# Very Short Answer Questions (PYQ)

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## [1 Mark]

**Q.1. Which one of the following is used in apiculture:**
***Hilsa, Apis indica, Sonalika***

**Ans.** Apis indica.

**Q.2. Mention the strategy used to increase homozygosity in cattle for desired traits.**

**Ans.** Inbreeding.

**Q.3. Write the importance of MOET.**

**Ans.** MOET is used to increase the herd size in a short time. It also improves the chances of production of hybrids.

**Q.4. Mention the role of 'genetic mother' in MOET**

**Ans.** Genetic mother is used for superovulation to produce 6-8 eggs (under the influence of FSH).

**Q.5. Write an alternate source of protein for animal and human nutrition.**

**Ans.** Single cell protein/*Spirulina*

**Q.6. Name the organism commercially used for the production of single cell protein.**

**Ans**. *Spirulina*

**Q.7. Which of the following produces single cell proteins?**

***Sonalika, Spirulina, Saccharomyces***

**Ans.** *Spirulina*

**Q.8. State the importance of biofortification.**

**Ans.**

i. Breeding of crops for improvement of nutritional quality.
ii. Higher level of vitamins/proteins/minerals/healthier fats. (*Any one*)

**Q.9. Name the following:**

**Q. The semi-dwarf variety of wheat which is high-yielding and disease-resistant.**

**Ans.** *Kalyan Sona/Sonalika*

**Q. Any one inter-specific hybrid mammal.**

**Ans.** Mule/Hinny/Liger/Tigon

**Q.10. Identify 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-yield.
iv. Aphids cannot infest rapeseed mustard.

**Ans.** (*ii*) and (*iv*) are correct.

**Q.11. Suggest the breeding method most suitable for animals that are below average in milk productivity.**

**Ans.** Outbreeding/Outcrossing/Cross-breeding/Artificial insemination/Hybridisation.

**Q.12. A herd of cattle is showing reduced fertility and productivity. Provide one reason and one suggestion to overcome this problem.**

**Ans.** Inbreeding depression or continuous inbreeding may be the reason of reduced fertility and productivity. To overcome this, the cattle should be mated with unrelated superior cattle of the same breed.

**Q.13. Which of the following is the semi-dwarf wheat that is high yielding and disease resistant?**

***Pusa Shubra, Kalyan Sona, Ratna***

**Ans.** *Kalyan Sona.*

**Q.14. What is the economic value of *Saccharum officinarum*?**

**Ans.** *Saccharum officinarum* has thicker stem, higher sugar content and grows well in South India.

**Q.15. Write the names of two semi-dwarf and high yielding rice varieties developed in India after 1966.**

**Ans.** *Jaya, Ratna*.

**Q.16. How is it possible to recover healthy banana plants from a diseased but desirable quality banana plant? Explain.**

**Ans.** Healthy bananas can be obtained by tissue culture technique. The meristem (apical and axillary) is free from virus. Hence, it is removed and grown *in vitro* to obtain healthy banana.

**Q.17. Why is the South Indian sugarcane preferred by agriculturalists?**

**Ans.** South Indian sugarcane has thicker stem and higher sugar content.

**Q.18. Name any two diseases the 'Himgiri' variety of wheat is resistant to.**

**Ans.** Leaf and stripe rust; Hill bunt

**Q.19. What is the economic value of Spirulina?**

**Ans.** *Spirulina* can serve as food rich in proteins, minerals, vitamins, fats and carbohydrates.

**Q.20. Write the name of the following:**

a. **The most common species of bees suitable for apiculture.**
b. **An improved breed of chicken.**

**Ans.**

**a.** *Apis indica*/*Apis mellifera*/*Apis dorsata*
**b.** Leghorn/Rhode island red/Minorcha.

## Very Short Answer Questions (OIQ)

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## [1 Mark]

**Q.1. What is dairying?**

**Ans.** The management of animals for milk and their products for human consumption.

**Q.2. Name any two diseases of poultry.**

**Ans.** *Ranikhet* and bird flu.

**Q.3. List any two economically important products for humans obtained from *Apis indica*.**

**Ans.** Honey and beeswax

**Q.4. Define inbreeding depression.**

**Ans.** The continuous inbreeding especially close inbreeding may lead to the reduced fertility and productivity. This is called inbreeding depression.

**Q.5. Which chemical is used for doubling the chromosome number?**

**Ans.** Colchicine

**Q.6. Name two cattle diseases.**

**Ans.** Anthrax, foot and mouth disease.

**Q.7. How is a mule produced?**

**Ans.** The mule is produced by breeding between male donkey and female horse (mare).

**Q.8. Name the Indian variety of rice patented by an American company.**

**Ans.** Basmati rice.

**Q.9. Name any plant growth regulator used in plant tissue culture.**

**Ans.** Name any plant growth regulator used in plant tissue culture.

**Q.10. Name the scientist who developed semi-dwarf varieties of wheat in Mexico.**

**Ans.** Norman E. Borlaug.

**Q.11. Name the varieties of rice from which semi-dwarf varieties have been developed.**

**Ans.** IR–8 and Taichung Native–I.

**Q.12. Give an example of somatic hybrid produced.**

**Ans.** Pomato is a somatic hybrid of potato and tomato.

**Q.13. Name two diseases caused by virus in crop plants.**

**Ans.** Tobacco mosaic and turnip mosaic.

**Q.14. Name the wheat variety developed, which is resistant to leaf and stripe rust.**

**Ans.** *Himgiri.*

**Q.15. What is somatic embryo?**

**Ans.** The embryo which develops from the somatic cell is called somatic embryo.

**Q.16. What is meant by ‘hidden hunger’?**

**Ans.** Consumption of food deficient in nutrients particularly, micronutrients, proteins and vitamins is called hidden hunger.

**Q.17. What is protoplast fusion?**

**Ans.** The merging of protoplasts obtained from two different cells to form a hybrid protoplast is called protoplast fusion.

**Q.18. Name two major practices induced in animal husbandry.**

**Ans.** Caring, feeding, breeding, etc.

**Q.19. What is the purpose of animal breeding?**

**Ans.** Purpose of animal breeding:

i. Increase in quantity of yield.
ii. Improving quality of produce.

**Q.20. Where was IR-8 developed?**

**Ans.** IR-8 was developed at International Rice Research Institute [IRRI] (Phillipins) .

**Q.21. Mention any two methods used for breeding for disease resistance apart from conventional method for hybridisation.**

**Ans.**

i. Selection among somaclonal variants
ii. Genetic engineering.

**Q.22. Write the scientific names of microorganism which produce high quantity of protein.**

**Ans.** *Methylophilus methylotrophus.*

**Q.23. A certain tissue, of a plant, infected with TMV was used to obtain a new plant using tissue culture technique. Identify the technique used and reason out the possibility of obtaining a new healthy plant.**

**Ans.** The technique used is tissue culture using meristematic tissue as this method produces virus free plants.

**Q.24. Genetic variability is the root of any breeding programme. How does this variation occur?**

**Ans.**

i. All the wild varieties and relatives of the cultivated crops are collected and preserved.
ii. For their characteristics, evaluation of these genetic collections are done.

