# CHAPTER > 09

# Strategies for Enhancement in Food Production



# Animal Husbandry

- It is the agricultural practice of breeding and raising livestock like buffaloes, cows, pigs, horses, cattle, sheep, camel, goat, etc.
- It includes poultry farming and fisheries.
- Fisheries include rearing, catching, selling, of fish, molluscs (shell-fish) and crustaceans (prawns, crabs, etc).
- More than 70% of worlds livestock population is in India and China. However, its contribution to the world farm produce is only 25%.

### Management of Farms and Farm Animals

Practices employed to enhance food production from animals targeted **management of farm** and **farm animals** such as dairy farm management and poultry farm management.

#### **Dairy Farm Management**

- Dairying is the management of animals for its milk and its product for human consumption. In dairy farm management, we deal with processes and systems that increase yield and improve quality of milk.
- Selection of good breeds having high yielding potential, combined with resistance to diseases is very important.
- Cattles have to be housed well, should have proper water and be maintained disease free.
- The feeding of cattle should be carried out in a scientific manner (quality and quantity of fodder).

- Strict cleanliness and hygiene are important while milking, storage and transport of the milk and its products.
- Regulator inspections for stringent up keep and proper record maintenance.
- Regular visits by a doctor would be mandatory.

#### **Poultry Farm Management**

- Poultry is the class of domesticated fowl (birds) used for food or their eggs.
- It mainly includes chicken and ducks and sometimes turkey and geese.
- Important components of poultry farm management include
  - Selection of disease free and suitable breeds
  - Proper and safe farm condition
  - Proper feed and water
  - Hygiene and healthcare
- A viral infection affecting poultry birds is bird flu. It is caused by infection with bird flu virus or H<sub>5</sub>N<sub>1</sub> virus. It is deadly to birds and can easily affect humans through consumption of their products (eggs, meat, etc) and other animals that come in contact with a carrier.

### **Animal Breeding**

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

• There are two kinds of breeding, i.e. **inbreeding** (breeding between same breeds) or **outbreeding** (breeding between different breeds).

Inbreeding	Outbreeding
Method of mating of more closely related individuals within the same breed, i.e. superior males and superior females of the same breed for 4-6 generations.	Method of mating of unrelated animals for 4-6 generations. It is of three types, i.e. outcrossing, cross-breeding and interspecific hybridisation.
Advantages It increases homozygosity, so it is used for developing purelines. It exposes harmful recessive genes that are eleminated by selection. It also helps in accumulation of superior genes and elimination of less desirable genes.	<b>Advantages</b> It produces hybrids with desirable characters of both the parents like better lactation period and high milk productions.

- Continued inbreeding reduces fertility and even productivity. This is called **inbreeding depression**. Whenever this becomes a problem. Selected animals of the breeding population should be mated with unrelated superior animals of the same breed. This usually helps to restore fertility and yield.
- **Outcrossing** is the mating of animals within same breed but having no common ancestors up to 4-6 generations. The offspring are called outcross. This method helps in increasing the milk production, growth rate in beef cattle etc.
- **Cross-breeding** is the mating of superior male of one breed with the superior female of another breed. The progeny formed by this, may themselves be used for the commercial production or alternatively used to develop new superior breeds.
- By this technique, **Hisardale** (a new breed of sheep) developed in Punjab by crossing **Bikaneri ewes** and **Marino rams**.
- **Interspecific hybridisation** is the mating of male and female animals of two different related species. The progeny may be of considerable economic value, e.g. mule.
- To improve the chances of successful production of hybrids, controlled breeding methods such as **MOET** (Multiple Ovulation Embryo Transfer) **technique** and **artificial insemination** are applied. These methods have given better results than the conventional selective hybridisation.
- In **artificial insemination**, the semen is collected from the male and injected into the reproductive tract of the selected female. In this way, desirable matings are carried and it helps us to overcome several problems of normal matings.
- In MOET, cow is administered with FSH hormone, to induce follicular maturation and superovulation and instead of 1, they produce 6-8 eggs. After mating, all these fertilised eggs at 8-32 cell stage are collected and transferred to surrogate mothers.

• The genetic mother becomes available for another round of superovulation. High milk-yielding breeds of females and high quality (lean meat with less lipid) meat- yielding bulls have been bred successfully this technique to increases a herd size in short time.

## **Bee-keeping**

- A remarkable growth in the practice of **bee-keeping** or **apiculture** has been observed as it is a old cottage industry requiring less manpower and management skills. Also,demand for its products **honey** (high nutritive value and indigenous medicine) and **beeswax** (used in the preparation of cosmetics and polishes) has increased significantly.
- Bee-keeping can be practiced in any area where sufficient pasture is available. The most common species of honybee is *Apis indica*.
- Few points are important for successful bee-keeping like-knowledge of the nature and habits of bees, selection of suitable location for beehives, catching and hiving of swarms, management of beehives during different seasons and proper handling and collection of honey and beeswax.

## **Fisheries**

- Fishery is another flourishing industry meeting the ever-increasing demand for fish, fish products and other aquatic foods. It includes catching, processing and marketing of fishes.
- Freshwater fishes which are very common include catla, rohu and common carp.
- Common marine fishes are hilsa, sardines, mackerel and pomfrets and selling of fish, shellfish and other aquatic animals.
- This industry provides employment to millions of fisherman and farmers particularly in the coastal states.
- Different techniques have been applied to increase the production of aquatic plants and animals such as **aquaculture** and **pisciculture**.
- **Blue revolution** is implemented to increase fish production.

