for a large number of plants under in vitro
- All the plants obtained by tissue culture are called somaclones, since they are genetically identical to each other as well as, to the parent plant.

(ii) Somatic hybrids are obtained by the method of somatic hybridisation. In this method, the naked protoplasts of cells of two plants are hybridised. Protoplasts are isolated by dissolving cell

wall and fused to get a hybrid protoplast. The fused nucleus is called heterokaryon that , grows further to form a new plant. The plants thus formed are called somatic hybrid.