**Q.25. State any one significance of interspecific hybridisation in plants.**

**Ans.** It is important for breeding disease-resistant plant varieties.

**Q.26. Which process decreases fertility and productivity in crops?**

**Ans**. Inbreeding depression.

**Q.27. Why are apical and axillary meristems used for tissue culture?**

**Ans.** Because these are free from virus.

**Q.28. Name the technology which in addition to tissue culture techniques play a pivotal role in enhancing food production.**

**Ans.** Embryo transfer technology

**Q.29. Why is mutation breeding necessary for producing disease resistance varieties?**

**Ans.** Because there is limited availability of disease resistance genes in the crop plants and their wild relatives.

**Q.30. What can be used as the reference material for comparison of any new improved variety?**

**Ans.** The best available local cultivar.

# Short Answer Questions-I (PYQ)

## [2 Marks]

**Q.1. What kind of areas are suitable for practicing apiculture? Write the scientific name of the variety commonly reared for the purpose.**

**Ans.** Bee pastures of wild shrub, fruit orchards and cultivated crop are suitable for practicing apiculture. The commonly reared variety for this purpose is Apis indica.

**Q.2.**

a. **List two advantages of keeping beehives in a crop field during flowering season.**
b. **Name one annual and one perennial crop species favourable to beeswax collection.**

**OR**

**Give the scientific name of the most common species of honey bee reared in India. Why is it advantageous to keep beehives in crop-fields during flowering periods?**

**Q.3.**

a. **Why are the plants raised through micropropagation termed as somaclones?**
b. **Mention two advantages of this technique.**

**Ans.**

a. Plants raised through micropropagation are genetically identical, hence the name somaclones.
b.
    i. Large number of plants are produced in short duration.
    ii. Virus free plants are produced.

**Q.4. State the disadvantage of inbreeding among cattle. How it can be overcome?**

**Ans.** Continuous inbreeding reduces fertility and productivity. This is called inbreeding depression. This can be overcome by different breeds or individuals of the same breed with unrelated superior animals. This is done by mating.

**Q.5. 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.**

**Ans.** Multiple ovulation embryo transfer technology (MOET) has successfully increased the herd size of cattle. The cow is administered with FSH to induce follicular maturation and superovulation to produce 6 to 8 eggs. It is then mated or artificially inseminated. The fertilised eggs are recovered non-surgically and transferred to surrogate mother where they develop into an improved variety.

**Q.6. High yielding cattle is a good solution for food enhancement. How does the MOET technology help to increase the herd size?**

**Ans.**

- It is a programme for herd improvement in animals like cattle, sheep, rabbits, buffaloes, mares, etc.
- High milk-yielding breeds of female have been bred with high quality (lean meat with less lipid) meat-yielding bulls to increase herd size in lesser time.

**Q.7. In MOET technology, two 'mothers' are needed to produce one calf. Justify.**

**Ans.** In MOET technology, one mother cow is administered hormones to induce follicular maturation and superovulation. These fertilised eggs are transferred to the second surrogate mothers for development.

**Q.8. Explain the advantage of cross-breeding of the two species of sugarcane in India.**

**Ans.** *Saccharum barberi*, grown in north India, had poor sugar content and yield, whereas *Saccharum officinarum*, grown in south India, had thicker stem and higher sugar content. The sugarcane species obtained after cross breeding these two species had thick stems, high sugar, high yield and ability to grow in north India.

**Q.9. Name any two common Indian millet crops. State one characteristic of millets that has been improved as a result of hybrid breeding so as to produce high yielding millet crops.**

**Ans.** Maize, *jowar, bajra* (*Any two*)
Resistant to water stress has been improved.

**Q.10. Enumerate four objectives for improving the nutritional quality of different crops for the health benefits of the human population by the process of "Biofortification".**

**Ans.**

i. Improving protein content and quality.
ii. Improving oil content and quality.
iii. Improving vitamin content and quality.
iv. Improving micronutrient or mineral content.

**Q.11. List the two steps that are essential for carrying out artificial hybridisation in crop plants and why.**

**Ans.**

a. **Selection of parents:** Only those plants should be selected which have desired traits.
b. **Crossing over:** Pollen grains from selected male plant is collected and transferred to the female plant after which it is bagged.

**Q.12. Identify A, B, C and D in the table given below.**

| Crop | Variety | Resistance to disease |
|---|---|---|
| Wheat | A | Leaf and stripe rust |
| B | *Pusa Shubhra* | Black-rot |
| Cowpea | *Pusa Komal* | C |
| Brassica | *Karan Rai* | D |

**Ans.**

A : *Himgiri*
B : Cauliflower
C : Bacterial blight
D : White rust

**Q.13. In an agricultural field there is a prevalence of the following organisms and crop diseases which are affecting the crop yield badly:**

**a.** White rust
**b.** Leaf and stripe rust
**c.** Black rot
**d.** Jassids

Recommend the varieties of crops the farmers should grow to get rid of the existing problem and thus improve the crop yield.

**Ans.**

| Crop disease | Disease resistant variety of crop |
|---|---|
| (a) White rust | *Pusa Swarnim* |
| (b) Leaf and stripe rust | *Himgiri* |
| (c) Black rot | *Pusa Shubhra* |
| (d) Jassids | *Pusa Sem 2* |

**Q.14. How has mutation breeding helped in improving the production of mung bean crop?**

**Ans.** Mutation breeding has helped in the production of disease resistant varieties of mung bean crops against yellow mosaic virus and powdery mildew.

**Q.15. Suggest four important steps to produce a disease resistant plant through conventional plant breeding technology.**

**Ans. Steps for producing disease resistant plants are:**

i. Screening of germplasm (for resistance sources)
ii. Hybridisation of selected parents
iii. Selection and evaluation of hybrids
iv. Testing and release of new varieties.

**Q.16. Bottled fruit juices are clearer as compared to those made at home. Explain.**

**Ans.** Bottled fruit juices contain enzymes pectinase and protease for making them clear.

**Q.17. How can pollen grains of wheat and rice which tend to lose viability within 30 minutes of their release be made available months later for breeding programmes?**

**Ans.** The pollen grains can be stored in liquid nitrogen (−196°C). Such stored pollen grains do not lose their viability for years and can be used in breeding programmes.

**Q.18. By taking two examples explain how has biofortification helped in improving food quality.**

**Ans.** Biofortification has improved protein content and quality, oil content and quality, vitamin content, micronutrients and mineral content. For example, Atlas 66 has been used as a donor for developing wheat varieties with improved protein content. Maize hybrids have been developed with increased amount of amino acids, lysin and tryptophan.

**Q.19. How are biofortified maize and wheat considered nutritionally improved?**

**Ans.** Biofortified maize has twice the amount of amino acids, lysine and tryptophan, compared to existing hybrids and the wheat variety has increased protein content.

**Q.20. What is outbreeding? Mention any two ways it can be carried out.**

**Ans.** Outbreeding refers to the breeding of unrelated animals either of the same breed but not having common ancestors or of different breeds or even different species.

**It can be carried out by:**

i. Outcrossing

ii. Cross-breeding
iii. Interspecific hybridisation

**Q.21. Differentiate between outbreeding and outcrossing.**

**Ans.** Outbreeding is breeding of unrelated animals (having no ancestors for 4–6 generations) belonging to same breed or different breeds or different species.

Outcrossing is breeding within the animals of same breed having no common ancestors for 4–6 generation on either side of the pedigree.