# **Plant Breeding**

- India's economy is based on agriculture and nearly 62% of the population is employed in this sector at various levels. As only limited land is fit for cultivation, India has to strive to increase yields per unit area from existing farm lands.
- Plant breeding techniques led to a dramatic increase in food production in 1960. This is often referred to as the **green revolution.**



## What is Plant Breeding?

- **Plant breeding** involves purposeful manipulation of plant species used to create varieties, which have increased crop yield, improved quality, increased tolerance to environmental stresses (extreme temperatures, salinity, drought), resistant to **pathogens** and to **insect pests**. Eventually, achieving the goal of increase in the yield of the food.
- Plant breeding programmes are carried out in a systematic way. The main steps in plant breeding are
  - 1. **Collection of variability** is the collection and preservation of all the different wild varieties, species and relatives of the cultivated species. The entire collection of plants or seeds having all the diverse alleles for all genes in a given crop is called **germplasm collection**.
  - 2. Evaluation and selection of parents is the identification of plants with desirable characteristics. The selected plants are multiplied and used in hybridisation process.
  - 3. Cross hybridisation among the selected parents to obtain desired crop characters, e.g. high protein quality of one parent combined with disease resistance from another parent. This is possible by cross hybidising the two parents to produce hybrids that have genetically combined characters in one plant.
  - 4. Selection and testing of superior recombinants is the selection of the plant having desired character combination. This step requires scientific evaluation of the progeny and yield plants that are superior to both of the parents. These are self- pollinated for several generations till they become uniform or homozyous.
  - 5. **Testing, release and commercialisation of new cultivars** The newly selected lines are evaluated for their yield and other agronomic traits (of quality, disease resistance, etc.) by
- growing these in the research fields and
- recording their performance under ideal fertiliser application, irrigation and other crop management practices.
  - Final step involves testing the generated varieties in farmer's fields, for at least three growing seasons, at several locations in the country, representing all the agroclimatic zones, where the crop is usually grown.
- Hybrid varieties of crop plants, developed in India are
  - Wheat Varieties such as Sonalika and Kalyan Sona are high yielding and disease resistant. These were derived from semidwarf variety developed by Nobel laureate Norman E Borlaug, at International Centre for Wheat and Maize Improvement (CIMMYT) in Mexico.
  - Rice Semidwarf rice varieties were derived from IR-8 [developed at International Rice Research Institute (IRRI), Philippines] and Taichung Native-1 (from Taiwan). Jaya and Ratna were developed in India.

 Sugarcane Saccharum barberi of North India had poor sugar content and yield. Tropical canes grown in South India Saccharum officinarum had thicker stems and higher sugar content but did not grow well in North India.

These two species were crossed to get sugarcane varieties with high yield, thick stems, high sugar content and ability to grow in North India.

 Millets Hybrid varieties of maize, jowar and bajra that are high yielding and resistant to water stress have been developed in India.

### Plant Breeding for Disease Resistance

- Fungal, bacterial and viral infections in cultivated crop species reduce the crop yield up to 20-30%, especially in tropical climates.
- To reduce infections and to cut down the use of fungicides and bactericides, disease resistant varieties need to be developed.
- Resistance of the host plant is the ability to prevent the pathogen from causing disease and is determined by the genetic constitution of the host plant.

Some of the diseases caused by various pathogens are

- **Fungi** Brown rust of wheat, red rot of sugarcane and late blight of potato.
- Bacteria Black rot of crucifers.
- Viruses Tobacco mosaic, turnip mosaic, etc.

#### Methods of Breeding for Disease Resistance

- **Conventional breeding** The steps are
  - Screening germplasm for resistance sources.
  - Hybridisation of selected parents.
  - Selection and evaluation of the hybrids.
    - Testing and release of new varieties.

#### Some Important Varieties Developed by Conventional Breeding

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



- **Mutation breeding** is the process of breeding by artificially inducing mutations using chemicals or radiations (gamma radiations).
- Mutation is the process by which base sequence within genes changes, resulting in the creation of a new character or trait not found in the parent plant, e.g.
  - In mung bean, resistance to yellow mosaic virus and powdery mildew were induced by mutations.
  - In **bhindi** (*Abelmoschus esculentus*), resistance to yellow mosaic virus was transferred from a wild species to the crop species by sexual hybridisation and a new variety of *A. esculentus* called Parbhani kranti was produced.

### Plant Breeding for Developing Resistance to Insect Pests

- Insect and pest infestations are another major cause for large scale destruction of crop plant and crop production.
   Insect resistance in host crop plants may be due to morphological, biochemical or physiological characteristics.
  - Morphological pest deterrents Hairy leaves in several plants are associated with resistance to insect pests, e.g. resistance to jassids in cotton and cereal leaf beetle in wheat. Solid stems in wheat, is not preferred by the stem sawfly, smooth leaved and nectar less cotton varieties do not attract bollworms.
  - Biochemical pest deterrents High aspartic acid, low nitrogen and sugar content in maize leads to resistance to maize stem borers. Breeding methods for insect pest resistance are same as for disease resistance. Sources of resistance genes may be cultivated varieties, germplasm collections of the crop or wild relatives.

#### Some Crop Varieties Breed by Hybridisation and Selection, for Insect Pest Resistance

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

## Plant Breeding For Improved Food Quality

- More than 840 million peoples in the world do not have adequate food to meet their nutritional and daily food requirements and about these billion people suffer from micronutrient, protein and vitamin deficiencies, i.e. hidden hunger.
- **Biofortification** is the method of breeding crops with higher levels of vitamins, minerals and healthier fats to improve public healths.



- The objective of breeding for improved nutritional quality is to improve
  - protein and oil content and quality
  - vitamin content.
  - micronutrients and mineral content.
- By using biofortification technique, we had developed
  - Maize hybrids with twice the amount of the amino acids, lysine and tryptophan, compared to existing maize hybrids.
  - Wheat variety, Atlas 66, having a high protein content.
  - An iron-fortified rice variety with five times higher iron content than in commonly consumed varieties.
  - Vitamin-A enriched carrots, spinach, pumpkin.
  - Vitamin-C enriched bitter gourd, bathua, mustard, tomato.
  - Iron and calcium enriched spinach and bathua.
  - Protein enriched beans broad, lablab, French and garden peas.
     The Indian Agricultural Research Institute, New

Delhi has released above mentioned vegetable crops rich in vitamins and minerals.

# Single Cell Protein (SCP)

- It refers to the source of mixed proteins extracted from pure or mixed culture of organisms or cells. It acts as a supplement or alternative source of protein that is not supplied by the traditional of conventional agriculture production.
- Several microbes have also been used as source of good proteins. Microbes like *Spirulina* and *Methylophilus methylotrophus* are being grown on an industrial scale on materials like waste water from potato processing plants (containing starch), straw, molasses, animal manure and even sewage.

#### Advantages of SCP

- Using waste as nutrient medium reduces environmental pollution.
- Because of their high rate of biomass production and growth, microbes can produce much bigger amount of protein than the larger animals, e.g. 250 gm of *Methylophilus methylotrophus* produces 25 tonnes of proteins.

# Tissue Culture

- As traditional breeding techniques were slow new technology called **tissue culture** was developed as a fast and efficient systems for crop improvement.
- Plants have a special property called **totipotency** which is the capacity to generate a whole plant from any cell.

- Plants can be regenerated in lab from **explants**, i.e. any part of a plant taken out and grown in a test tube, under sterile conditions in special nutrient media.
- The nutrient medium must provide, a carbon source such as sucrose, inorganic salts, vitamins, amino acids and growth regulators like auxins and cytokinins.
- Micropropagation is the method of producing thousands of plants through tissue culture.
   Each of these plants will be genetically identical to the original plant from which they were grown, i.e. they are somaclones.

Many important food plants like tomato, banana, apple, etc., have been produced on commercial scale using this method.

- Another application of tissue culture method is the recovery of healthy plants from diseased plants. Even when the plant is infected with a virus, the **meristem** (apical and axillary) remains infection free; it can be removed, grown *in vitro* to obtain virus-free plants. Meristems of banana, sugarcane, potato, etc., have been isolated.
- **Somatic hybridisation** is the process of *in vitro* fusion of protoplasts of somatic cells obtained from different varieties or species of plants on a suitable nutrient medium to develop a hybrid. In this process, first the cell wall of plant cells are removed.

The protoplasts of these cells are allowed of fuse in the presence of PEG. Later, the fused protoplasts develop thin own walls and are called as **somatic hybrids**, e.g. pomato.



# **TOPIC 1** ~ Animal Husbandry, Management of Farms and Farm Animals

- **1** ..... is the agricultural practice of feeding, breeding and raising livestock. Choose the most appropriate word to fill in the blank.
  - (a) Animal husbandry
  - (b) Cattle improvement
  - (c) Both (a) and (b)  $\left(a\right)$
  - (d) Cattle farming
- 2 Animal husbandry includes
  - (a) fisheries (b) poultry farming
  - (c) dairying (d) All of these
- **3** Crustacean fishery is connected with exploitation of
  - (a) oysters and crabs
  - (b) mussels and squids
  - (c) shell and cuttle fish
  - (d) crabs and prawn
- **4** Livestock refers to
  - (a) pet animals
  - (b) poultry and pet animals
  - (c) domestic animals which are kept for use or profit
  - (d) None of the above
- **5** The practices concerned with the improvement in animal husbandry include
  - (a) management of farm and farm animals
  - (b) management of animals and plants at a same place
  - (c) genetic engineering
  - (d) None of the above

- **6** The management of animals for milk and its products for human consumption is called
  - (a) dairy farming (b) poultry farming
  - (c) white revolution (d) livestock improvement
- **7** In dairy farm management
  - (a) livestock improvement is done
  - (b) milk yield and quality is improved
  - (c) regular inspection of animals
  - (d) All of the above
- **8** Choose the correct option.
  - (a) More than 70% of the world livestock population is in India and China
  - (b) The contribution of India and china to the world farm produce is about 25%
  - (c) Important livestock of India are cattle and buffaloes
  - (d) All of the above
- **9** Which of the following qualities is considered for the selection of good breeds?
  - (a) High yielding potential (b) Resistance to diseases
  - (c) Breed with pureline (d) Both (a) and (b)
- **10** What measures should be taken for cattles, to realise the yield potential?
  - (a) They have to be housed well
  - (b) Feeding should be in scientific manner
  - (c) Hygienic milking, storage and transport of milk
  - (d) All of the above

- **11** Which of the following birds are domesticated in poultry farm management?
  - (a) Chicken (b) Ducks
  - (c) Turkey and geese (d) All of these
- **12** Which of the following points should be kept into consideration for management of poultry farm? A. Selection of disease free and suitable breeds
  - B. Proper and safe farm conditions

  - C. Proper feed and water
  - D. Hygiene and healthcare (a) A,B,C (b) A,C,D (d) None of these
  - (c) A,B,C,D
- **13** Bird flu is a ..... disease.
  - (a) viral (b) bacterial (c) fungal
    - (d) algal



Identify improved breed shown in diagram.