**Q.22. Plant breeding technique has helped sugar industry in North India. Explain how.**

**Ans. Sugarcane**

- ***Saccharum barberi*** and ***Saccharum officinarum*** were crossed to obtain sugarcane varieties having desirable qualities.
- *S. barberi* was grown in north India, had poor sugar content and yield.
- *S. officinarum* did not grow in north India but had thicker stem and higher sugar content.
- The new sugarcane varieties formed by crossing the 2 varieties had the following qualities:
    a. high yield,
    b. thick stem,
    c. high sugar content,
    d. ability to grow in north India.

**Q.23. Write the importance of bagging of unisexual flowers in crop improvement programme.**

**Ans**. The emasculated flowers are covered with a bag of butter paper to prevent contamination of stigma with unwanted pollen. This process is called bagging. When this stigma attains receptivity, mature pollen grains are dusted on the stigma and the flowers are rebagged to allow the fruits to develop.

**Q.24. Identify 'A', 'B', 'C' and 'D' in the given table.**

| Crop | Variety | Resistance to disease |
|---|---|---|
| A | *Himgiri* | Leaf rust |
| Cauliflower | *Pusa Shubhra* | B |
| Brassica | *Pusa Swarnim* | C |
| Cowpea | D | Bacterial blight |

**Ans.**

| Crop | Variety | Resistance to disease |
|---|---|---|

| | | |
|---|---|---|
| Wheat | *Himgiri* | Leaf rust |
| Cauliflower | *Pusa Shubhra* | Black rot/Curl blight black rot |
| Brassica | *Pusa Swarnim* | White rust |
| Cowpea | *Pusa Komal* | Bacterial blight |

**Q.25.**

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.**

**OR**

**How is it possible to recover healthy banana plants from a diseased but desirable quality banana plant? Explain.**

**Ans.**

i. Totipotency is the ability of a cell to grow or generate the whole plant.
ii. Healthy banana plants can be obtained from diseased plants by meristem culture. Although the plant is virus infected, the apical and axillary meristem is free of virus. The meristem is removed from the plant and grown in vitro by micropropagation. The plants produced are virus-free.

**Q.26. How can healthy potato plants be obtained from a desired potato variety which is viral infected? Explain.**

**Ans.** Even though a plant is infected by a virus, the area meristem (apical or axillary) is free of virus. So the meristem can be removed and grown in vitro in sterile condition and special nutrient/ culture medium.

**Q.27. How does culturing *Spirulina* solve the food problems of the growing human population?**

**OR**

**"Large scale cultivation of Spirulina is highly advantageous for human population." Explain giving two reasons.**

**Ans.** Microbes are being grown on an industrial scale as source of good protein. Microbes like Spirulina can be grown easily on materials like waste water from potato processing plants (containing starch), straw, molasses, animal manure and even sewage, to produce large quantities and can serve as food rich in protein, minerals, fats

carbohydrate and vitamins. Incidentally such utilisation also reduces environmental pollution and hence is environment friendly.

**Q.28. Identify two ways in which *Spirulina* is helpful to mankind.**

**Ans.** Spirulina is a source of food rich in protein, minerals, fats, carbohydrates and vitamins. It can grow on waste water from potato processing plants, straw, molasses, animal manure and even sewage, so it also reduces water pollution.

**Q.29. "Growing Spirulina on a large scale is beneficial both environmentally and nutritionally for humans." Justify.**

**Ans.** *Spirulina* can be grown easily on materials like waste water from potato processing plants, straw, molasses, animal manure, sewage. This way it reduces environmental pollution and hence is environmentally beneficial. It serves as food rich in protein, carbohydrate, fats, vitamins and minerals. Thus, it is nutritionally beneficial too.

**Q.30. How are somaclones cultured from explants in in vitro conditions? Why are somaclones so called?**

**Ans.** A part of the plant called explant is taken for tissue culture. The explant is grown in aseptic condition in synthetic/cultural media which is rich in inorganic nutrients, vitamins, amino acids and growth regulators like cytokinin and auxin. The method of growing or producing thousands of plants through tissue culture is called micropropagation.

The plants produced from tissue culture are genetically identical to the original plant from which they are grown, so they are called somaclones.

## Short Answer Questions-I (OIQ)

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## [2 Mark]

**Q.1. Name two factors on which the yield of milk depends.**

**Ans.**

i. Quality of the breed.
ii. Type of food (fodder).

**Q.2. Keeping beehives in crop fields has several advantages. List any two.**

**Ans.**

i. Pollination management
ii. Versatile use of resources

iii. Honey production at no cost.

**Q.3. What is inbreeding and interspecific hybridisation in animals? Give an example of each.**

**Ans.** The crossing between two individuals of a species that are related by descent for 4–6 generations is called inbreeding, *e.g.*, a cross between superior cow and superior bull.

The cross between two individuals of different species of the same genus is called interspecific hybridisation, *e.g*., a mule is suitable example that is obtained by crossing between a male donkey and a female horse.

**Q.4. What is inbreeding? What is the danger of inbreeding?**

**Ans.** The mating of more closely related individuals within the same breed for 4–6 generations is called inbreeding.
It may lead to inbreeding depression, *i.e.*, the loss of fertility, vigour and productivity of the hybrid.

**Q.5. What is inbreeding depression? Why do the self-pollinated crops not show the ill effects of inbreeding depression?**

**Ans.** The continuous inbreeding may lead to reduced fertility and productivity called inbreeding depression. Self-pollinated crop does not show the ill effects of inbreeding depression because the deleterious allele becomes homozygous and exhibits their lethal effect so it is eliminated by selection.

**Q.6. Differentiate between inbreeding and heterosis. What is inbreeding depression?**

**Ans.**

| Inbreeding | Heterosis |
|---|---|
| The cross between two individuals of a species that are related by descent is called inbreeding. | The cross between two unrelated individuals or species or genus may develop an improved hybrid called heterosis. |

The loss of vigour/fertility and productivity due to continuous inbreeding especially close inbreeding is called inbreeding depression.

**Q.7. In animal husbandry, if two closely related animals are mated for a few generations, it results in loss of fertility and vigour. Why is this so?**

**Ans.**

The phenomenon being referred to is called ‘inbreeding depression’ and results in loss of fertility and vigour. This happens because the recessive alleles tend to get together and express harmful effects in the progeny.

**Q.8. Success rate of artificial insemination in cattle is fairly low. Identify any other mean to improve the successful production of hybrids. State the advantages of this technique.**

**Ans.** Multiple Ovulation Embryo Transfer (MOET) technology can be used to improve production of hybrids. This technique produces 8-10 eggs at a time and the genetic mother is only available for superovulation. By this technique, herd size can be increased in a short time.

**Q.9. How is outcrossing different from cross breeding?**

**Ans.** Outcrossing is the practice of mating animals of the same breed that have no common ancestors on either side of their pedigree up to 4-6 generations whereas cross breeding is the cross of one with superior females of another breed.

**Q.10. "Artificial insemination helps overcome several problems of normal mating". Justify the statement and list a few of them.**

**Ans.** This statement is completely justified.

i. It helps in selective breeding in animals.
ii. Semen of a single bull can be used to impregnate several females.
iii. Quality semen is available in preserved form all the time at all places.
iv. Frozen semen can be exported or imported. It is the most reliable method.