- (a) A-Jersey, B-Leghorn (b) A-Surti, B-Sangamneri
- (c) A-Marwari, B-Sirohi (d) A-Beetal, B-Jamunapari
- **15** An infectious bacterial disease of cattle, buffaloes, sheeps and goats is
  - (a) anthrax (b) rinderpest (c) tick fever
    - (d) necrosis

# **TOPIC 2** ~ Animal Breeding, Bee-keeping and Fisheries

- **16** Which of the following is an aim of animal breeding?
  - (a) Increasing the yield of animals
  - (b) Improving the desirable qualities of the produce
  - (c) Producing better looking animals
  - (d) Both (a) and (b)
- **17** The term 'breed' refers to
  - (a) a group of animals not related by descent but similar in most characteristics
  - (b) a group of animals related by descent and similar in most characteristics
  - (c) a group of animals related by descent but have almost different characteristics
  - (d) a group of animals neither related by descent nor have similar characteristics
- **18** The term 'inbreeding' refers to
  - (a) mating of more closely related individuals within the same breed for 4-6 generations
  - (b) mating of unrelated animals of the same breed
  - (c) mating of animals within the same breed, but having no common ancestors up to 4-6 generations
  - (d) superior males of one breed are mated with superior females of another breed
- **19** A superior female, in the case of cattle is the ...A... that produces more milk per lactation. On the other hand, a superior male is the  $\dots B \dots$ , which gives rise to ... C... as compared to those of other males. Here, A to C refers to
  - (a) A-cow, B-bull, C-superior progeny
  - (b) A-buffalo, B-bull, C-inferior progeny
  - (c) A-cow, B-bull, C-inferior progeny
  - (d) A-cow, B-bull, C-normal progeny

- **20** Continued inbreeding
  - (a) reduces fertility
  - (b) reduces productivity
  - (c) causes inbreeding depression
  - (d) All of the above
- **21** Homozygous purelines in cattle can be obtained by

#### **NEET 2017**

- (a) mating of related individuals of same breed
- (b) mating of unrelated individuals of same breed
- (c) mating of indviduals of different breed
- (d) mating of individuals of different species
- **22** Suggest a way to overcome inbreeding depression. (a) Selected animals should be mated with related superior animals of different breed
  - (b) Selected animals should be mated with unrelated superior animals of same breed
  - (c) Selected animals should be mated with related superior animals of same breed
  - (d) Selected animals should be mated with unrelated superior animals of different breed
- **23** Outbreeding is an important strategy of animal husbandry because it **CBSE-AIPMT 2015** (a) helps in accumulation of superior genes
  - (b) is useful in producing purelines of animals
  - (c) is useful in overcoming inbreeding depression
  - (d) exposes harmful recessive genes that are eliminated by selection
- **24** When breeding is between the unrelated animals, including individuals of the same breed but having no common ancestors for 4-6 generations or between different breeds or different species, is called
  - (a) outbreeding (b) inbreeding
  - (c) controlled breeding (d) hybridisation

- **25** Hissardale is a new breed of ...A... developed in Punjab by crossing ...B... and ...C.... Here A to C refers to
  - (a) A-sheep, B-Bikaneri ewes, C-Marino rams
  - (b) A-chicken, B-Dorking, C-Sussex
  - (c) A-chicken, B-Leghorn, C-Plymouth rock
  - (d) A-cow, B-Jersey, C-Brown Swiss

# **26** Interspecific hybridisation is the mating of **NEET 2016**

- (a) animals within same breed without having common ancestors
- (b) two different related species
- (c) superior males and females of different breeds
- (d) more closely related individuals within same breed for 4-6 generations
- **27** A mule is produced by
  - (a) cross-breeding
  - (b) outcrossing
  - (c) inbreeding
  - (d) interspecific hybridisation
- 28 Controlled breeding experiments are carried out using (a) interspecific hybridisation
  - (b) artificial insemination
  - (c) outcrossing
  - (d) intraspecific hybridisation
- **29** MOET stands for
  - (a) Multiple Ovulation Embryo Transfer technology
  - (b) Multiple Ovary and Embryo Transfer technology
  - (c) Multiple Ovulation Embryo Test technology
  - (d) Method of Egg Transfer
- **30** In MOET procedure, to induce follicular maturation and superovulation which of the following hormones are administered to the cow?
  - (a) Follicle stimulating hormone
  - (b) Progesterone
  - (c) Androgen
  - (d) Oxytocin
- **31** During MOET at which of the following stages, embryo is transferred to surrogate mothers
  - (a) Unfertilised ovules
  - (b) 2-celled stage
  - (c) Fertilised egg
  - (d) 8-32 celled stage
- **32** In which of the following techniques high milk giving breeds of females and high quality meat giving bulls have been bred successfully to increase herd size short time?
  - (a) MOET
  - (b) Artificial insemination
  - (c) Interspecific hybridisation
  - (d) Induced mutation

- **33** Fill up the blanks.
  - I. .....A .....refers to the cross of superior males of one breed with superior females of another breed.
  - II.  $\dots B \dots B$  is a method of controlled breeding in which semen from the selected male parent is injected into the reproductive tract of the selected female parent.
  - III. ..... *C* ..... refers to crossing between male and female animals of two different species.
  - IV. ..... *D* ..... is a programme for herd improvement in animals like cattle, sheep, buffaloes, etc.

	Α	В	С	D
(a)	MOET	Interspecific hybridisation	Artificial insemination	Cross-breeding
(b)	Cross-breeding	Artificial insemination	Interspecific hybridisation	MOET
(c)	Artificial insemination	MOET	Cross-breeding	Interspecific hybridisation
(d)	Interspecific hvbridisation	Artificial insemination	MOET	Cross-breeding

- **34** Rearing of honeybees for obtaining honey and beeswax is called
  - (a) pisciculture(b) sericulture(c) apiculture(d) aquaculture
- **35** Most common honeybee species in India
  - (a) *Apis indica* (b) *Apis florea*
  - (c) Apis mellifera (d) Apis dorsata
- **36** Which of the following given point is important for successful bee-keeping?
  - (a) Knowledge of the nature and habits of bees
  - (b) Selection of suitable location for keeping the beehives
  - (c) Catching and hiving of swarms (group of bees) and their management during different seasons
  - (d) All of the above
- **37** Keeping beehives in crop field during flowering period
  - (a) improve honey and wax yield
  - (b) improves crop yield
  - (c) pollination efficiency
  - (d) All of the above
- **38** Name the industry that includes catching, processing or selling of aquatic animals.
  - (a) Fisheries (b) Apiculture
  - (c) Sericulture (d) None of these
- **39** Which of the following is not a freshwater fishes?
  - (a) catla (b) rohu
  - (c) common carp (d) mackerel

- **40** Edible fishes found in marine water habitat is/are
  - (a) sardines
  - (b) pomfrets
  - (c) Hilsa
  - (d) All of the above
- 41 Among the following edible fishes, which one is a marine fish having rich source of omega-3 fatty acids? NEET 2016

   (a) Mystus
  - (b) Magur
  - (c) Mrigala
  - (d) Mackerel

- **42** Which of the following activities has contributed towards increased production of aquatic organisms?
  - (a) Pisciculture and sericulture
  - (b) Pisciculture and aquaculture
  - (c) Pisciculture and blue revolution
  - (d) Blue and green revolution
- 43 The byproducts obtained from fisheries are
  - (a) isinglass, oil, shagreen and fishmeal
  - (b) eggs, meat, oil and leather
  - (c) isinglass and eggs
  - (d) None of the above

# **TOPIC 3**~ Plant Breeding and Single Cell Protein

- 44 Green revolution in India was possible due to
  - (a) exploitation of high yielding varieties
  - (b) intensive cultivation
  - (c) better irrigation, fertilisers and pesticide facilities
  - (d) All of the above
- **45** Green revolution depended mainly on plant breeding techniques for high yielding and disease resistant varieties in
  - (a) wheat (b) rice (c) maize (d) All of these
- **46** ..... is the purposeful manipulation of plant species in order to create plant types that are better suited for cultivation, give better yield and are disease resistant. Fill up the blanks.
  - (a) Aquaculture
  - (b) Plant breeding
  - (c) Animal husbandry
  - (d) Apiculture
- **47** Following are the steps to produce a new genetic variety of crop.

Collection of germplasm.

Cross-breeding/Hybridisation  

$$\downarrow$$
  
 $B$   
 $\downarrow$ 

Testing, release and commercialisation of the new cultivars

Choose appropriate option for A and B.

- (a) A-Selection of parents; B-Testing of superior recombinants
- (b) A-Evaluation of parents; B-Selection of superior recombinants

- (c) A-Testing of parents; B-Selection of superior recombinants
- (d) A-Evaluation and selection of parents; B-Selection and testing of superior recombinants
- **48** Which of the following is considered as the root of any breeding programme?
  - (a) Genetic variability
  - (b) Cross hybridisation
  - (c) Hybrid vigour
  - (d) Heterosis
- **49** In plant breeding programmes, the entire collection (of plants/seeds) having all the diverse alleles for all genes in a given crop is called **NEET 2013** 
  - (a) selection of superior recombinants
  - (b) cross-hybridisation among the selected parents
  - (c) evaluation and selection of parents
  - (d) germplasm collection
- **50** Which of the following is the main aim of evaluation of germplasm in plant breeding programme?
  - (a) To identify plants with desirable combination of characters
  - (b) For effective exploitation of the natural genes
  - (c) To look for harmful mutated gene
  - (d) For collection of variability
- **51** In case of plant breeding, cross hybridisation is a time consuming and tedious process because
  - (a) pre-existing genetic variability is collected from wild varieties, species and relatives of the cultivated crop species
  - (b) it involves the selection of plants among the progeny of the hybrids with desired combination of characters
  - (c) it involves emasculation and bagging techniques to transfer desired pollen grains to the stigma of desired plant
  - (d) None of the above

- **52** During selection and testing of superior recombinants, selected superior plants are self-pollinated for several generation. Why?
  - (a) So that they reach a state of uniformity (homozygosity)
  - (b) So that the characters will not segregate in the progeny
  - (c) Both (a) and (b)
  - (d) Selected superior plants are not self-pollinated but cross-pollinated
- **53** After India independence, one of the main challenges facing the country was
  - (a) improving science and technology
  - (b) producing enough food for increasing population
  - (c) production of disease resistance varieties of crops
  - (d) Both (b) and (c)  $\left( c \right)$
- **54** Semidwarf variety of wheat was developed by
  - (a) Norman E Borlaug (b) MS Swaminathan
  - (c) WY Cheung (d) Fontana
- 55 Semidwarf variety of wheat was developed at
  - (a) International Centre for Wheat and Maize Improvement Brazil
  - (b) International Centre for Wheat and Maize Improvement Mexico
  - (c) International Centre for Wheat and Rice Improvement Japan
  - (d) International Centre for Wheat and Gram Improvement Mexico
- **56** Example of high yielding and disease resistant wheat variety is
  - (a) Sonalika (b) IR-8 (c) Ratna (d) Jaya
- **57** Semidwarf varieties of rice were derived from
  - (a) IR-8 and Taichung Native-I
  - (b) Atlas 66
  - (c) Kalyan Sona
  - (d) Jaya and Ratna
- **58** International Rice Research Institute (IRRI) is situated at
  - (a) New York (USA) (b) Tokyo (Japan)
  - (c) Manilla (Philippines) (d) Hyderabad (India)
- 59 Where Taichung Native-1 was developed?(a) Taraiva(b) Tokyo(c) Tallinn(d) Taiwan
- **60** Jaya and Ratna are varieties of (a) maize (b) wheat (c) rice (d) millet
- **61** *Saccharum barberi* and *Saccharum officinarum* are varieties of
  - (a) sugarcane (b) maize (c) wheat (d) rice
- **62** The sugarcane growing in North India and having a poor sugar content and yield is
  - (a) *Saccharum officinarum*
  - (b) Saccharum barberi
  - (c) Both (a) and (b)
  - (d) None of the above