**Q.11. How can we improve the success rate of fertilisation during artificial insemination in animal husbandry programmes?**

**Ans.** The technology called MOET or Multiple Ovulation Embryo Transfer is used to increase the success rate.

**Multiple Ovulation Embryo Transfer Technology (MOET)**

- It is a programme for herd improvement in animals like cattle, sheep, rabbits, buffaloes, mares, etc.
- High milk-yielding breeds of female have been bred with high quality (lean meat with less lipid) meat-yielding bulls to increase herd size in lesser time.

**Procedure**

i. A cow is administered hormones with FSH-like activity to induce follicular maturation and super-ovulation.
ii. The cow produces 6−8 eggs instead of one egg produced normally.
iii. It is now, either mated with an elite bull or artificial insemination is carried out.
iv. When the fertilised eggs attain 8−32 cells stage, they are non-surgically removed and transferred to a surrogate mother.
v. The genetic mother can now be again super-ovulated.

**Q.12. Keeping beehives in crop fields has several advantages. List any two.**

**Ans.**

i. Pollination management
ii. Versatile use of resources
iii. Honey production at no cost

**Q.13. What is interspecific hybridisation? Give one example of a crop in which it is practiced and mention one advantage derived from it.**

**Ans.** The cross between two individuals of different species of the same genus is called interspecific hybridisation. Resistance to yellow mosaic virus in Okra (*Abelmoschus esculentus*) was transferred from a wild species and resulted in a new variety of *A. esculentus* called *Parbhani Kranti*.
One advantage is that a disease resistant variety is obtained.

**Q.14. What is single cell protein? What is the significance of such a protein?**

**Ans.** The biomass obtained from microorganisms can be treated or processed in industry to be used as food and is called single cell protein.

**Significance of single cell proteins:**

i. Its production reduces pollution as it uses organic wastes and industrial effluents.
ii. Single cell protein provides a protein-rich diet.
iii. It fulfills the demand of protein for human diet and takes off the pressure from agriculture system.

**Q.15. Name the two main categories of mutagens. Give one example of each.**

**Ans.** The two main categories of mutagens are:

i. Physical mutagens, *e.g.*, gamma rays
ii. Chemical mutagens, *e.g.*, sodium azide

**Q.16. What are induced mutation? Give one example each of physical and chemical mutagen.**

**Ans.** The mutation which occurs due to treatment by mutagens is called induced mutation.

Physical mutagen — Gamma rays
Chemical mutagen — Ethyl methane sulphonate.

**Q.17. Write the scientific names of sugarcane grown in north India and south India, respectively. Mention their characteristics.**

**Ans.** Sugarcane species grown in north India is the *Saccharum barberi*. It has low sugar content and yield. The sugarcane grown in south India is the species *Saccharum officinarum*. It failed to grow in north India but is rich in sugar content and possesses thick stem with high yield.

**Q.18. What is meant by germplasm collection? What are its benefits?**

**Ans.** The collection of all the diverse alleles of all the genes of a crop plant is called germplasm collection. It is of great benefit in plant breeding programmes as it offers the breeders the entire genes and alleles and the characteristics which they express. The breeder selects the most favourable characters of a particular gene and manipulate its transfer to a desirable parent.

**Q.19. What is micropropagation?**

Ans. Micropropagation is the production of healthy plantlet by rapid vegetative multiplication under aseptic and controlled conditions.

**Q.20. Suggest two features of plants that will prevent insect and pest infestation.**

**Ans.**

i. Increasing hair growth on aerial parts of plants.
ii. Rendering the flowers nectar less.
iii. Enabling plants to secrete insect killing chemicals (toxins).

**Q.21. Why is selection process after hybridisation very crucial in breeding programmes?**

**Ans.**

i. This step yields plants that are superior to both of parents.
ii. These plants are self pollinated to raize homozygous or purelines for breeding purpose.

**Q.22. How are evaluation and testing of new crop variety carried out?**

**Ans.** Evaluation is done by growing these plants in research fields and recording their performance under ideal fertilizer application, irrigation and other crop management practices.

**Q.23. What is the meaning of sterilisation? Why is it essential in tissue culture?**

**Ans.** Sterilisation refers to the complete killing of microorganisms so that a normal, pathogen free condition is created. Sterilisation is essential in tissue culture because it requires regeneration of plant from explants, in a test tube, under sterile conditions. So, sterilisation is prerequisite as growth of unwanted microorganisms would contaminate the nutrient media and further procedure would be difficult to carry out.

**Q.24. Following are the steps in a particular process. Name the process and fill in the steps that are given as blanks:**

Collection of germplasm

↓

_____(*a*)_____

Cross breeding/hybridisation

↓

_____(*b*)_____

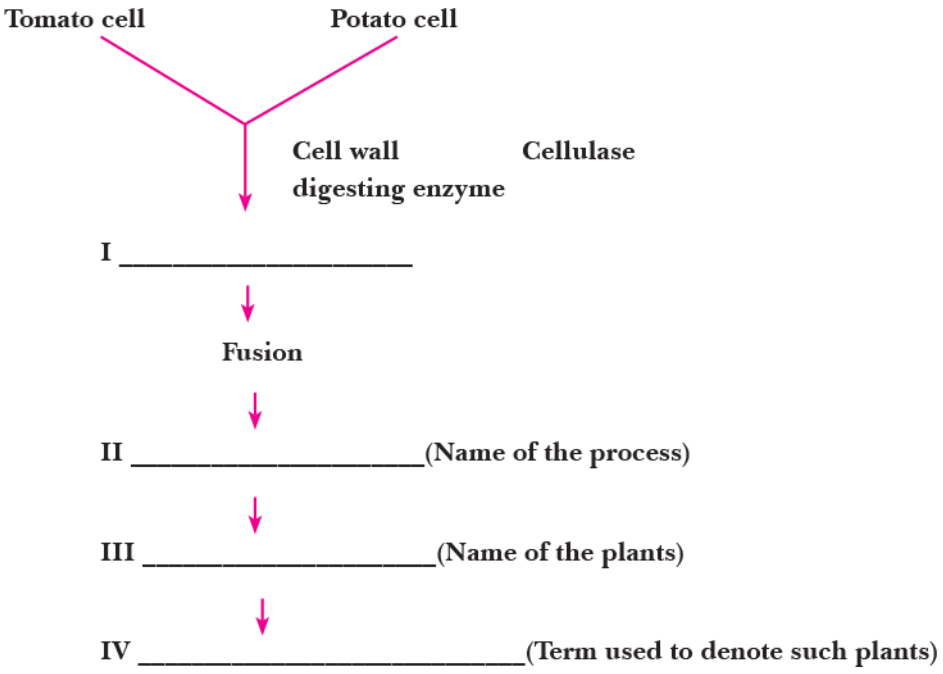
↓

**(v) Testing, release and commercialisation of the new cultivar.**

**Ans.**

a. Evaluation and selection of parents.
b. Selection and testing of superior recombinants.

**Q.25. Fill in the blanks:**




**Ans.**

I. — Protoplasts;
II. — Somatic hybridisation;
III. — Pomato;
IV. — Somatic hybrid

**Q.26. Give two examples of biofortified crops. What benefits do they offer to the society?**

**Ans.** Maize, wheat, rice, bathua, spinach, pulses have biofortified varieties. Maize hybrids have twice the amount of amino acids, fortified wheat variety has high protein content, fortified rice has high quantity of iron. Consumption of such biofortified foods will enrich the nutritive value of our common foods and will vastly improve public health. It may even help overcome several nutrient deficiency disorders latent in our country.