- **63** Saccharum officinarum variety of sugarcane had
  - (a) thin stems and higher sugar content
  - (b) thick stems and higher sugar content
  - (c) thick stems and poor sugar content
  - (d) thin stems and poor sugar content
- **64** The genetic ability of a plant to prevent pathogens from causing disease is called
  - (a) resistance (b) prevention
  - (c) pathology (d) None of these
- **65** Which one of the following is a bacterial disease?
  - (a) Tobacco mosaic
  - (b) Turnip mosaic
  - (c) Black rot of crucifer
  - (d) Late blight of potato
- 66 Hairy root disease of dicot plants is caused by

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- (a) Agrobacterium tumefaciens
- (b) Agrobacterium rhizogene
- (c) Bacillus thuringiensis
- (d) Meloidogyne incognita
- **67** Method(s) of breeding plants for acquiring disease resistance is/are
  - (a) conventional breeding techniques
  - (b) mutation breeding
  - (c) tissue culture
  - (d) Both (a) and (b)
- **68** The conventional method of breeding for disease resistance includes
  - (a) screening of germplasm for resistant sources.
  - (b) hybridisation of selected parents.
  - (c) induction of mutation.
  - (d) Both (a) and (b)
- **69** Himgiri developed by hybridisation and selection for disease resistance against rust pathogens is a variety of
  - (a) chilli(b) maize(c) sugarcane(d) wheat
- **70** Some crop varieties bred by hybridisation and selection for disease resistance to fungi, bacteria and viral disease are shown below. Fill up the blanks *A* to *D*.

Crop	Variety	Resistance to diseases
A	Himgiri	Leaf and stripe rust, hill bunt
Brassica	Pusa Swarnim (Karan rai)	В
Cauliflower	Pusa Shubhra, Pusa Snowball K-1	Black rot and curl blight black rot
Cowpea	С	Bacterial blight
Chilli	D	Chilli mosaic virus, tobacco mosaic virus and leaf curl

- (a) A-Wheat, B-White rust, C-Pusa Komal, D-Pusa Sadabahar
- (b) A-Pusa Sadabahar, B-Black rust, C-Pusa Komal, D-Wheat
- (c) A-Rice, B-White rust, C-Pusa Karan, D-Wheat
- (d) A-Maize, B-Brown rust, C-Pusa Karan, D-Millet
- **71** *Triticale* is the first man-made cereal crop.
  - Mention the type of hybridisation through which it was produced **AIIMS 2018**
  - (a) intervarietal hybridisation
  - (b) interspecific hybridisation
  - (c) intergeneric hybridisation
  - (d) intravarietal hybridisation
- **72** Consider the following measures that could be taken to successfully grow chickpea in an area where bacterial blight is common. **AIIMS 2018** (a) Spray with bordeaux mixture
  - (b) Use of disease-free seeds only
  - (c) Use of varieties resistant to the disease
  - (d) All of the above
- **73** The process by which genetic variations are created through changes in the base sequences within genes is (a) plant breeding (b) interspecific hybridisation
  - (c) outcrossing (d) mutation
- **74** The process of breeding by artificially inducing mutations with chemicals or radiations is called (a) artificial breeding (b) chemical breeding (c) synthetic breeding (d) mutation breeding
- **75** In mutation breeding, mutations are induced by using radiation like

(a)	Gamma rays	(b)	X-rays
(c)	UV-rays	(d)	All of these

76 In mung bean, resistance to yellow mosaic virus and powdery mildew were brought about by

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- (a) mutation breeding
- (b) biofortification
- (c) tissue culture
- (d) hybridisation and selection
- **77** Resistance to yellow mosaic virus in bhindi was transferred from a wild species and resulted in new variety of A. esculentus called

(a)	Golden Kranti	(b)	Sonalika
(c)	IR-8	(d)	Parbhani Kranti

- **78** The host crop plants may be resistant to insect pests due to the
  - (a) morphological characteristics
  - (b) biochemical characteristics
  - (c) physiological characteristics
  - (d) All of the above

- **79** Hairy leaves of many plants are associated with resistance to .....
  - (a) insect pests (b) bacteria
  - (c) virus (d) bollworm
- **80** Solid stem in wheat exhibits non-preference by (a) jassids
  - (b) fruit borer
  - (c) stem borer
  - (d) stem sawfly
- **81** In cotton, smooth leaf and the absence of nectar repel (a) sawfly (b) bollworms (c) beetle (d) jassids
- 82 In maize, the presence of high aspartic acid, low nitrogen and sugar content protect them from
  - (a) aphids
  - (b) fruit borers
  - (c) jassids
  - (d) stem borers
- **83** Some released crop varieties bred by hybridisation and selection, for insect pest resistance are given in the table. Fill up the blanks.

Crops	Varieties	Insect pests
Brassica	Α	Aphids
В	Pusa Sem 2, Pusa Sem-3	Jassids, aphids and fruit borer
С	Pusa Sawani, Pusa A-4	Shoot and fruit borer

- (a) A-Pusa Karan, B-Flat bean, C-Bhindi
- (b) A-Pusa Gaurav, B-Flat bean, C-Okra
- (c) A-Pusa Shubhra, B-Wrinkled bean, C-Pea
- (d) A-Pusa Komal, B-Smooth bean, C-Bhindi
- 84 Which of the following are not disease resistant varieties?

(a) Pusa Gaurav	(b) Pusa Sem-2
(c) Pusa Sawani	(d) All of these

- **85** Hidden hunger is best indicated as
  - (a) inability of majority of people to buy enough fruits, vegetables, legumes, fish and meat and thus suffer from deficiency of vitamin, protein, etc.
  - (b) people are unable to buy healthy drink item and thus suffer from deficiency
  - (c) people are unable to buy junk food thus suffer from deficiency
  - (d) All of the above
- **86** Majority of people suffer from malnutrition because their food does not contain essential micronutrients specially
  - (a) iron (b) iodine and zinc (c) vitamin-A
    - (d) All of these

- 87 The deficiency of essential micronutrients in food mav
  - I. increase risk for disease.
  - II. reduce mental ability.
  - III. reduce lifespan.
  - Choose the correct option.

(a)	I, II and III	(b)	I and III
(c)	Only I	(d)	I and II

(c)	Unly I	(d) 1 an

- **88** Biofortified crops are
  - (a) crops with increased yield
  - (b) crops with disease resistance
  - (c) herbicide resistant crops
  - (d) crops with high nutritive value
- **89** What objectives are undertaken during crop-breeding for improved nutritional quality?
  - (a) Improve protein and oil content and quality
  - (b) Improve content of micronutrients and minerals
  - (c) Improved vitamin content
  - (d) All of the above
- **90** A biofortified wheat variety is
  - (a) Altas 66 (b) IR-8
  - (d) Sonalika (c) Kalyan Sona
- 91 The Indian Agricultural Research Institute, New Delhi has released several fortified vegetable crops that are rich in vitamins and minerals. They are
  - I. Vitamin-A enriched carrot, spinach, pumpkin.
  - II. Vitamin-Cenriched bitter gourd, bathua, mustard and tomato.
  - III. Iron and calcium enriched spinach and bathua.
  - IV. Protein enriched broad beans, French bean, garden pea.

# **TOPIC 4**~ Tissue Culture

- **97** The technique of regeneration of whole plant from any part of a plant by allowing it to grow on a suitable culture under aseptic sterile conditions in vitro is called
  - (a) tissue culture
  - (b) plant culture
  - (c) micropropagation
  - (d) somatic hybridisation
- **98** Which one is used in tissue culture? **JIPMER 2018** 
  - (a) Explant (b) Somaclones
  - (c) Hybridisation (d) None of these
- 99 The capacity of a cell explant to grow into a whole plant is called
  - (a) callus (b) tissue culture
  - (c) cellular totipotency (d) All of these

- Choose the correct option.
- (a) I, II and IV (b) All of these (c) II, III and IV
  - (d) None of these
- 92 One of the alternate sources of protein for animal and human nutrition is
  - (a) single cell protein
  - (b) proteomix
  - (c) double cell protein
  - (d) All of these
- **93** Single cell protein is an alternative protein source for animal and human nutrition formed from certain beneficial microorganisms like
  - (a) Spirulina
  - (b) Methylophilus methylotrophus
  - (c) Both (a) and (b)
  - (d) None of the above
- 94 Microbes like Spirulina, can also be grown on industrial scale as source of good
  - (a) fat (b) carbohydrate
  - (d) All of these (c) minerals
- **95** Single cell protein reduces
  - (a) environmental pollution
  - (b) greenhouse effect
  - (c) global warming
  - (d) production and growth of crop
- **96** 250 g of *Methylophilus methylotrophus* bacterium has been used to produce
  - (a) 15 tonnes of proteins
  - (b) 25 tonnes of proteins
  - (c) 35 tonnes of proteins
  - (d) 50 tonnes of proteins
- **100** What are the requirements in tissue culture?
  - (a) Hormones like auxin, cytokinin, agar-agar AIIMS 2019
  - (b) Inorganic salt, vitamin, amino acid only
  - (c) Carbon source like sucrose only
  - (d) All of the above
- **101** To meet the demands of the society, *in vitro* production of a large number of plantlets in a short duration is practiced in floriculture and horticulture industry today. It is called
  - (a) somatic hybridisation (b) micropropagation
  - (c) hybridoma technology (d) somaclonal variation
- **102** A technique of micropropagation is

#### **CBSE-AIPMT 2015**

(a) somatic hybridisation (b) somatic embryogenesis (c) protoplast fusion (d) embryo rescue

- **103** The plants produced from tissue culture are genetically identical to the original plant from which they are grown so they are called
  - (a) somaclones (b) clones
  - (c) para clones (d) None of these
- **104** Virus free plants can be formed by **AIIMS 2019** (b) callus culture (a) meristem culture (c) somatic cell culture (d) protoplast fusion
- **105** Meristem culture is practiced in
  - (a) floriculture (b) aquaculture (c) horticulture (d) pisciculture
- **106** To obtain virus-free healthy plants from a diseased one by tissue culture technique, which part/parts of the diseased plant will be taken? **CBSE-AIPMT 2014** 
  - (a) Apical meristem only
  - (b) Palisade parenchyma
  - (c) Both apical and axillary meristems
  - (d) Epidermis only

#### **CBSE-AIPMT 2015**

- **107** A protoplast is a cell (a) without plasma membrane (b) without nucleus (c) undergoing division
  - (d) without cell wall

- **108** Somatic hybrids are produced by the fusion of .....
  - (a) protoplasts of two cells
  - (b) cytoplasm of two cells (c) nucleus of two cells
  - (d) DNA of two cells
- **109** The embryo which develops from somatic cell is called
  - (a) somatic embryo
  - (b) reproductive embryo
  - (c) sterile embryo
  - (d) None of the above
- **110** 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
  - (a) somatic hybridisation
  - (b) cross hybridisation
  - (c) intravarietal hybridisation
  - (d) interspecific hybridisation
- **111** Pomato is a somatic hybrid of
  - (a) potato and onion
  - (c) potato and brinjal
- (b) potato and tomato (d) brinjal and tomato

# NEET SPECIAL TYPES QUESTIONS

# I. Assertion and Reason

**Direction** (Q. Nos. 112-121) In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R).

*Of the statements, mark the correct answer as* 

- (a) If both A and R are true and R is the correct explanation of Α
- (b) It both A and R are true, but R is not the correct explanation of A
- (c) If A is true, but R is false
- (d) If A is false, but R is true
- **112** Assertion (A) Bird flu disease is the disease of poultry. **Reason** (R) It is caused by a bacterium.
- **113** Assertion (A) In tissue culture, whole plant can be produced from any plant cell.