**Q.27. Name the improved characteristics of wheat that helped India achieve green revolution.**

**Ans.**

i. Semi-dwarf nature
ii. Quick yielding feature
iii. High yielding feature
iv. Disease resistant feature

**Q.28. Suryakant had banana plantation in his field. Quality of the fruit was excellent but the yield suffered due to infection of the plants by a virus. Suggest a fast and efficient method to get healthy and a large number of plants in the next generation without compromising on the existing quality. Justify the selection of your method.**

**Ans.** He can grow thousands of plants through tissue culture of meristem by micro-propagation. He can remove the meristem and grow it *in vitro* using tissue culture technique. Although the plant is infected with a virus, the meristem (apical and axillary) is free of viruses.

**Q.29. Demand for mushroom as food has led to its culturing on a large scale. Similarly, it is perceived that microbes too would become acceptable as food. Identify a microbe which can be cultured as a food source and give the applicability of its culture in the given context.**

**Ans.** *Spirulina* or *Methylophilus methylotrophus* can be cultured as a food source. *Spirulina* produces large quantities of food rich in protein, minerals, fats, carbohydrates and vitamins.

250 gm of *Methylophilus methylotrophus* produces 25 tonnes of protein per day. (*Any one*)

**Q.30. To reduce the percentage of population suffering from hunger and malnutrition, microbes are grown on a large scale to act as food supplements. Mention any two microbes used as food supplement and suggest their role.**

**Ans.** The two microbes used as food supplements are:

i. *Spirulina:* Produces large quantities of food rich in protein, minerals, fats, carbohydrates and vitamins.
ii. *Methylophilus methylotrophus:* 250 gm of this microorganism produces 25 tonnes of protein per day.

**Q.31. Lifestyle diseases are increasing alarmingly in India. We are also dealing with large scale malnutrition in the population. Is there any method by which we can address both these problems?**

**Ans**. The answer to address both these problems is biofortification. This looks at improving food quality with respect to protein, oil, vitamin, micro-nutrient and mineral content. The oils need to be rich in omega-3 fatty acids which are good for heart. Similarly, proteins should have more of lysine and tryptophan (essential amino acids). Many varieties of maize, carrots and spinach have been released which fulfill the above criteria.

# Short Answer Questions-II (PYQ)

## [3 Marks]

**Q.1. List any four important components of poultry farm management.**

**OR**

a. **Name any two fowls other than chicken reared in a poultry farm.**
b. **Enlist four important components of poultry farm management.**

**Ans. Four important components of poultry farm management are:**

i. Selection of disease-free and suitable breeds
ii. Proper and safe farm conditions
iii. Proper feed and water
iv. Hygiene and health care

**OR**

a. Ducks and geese.
b. Four important components of poultry farm management are:
    i. Selection of disease-free and suitable breeds
    ii. Proper and safe farm conditions
    iii. Proper feed and water
    iv. Hygiene and health care

**Q.2. Enumerate any six essentials of good, effective dairy farm management practices.**

**Ans. The following efforts need to be put in:**

i. The cattle in the dairy farm must be housed and fed properly.
ii. Cleanliness should be maintained in the milking area.
iii. The health of the dairy cattle should be of utmost importance and a veterinary doctor must visit regularly.
iv. Regular inspections of the farm, maintaining records, identification and rectification of problems should be done along with maintaining precautionary measures.
v. Milking should be done in a dirt-free area and all the sanitary conditions should be maintained.
vi. High-yielding and disease-resistant breeds can be selected to maximise benefits.

**Q.3. Explain the advantages of animal inbreeding plant programme. Mention when would inbreeding depression occur.**

**OR**

**What is inbreeding depression and how is it caused in organisms? Write any two advantages of inbreeding.**

**Ans. Animal inbreeding has the following advantages:**

i. It helps in evolving the pure lines of animals.
ii. It helps in accumulation of superior genes and elimination of less desirable genes.
iii. There is an increase in productivity in the inbred population.

Inbreeding depression stands for the inability of an organism to reproduce. It occurs due to continued inbreeding especially close inbreeding. There is reduction in fertility and productivity of the population that is inbred continuously.

**Q.4.**

**a. Explain how to overcome inbreeding depression in cattle.**
**b. List three advantages of inbreeding in cattle.**
**c. Name an improved breed of cattle.**

**Ans.**

**a.** In order to overcome the cattle from inbreeding depression, selected animals of the breeding population should be mated with unrelated superior animals of the same breed. This helps in restoring the fertility and yield in the cattle.
**b.**
   i. Pure lines can be obtained.
   ii. Harmful recessive genes are exposed that are eliminated by selection.
   iii. Superior genes can be accumulated by inbreeding by eliminating undesirable genes.
**c.** Jersey cow.

**Q.5. Mention the cause and effect of inbreeding depression in cattle. How can it be overcome? Explain.**

**Ans.** Inbreeding which refers to the mating between closely related individuals with the same breed for 4–6 generations causes inbreeding depression. Continued inbreeding, especially close inbreeding usually reduces the fertility and even productivity of the organism, this is called as inbreeding depression.

It can be overcome by mating the selected animals of breeding population with unrelated superior animals of same breed to restore fertility and yield.

**Q.6.**

a. **What is inbreeding depression?**
b. **Explain the importance of "selection" during inbreeding in cattle.**

**Ans.**

a. Continuous inbreeding, especially close inbreeding, usually reduces fertility and even productivity or yield. This phenomenon is called inbreeding depression.
b. Selection during inbreeding helps in accumulation of superior genes and elimination of less desirable genes. It increases homozygosity, pure lines, true breeding and helps to restore fertility. It also helps to increase yield or productivity. The cattle produces more milk per lactation, produces superior progeny and produces disease resistant breeds.

**Q.7. Expand MOET. Explain the procedure of this technology in cattle improvement.**

**Ans.** MOET stands for Multiple Ovulation Embryo Transfer Technology.

**Procedure:**

i. A cow is administered hormones with FSH-like activity to induce follicular maturation and super-ovulation.
ii. The cow produces 6−8 eggs instead of one egg produced normally.
iii. It is now, either mated with an elite bull or artificial insemination is carried out.
iv. When the fertilised eggs attain 8−32 cells stage, they are non-surgically removed and transferred to a surrogate mother.
v. The genetic mother can now be again super-ovulated.

**Q.8.**

a. **What is the programme called that is involved in improving success rate of production of desired hybrid and herd size of cattle?**
b. **Explain the method used for carrying this programme for cows.**

**Ans.**

a. Multiple ovulation embryo transfer method/MOET.
b. Procedure :
    i. A cow is administered hormones with FSH-like activity to induce follicular maturation and super-ovulation.
    ii. The cow produces 6−8 eggs instead of one egg produced normally.
    iii. It is now, either mated with an elite bull or artificial insemination is carried out.
    iv. When the fertilised eggs attain 8−32 cells stage, they are non-surgically removed and transferred to a surrogate mother.
    v. The genetic mother can now be again super-ovulated.

**Q.9.**

a. **Name the Indian scientist whose efforts brought 'green revolution' in India.**
b. **Mention the steps that are essentially carried out in developing a new genetic variety of crop under plant breeding programme.**

**Ans.**

a. M.S. Swaminathan brought green revolution in India.
b. The steps are:
    i. Collection of variability.
    ii. Evaluation and selection of parents.
    iii. Cross hybridisation among the selected parents.
    iv. Selection and testing of superior recombinants.
    v. Testing, release and commercialisation of new cultivars.

**Q.10. Define totipotency of a cell. List the requirements if the objective is to produce somaclones of a tomato plant on commercial scale.**

**Ans**. The capacity of a cell/explant to grow into a whole plant is called totipotency.

**Requirements:**

i. Explant: Any part of a plant taken out and grown in a test tube.
ii. Nutrient medium: It must have carbon source (sucrose), inorganic salts, growth regulators (auxins, cytokinins, etc.), vitamins and amino acids.
iii. Suitable light and temperature conditions.

**Q.11. An organic farmer relies on natural predation for controlling plant pests and diseases. Justify giving reasons why this is considered to be a holistic approach.**

**Ans.** Besides acting as 'conduits' for energy transfer across trophic levels, predators are used in biological control of plant pests. This ability of the predator is based on its regulating the prey population.

The natural predators reduce interspecific competition and does not harm the crop plants. For example, in an area the invasive cactus can be brought under control by cactus-feeding predator (a moth).

Using natural predation, the ecosystem is kept stable without harming any of the trophic levels.

**Q.12. Explain the process of artificial hybridisation to get improved crop variety in (i) plants bearing bisexual flowers (ii) female parent producing unisexual flowers.**

**Ans.**

i. In plants bearing bisexual flowers, the anthers are removed from the flower before they dehisce. This is called emasculation. The emasculated flowers are covered with a bag of butter paper to prevent contamination of stigma with unwanted pollen. This process is called bagging. When this stigma attains receptivity, mature pollen grains are dusted on the stigma and the flowers are rebagged to allow the fruits to develop.
ii. If the female parent produces unisexual flowers, there is no need of emasculation. The flower buds are bagged before the flowers open. When the stigma becomes receptive, pollen is dusted on stigma and the flower is rebagged.

**Q.13. IARI has released several varieties of crop plants that are biofortified. Give three examples of such crops and their biofortifications.**

**Ans.**

i. Bittergourd enriched in vitamin C.
ii. Carrots enriched in vitamin A.
iii. Spinach enriched in iron and calcium.

**Q.14.**

**a. Write the desirable characters a farmer looks for in his sugarcane crop.**
**b. How did plant breeding techniques help north Indian farmers to develop cane with desired characters?**

**Ans.**

a. The desirable characters for a sugarcane crop are high yield, thick stem, high sugar content and ability to grow in their areas.
b. *Saccharum barberi* had poor sugar content and yield but *Saccharum officinarum* had thicker stems and higher sugar content. By crossing *Saccharum officinarum* the south Indian variety with *Saccharum barberi* the north Indian low yield variety the farmers developed cane having desired characteristics.

**Q.15. Explain the efforts which must be put in to improve health, hygiene and milk yield of cattle in a dairy farm.**

**Ans. The following efforts need to be put in:**

i. The cattle in the dairy farm must be housed and fed properly.
ii. Cleanliness should be maintained in the milking area.
iii. The health of the dairy cattle should be of utmost importance and a veterinary doctor must visit regularly.
iv. Regular inspections of the farm, maintaining records, identification and rectification of problems should be done along with maintaining precautionary measures.

v. Milking should be done in a dirt-free area and all the sanitary conditions should be maintained.
vi. High-yielding and disease-resistant breeds can be selected to maximise benefits.

**Q.16. Differentiate between somaclones and somatic hybrids. Give one example of each.**

**Ans.**

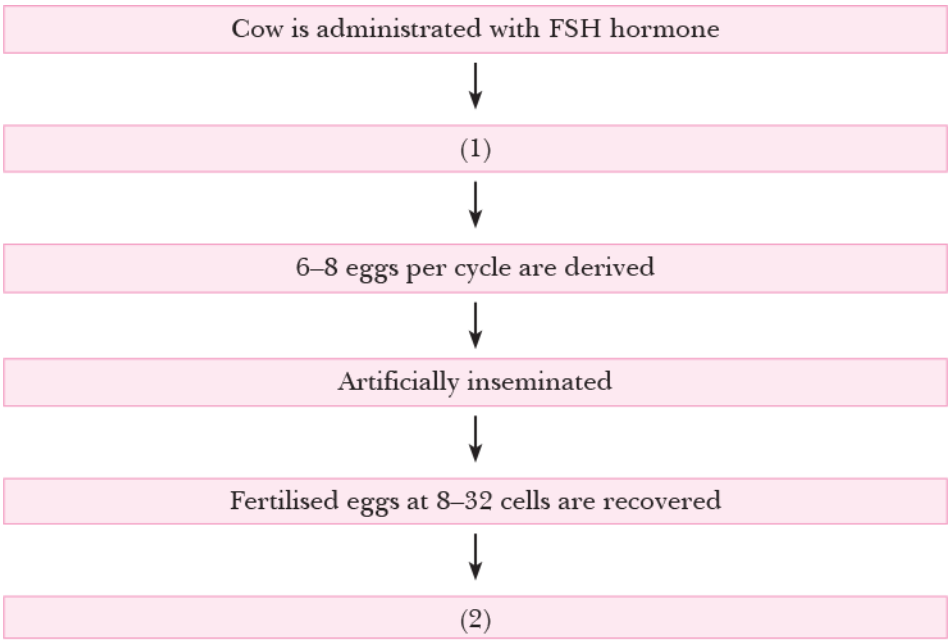
| S. No. | Somaclones | Somatic hybrids |
|---|---|---|
| (i) | These are genetically identical to the original plant from which they are grown. | These are formed by fusion of somatic cells obtained from different varieties or species of plant. |
| (ii) | These are produced by tissue culture or micropropagation. | These are produced by somatic hybridisation. |
| (iii) | **Example:** Tomato, banana, etc. | **Example:**Pomato formed by fusion of tomato and potato. |

**Q.17. Differentiate between inbreeding and outbreeeding in cattle. State one advantage and one disadvantage for each one of them.**

**Ans.**

| Inbreeding | Outbreeding |
|---|---|
| 1. It is breeding between same breeds of animals.<br>2. **Advantage:** Helps in accumulation of superior genes.<br>3. **Disadvantage:** Reduces fertility/productivity. | 1. It is breeding between different breeds of animals.<br>2. **Advantage:** Helps overcoming inbreeding depression.<br>3. **Disadvantage:** There is a possibility of introduction of undesirable characters. |

**Q.18. Study the flow chart given below:**




**Q. Identify the events that take place at stages (1) and (2) respectively.**

**Ans.** Events taking place at:
Stage (1) — Follicular maturation;
Stage (2) —Transfer to surrogate mothers

**Q. State the importance of the technology explained above.**

**Ans.** Due to this technology, high milk-yielding breeds of cows and high quality meat yielding bulls have been bred successfully to increase herd size in a short time.

**Q.19. Why is it necessary to emasculate a bisexual flower in a plant breeding programme? Mention the condition under which emasculation is not necessary.**

**Ans.** Emasculation is necessary to ensure that only the desired pollen grains are used for pollination and the stigma is protected from contamination (from unwanted self pollen). The anthers are removed followed by bagging so the plant now behaves as a female plant. The pollen grains from the anthers of the desired male plant can be dusted on the stigma of flower of the female plant to obtain desired results.

**Emasculation is not required if the plant produces unisexual flowers.**

**Q.20.**

a. Write the two limitations of traditional breeding technique that led to promotion of micro propagation.
b. Mention two advantages of micropropagation.
c. Give two examples where it is commercially adopted.

**Ans.**

a.
   i. Failed to keep pace with demand.
   ii. Failed to provide fast and efficient system of crop improvement.

b.
   i. Large number of plants can be developed in a short duration.
   ii. Production of genetically identical plants or somaclones.
   iii. Healthy plants can be recovered from diseased plants. [*Any two*]

c. Tomato, banana, apple. [*Any two*]

**Q.21. Mention the property of plant cells that has helped them to grow into a new plant in *in vitro* conditions. Explain the advantages of micropropagation.**

**Ans.** The property of plant cells that helped them to grow into a new plant is totipotency. The advantages of micropropagation are:

i. It is possible to achieve propagation of a large number of plants in very short durations. Plants like tomato, banana, apple, etc., have been produced on commercial scale.
ii. Healthy plants can be recovered from diseased plants by micropropagation. This is done by removing the meristem, which is disease-free and growing it *in vitro*. This has been done in banana, sugar cane, potato, etc.

**Q.22. How can crop varieties be made disease-resistant to overcome food crisis in India? Explain. Name one disease-resistant variety in India of:**

**a. Wheat to leaf and stripe rust.**
**b. *Brassica* to white rust.**

**Ans.** Crop varieties can be made disease-resistant by conventional breeding methods or by mutation breeding. The germplasm is screened for resistance sources or mutations are introduced, followed by hybridisation of selected parents. The resulting hybrids are evaluated and tested. Finally, disease-resistant varieties are released.

**Disease-resistant variety of:**

a. Wheat to leaf and stripe rust—*Himgiri*.
b. *Brassica* to white rust—*Pusa swarnim*.

**Q.23. Answer the following questions:**

**Q. What is micropropagation? Why are the plants produced by micropropagation called somaclones?**

**Ans.** Micropropagation is the method of growing a number of plants through tissue culture. Since tissue culture involves only mitotic divisions, the plantlets formed are genetically identical and hence are called somaclones.

**Q. Name the technique by which healthy plants can be recovered from the diseased plants.**

**Ans.** Meristem culture.

**Q.24. Answer the following questions:**

**Q. "Fortification of crops is the need of the hour." Give two reasons.**

**Ans.** Fortification of crops is needed for following reasons:

a. To improve the nutritional quality,
b. to improve public health,
c. to prevent malnutrition, (Any two)

**Q.25. Select one fresh water and one marine fish from the following:**

**Prawn; Catla; Mackerel; Lobster**

**Ans.** Fresh water : Catla

Marine fish : Mackerel.

## Short Answer Questions-II (OIQ)

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### [3 Marks]

**Q.1. What is mutation? What is its significance in the biological world? Name any two agents that induce mutation.**

**Ans.** The sudden, heritable change in genetic sequence of an individual is called mutation.

Mutation may cause development of new characters or traits which was absent in parental type. The two agents that induce mutation are gamma radiation and ethyl methane sulphonate.

**Q.2. What is mutation? List the step how mutation breeding is carried out in agricultural crop.**

**Ans.** The sudden, heritable change in genetic sequence of an individual is called mutation.

**Steps of mutation breeding in agricultural crop:**

i. Mutation is induced by chemical or physical means, for example, gamma rays.
ii. Selection of the plant for disease resistance.
iii. These plants are multiplied for breeding.
iv. The selected plants are hybridised.
v. Selection of disease resistant plants, followed by their testing and finally release of the variety.

**Q.3. Give one example of disease caused each by fungi, bacteria and viruses in crop plant.**

Ans. **Fungal disease:** Red rot of sugarcane, brown rust of wheat.
**Bacterial disease:** Citrus canker, black rot of crucifers.
**Viral disease:** Turnip mosaic, tobacco mosaic.

**Q.4. Mention '*a*' and '*b*' in the following flow chart. Why is its importance (technique shown in following flow chart) increasing?**

Habit and nature of bees
↓
Selection of location
↓
Catching and having of swarms
↓
*a*
↓
*b*

**Ans.**

a. Management of beehives.
b. Handling and collection of honey.

**Importance of apiculture is increasing because—**

i. it produces beeswax, which is used in industries for preparation of cosmetics and polishes.
ii. honey has high nutritive value and is also a key ingredient in many medicines.

**Q.5. According to Global Hunger Index, 2014, two billion people suffer from hidden hunger. Apply your knowledge of plant breeding techniques to suggest a programme to improve public health. Specify four objectives of the programme. Also, mention one example of such a produce.**

**Ans.** Biofortification can improve public health. It involves breeding crops with higher levels of vitamins and minerals, or higher protein and healthier fats.
Breeding for improved nutritional quality is improving:

i. Protein content and quality;
ii. Oil content and quality;
iii. Vitamin content; and
iv. Micronutrient and mineral content.

In the year 2000, maize hybrids that had twice the amount of the amino acids, lysine and tryptophan, compared to existing maize hybrids were developed. Another example is the wheat variety, Atlas 66, having a high protein content which has been used as a donor for improving cultivated wheat.

# Long Answer Questions (PYQ)

## [5 Marks]

**Q.1. What is "biofortification"? Write its importance. Mention the contribution of Indian Agricultural Research Institute towards it with the help of two examples.**

**Ans. Biofortification** is the method for developing crops with higher levels of vitamins, minerals, proteins and healthier fats to improve public health.
The objectives of biofortification is to improve

i. protein content and quality.
ii. oil content and quality.
iii. vitamin content.
iv. micronutrients and mineral content.

The Indian Agricultural Research Institute released several vegetable crops that are rich in vitamins and minerals. For example, vitamin A enriched carrots, vitamin C enriched bitter gourd, etc.

**Q.2. 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.**

**Ans.**

i. Collection of variability on germplasm collection. All different wild varieties, species and relatives of cultivated species are collected and preserved.
ii. Evaluation and selection of parents to identify plant with desirable combination of character. Pure lines are created.
iii. Cross hybridisation among selected parents to produce hybrids.
iv. Selection and testing of superior recombinants. Selection among the progeny of the hybrids that have desired character combinations, superior to both the parents are self pollinated for several generations.
v. Testing, release and commercialisation of new cultivars. Newly selected lines are evaluated for yield and other agronomic traits of quality or disease resistance in research fields followed by testing the material in farmers fields.

**Q.3. Answer the following questions:**

**Q. State the objective of animal breeding.**

**Ans.** Objective of animal breeding is to increase the yield of animal and improve the desirable qualities of the produce.

**Q. List the importance and limitations of inbreeding. How can the limitations be overcome?**

**Ans. Importance:**

i. Increases homozygosity
ii. Evolves pure line
iii. Expose harmful recessive genes
iv. Help in accumulation of superior genes
v. Eliminates less desirable genes.

**Limitation :**

Inbreeding reduces fertility and productivity (inbreeding depression).

The limitation can be overcomed by outbreeding or cross breeding cross breeding or outcross or interspecific hybridisation. Selected animals is to be bred with unrelated superior animals of the same breed.

**Q. Give an example of a new breed each of cattle and poultry.**

**Ans.** *Jersey*/*Hissardale*—a new breed by crossing Bikaneri ewes and Mirano rams (cattle) and Leghorn (poultry).

**Q.4. Answer the following questions:**

**Q. What is plant breeding? List the two steps the classical plant breeding involves.**

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

**The two steps for classical plant breeding are:**

i. Cross breeding or cross hybridisation of pure lines.
ii. Artificial selection to produce plants with desirable traits.

**Q. How has the mutation breeding helped in improving crop varieties? Give one example where this technique has helped.**

**Ans.** Mutation breeding is done by artificially inducing mutations using chemicals (like aniline) or radiations (like gamma radiations) and using plants that have desirable character.

In moong bean, resistance to yellow mosaic virus and powdery mildew were introduced by mutations.

**Q.5. Answer the following questions:**

**Q. Name the tropical sugarcane variety grown in South India. How has it helped in improving the sugar cane quality grown in North India?**

**Ans.** *Saccharum officinarum* is grown in South India. It was crossed with North Indian variety (*Saccharum barberi*) to combine the desirable qualities of high **yield**, thick stems high sugar and ability to grow in North India.

**Q. Identify '*a*', '*b*' and '*c*' in the following table:**

| No. | Crop | Variety | Insect Pests |
|---|---|---|---|
| 1. | *Brassica* | ***Pusa Gaurav*** | (*a*) |
| 2. | *Flat Bean* | ***Pusa Sem 2*** | (*b*) |
| | | ***Pusa Sem 3*** | |
| 3. | *(c)* | ***Pusa Sawani*** | Shoot and Fruit borer |
| | | ***Pusa A-4*** | |

**Ans.**

a. Aphids
b. Jassids/aphids/fruit borer
c. Okra (*Bhindi*).

**Q.6. Answer the following questions:**

**Q. Name the technology that has helped the scientists to propagate on large scale the desired crops in short duration. List the steps carried out to propagate the crops by the said technique.**

**Ans.** The technology that has helped the scientists to propagate on large scale the desired crops is tissue culture or micropropagation.

**The steps to propagate crops are:**

i. Obtaining an explant from a plant.
ii. Growing the explant in a test tube under sterile conditions.
iii. A special nutrient or culture medium is provided for growth.

**Q. How are somatic hybrids obtained?**

**Ans.** Isolated single cells are isolated from plants. Their cell walls are digested to obtain protoplasts. Isolated protoplasts from two different plant varieties are fused to get hybrid protoplasts.

# Long Answer Questions (OlQ)

## [5 Marks]

**Q.1. Enumerate the points that have to be considered for successful bee-keeping.**

**Ans. Bee-keeping (Apiculture)**

- The maintenance of hives of honeybees for the production of honey is termed **bee-keeping** or **apiculture.**
- Bee-keeping is practiced in any area where there is availability of sufficient bee pastures of some wild shrubs, fruit orchards and cultivated crops.
- Among several species of honeybees, one of the most common that can be reared is Apis indica.
- A successful bee-keeping requires:
  i. Knowledge of the nature and habits of bees.
  ii. Selection of a suitable location for keeping the beehives.
  iii. Catching and hiving of swarms (groups of bees).
  iv. Management of beehives during different seasons.
  v. Handling and collection of honey and beeswax.

**Ecological Importance of Bees**

- Bees are the pollinators of many crop species like sunflower, Brassica, apple and pear. So keeping beehives in crop fields during flowering period increases both crop yield and honey yield.

**Commercial Importance of Bees**

i. Honey is used as food of very high nutritive value.
ii. Honey is also used in the indigenous system of medicines.
iii. Beeswax produced by honeybees is used in industry to prepare cosmetics and polishes.

**Q.2. What is somatic hybridisation? Explain the various steps involved in the process. Mention any two uses of somatic hybridisation.**

**Ans. Somatic Hybridisation**

- The process of fusion of protoplast of somatic cells obtained from different varieties or species of plant on a suitable nutrient medium in vitro to develop a somatic hybrid is called somatic hybridisation.
- It is carried out by the following steps:
  i. Single cells from selected plants are isolated.
  ii. The cell walls of cells are digested by enzymes like pectinase and cellulase, to expose the naked protoplasts.

iii. Naked protoplasts surrounded only by plasma membranes are isolated.
iv. The isolated protoplasts are fused to obtain hybrid protoplasts under sterile conditions in special nutrient media.
v. The hybrid protoplasts are cultured in a suitable media to form new plant.

- Pomato is an example of a somatic hybrid produced by fusion of tomato and potato protoplasts.

**Uses:**

i. Somaclonal variations can be created by this method.
ii. The plant which failed to produce sexual hybrid may produce somatic hybrids.
iii. Healthy plants can be recovered from diseased plants.

**Q.3. What is meant by the following:**

**Q. Somatic hybrid**

**Ans. Somatic hybrid:** Somatic hybrid is a product obtained by the fusion of somatic cell protoplast, obtained from two different varieties or species of plants cultured on a suitable nutrient medium under sterile conditions.

**Q. Micropropagation**

**Ans. Micropropagation:** Micropropagation is the method of producing thousands of plants through tissue culture method.

**Q. Explant**

**Ans. Explant:** The part of the plant from which a new plant is generated by tissue culture is called explant.

**Q. Somaclones**

**Ans. Somaclones:** The genetically identical plants developed from any part of the plant by tissue culture or micropropagation are called somaclones.

**Q. Tissue culture**

**Ans. Tissue culture:** The technique to generate whole plant from an explant with in vitro conditions on a suitable synthetic medium is called tissue culture.

**Q.4. Differentiate between an inbred line and a hybrid variety of crop. Explain the steps involved in the production of the hybrid variety.**

Ans.

| Inbred line | Hybrid variety |
|---|---|
| The continuous inbreeding in a cross-pollinated crop develops a homozygous line called inbred line. | A hybrid variety is produced by crossing two different species where progeny obtained is used for raising the next seasonal crop. |

**Steps involved in hybrid variety production:**

i. The continuous inbreeding is maintained to obtain an inbred line.
ii. A series of tests are done to evaluate the inbred.
iii. $F_1$ seeds are produced in large scale to distribute among farmers to check for subsequent generations.

**Q.5. Answer the following questions:**

**Q. What is protoplast?**

**Ans.** The plant cell without the cell wall is called protoplast.

**Q. Name the two enzymes used in producing protoplasts.**

**Ans.** Pectinase and cellulase.

**Q. Describe the steps in producing somatic hybrids from protoplast.**

**Ans.** It is carried out by the following steps:

i. Single cells from selected plants are isolated.
ii. The cell walls of cells are digested by enzymes like pectinase and cellulase, to expose the naked protoplasts.
iii. Naked protoplasts surrounded only by plasma membranes are isolated.
iv. The isolated protoplasts are fused to obtain hybrid protoplasts under sterile conditions in special nutrient media.
v. The hybrid protoplasts are cultured in a suitable media to form new plant.

**Q. Mention the usefulness of somatic hybridisation.**

**Ans. Uses are:**

a. Somaclonal variations can be created by this method.
b. The plant which failed to produce sexual hybrid may produce somatic hybrids.
c. Healthy plants can be recovered from diseased plants.