**Reason** (R) Plant cells possess totipotency which allow any viable plant cell to differentiate into somatic embryo that can give rise to different cells of plants.

**114** Assertion (A) Interspecific crosses are rare in nature and intergeneric crosses almost unknown. Reason (R) Interspecific cross combine undesirable

features of both the parents. **115** Assertion (A) Protoplast culture is an important technique of somatic hybrids. Reason (R) Protoplast culture technique results in the production of somatic hybrids.

- **116** Assertion (A) Virus-free plants can be produced by meristem tissue culture. Reason (R) In virus infected plant, only apical mesistem is free of virus.
- **117** Assertion (A) Inbreeding produces pureline. Reason (R) It causes homozygosity.
- **118** Assertion (A) Hybrid vigour (heterosis) is the phenotypic superiority of hybrid over both of its parents.

Reason (R) Characters of both the parents get expressed in the hybrid progeny.

**119** Assertion (A) Biofortification is the most practical approach to improve the health of the people suffering form hidden hunger.

**Reason** (R) Biofortification is used to increase nutrient value of crops.

**120** Assertion (A) Aquaculture practice is economically very beneficial.

**Reason** (R) It involves breeding, rearing, harvesting and management of useful aquatic plants and animals.

**121** Assertion (A) Light is an essential component of poultry farm management.

**Reason** (R) Exposure to 14-16 hours of light ensures optimum production of eggs.

# II. Statement Based Questions

- **122** Select the incorrect statement.
  - (a) Inbreeding is essential to evolve purelines in any animals
  - (b) Inbreeding selects harmful recessive genes that reduce fertility and productivity
  - (c) Inbreeding helps in accumulation of superior genes and elimination of undesirable genes
  - (d) Inbreeding increases homozygosity
- **123** Select the incorrect statement regarding inbreeding.

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- (a) Inbreeding helps in the elimination of deleterious alleles from the population
- (b) Inbreeding is necessary to evolve a pureline in any animals
- (c) Continued inbreeding reduces fertility and leads to inbreeding depression
- (d) Inbreeding depression cannot be overcome by outcrossing
- **124** Mark the incorrect statement for inbreeding.

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- (a) Inbreeding depression increases productivity
- (b) Inbreeding depression can be overcome by outcrossing
- (c) Produces purelines
- (d) Increases homozygosity
- **125** Which of the following statements is correct for cross-breeding?
  - (a) Refers to the cross of superior male of one breed with superior female of another breed
  - (b) Is used to produce purelines
  - (c) Causes reduction in fertility
  - (d) Is best for amimals below average in milk productivity, growth rate, etc.
- **126** Which of the following statements given below are correct?
  - (a) The progeny of cross-breeding may be used for commercial production

- (b) In case of artificial insemination, the semen can be used immediately or can be frozen for later use
- (c) Controlled breeding experiments are carried out using artificial insemination and multiple ovulation embryo transfer technology
- (d) All of the above
- **127** Which of the following statements are not the main objective of animal breeding?
  - (a) Improved growth rate
  - (b) Increased production of milk, meat, egg, wool, etc.
  - (c) Superior quality of milk, meat, eggs, wool, etc.
  - (d) Improved resistance to various diseases
- **128** Go through the given statements and choose the correct statement.
  - (a) Hilsa, sardines, mackerel are freshwater fishes
  - (b) Catla and common carp are marine fishes
  - (c) Blue revolution is concerned with fisheries
  - (d) Both the term aquaculture and pisciculture are used for rearing fishes only
- **129** Which of the following statements are correct?
  - (a) Hybrid breeding have led to the development of several high yielding varieties resistant to water stress
  - (b) A group of animals related by descent and similar in most characters are called a breed
  - (c) The agriculture practice of breeding and raising livestock is called animal husbandry
  - (d) All of the above
- **130** Read the following statements. Choose the option for correct statement.
  - (a) Pusa Gaurav is a maize variety resistant to aphids
  - (b) Pusa A-4 is okra variety resistant to aphids
  - (c) Himgiri is a wheat variety resistant to hill bunt
  - (d) Parbhani Kranti is resistant to rust disease
- **131** Which statements are correct about Atlas-66?
  - (a) It has high protein content
  - (b) It has been used as a donor for improving cultivated wheat
  - (c) Both (a) and (b)
  - (d) Protina, Shakti and Rattan are three improved and biofortified hybrids of Atlas-66
- **132** The parameters carried out for managing dairy farm are
  - I. selection of both the male and female animals having high yielding potential and resistance to diseases.
  - II. regular visits by a veterinary doctor.
  - III. each animal should be fed with a balance diet.
  - IV. pay attention to good animal management and general supervision.
  - Which of the above statements are correct?
  - (a) I and II (b) I, II and III
  - (c) II, III and IV (d) All of these

- **133** Animal husbandry deals with
  - I. breeding of livestock buffaloes, cows, sheep, camels, etc. that are useful to humans.
  - II. rearing, catching, selling, etc. of fish, molluscs and crustaceans.
  - III. breeding plants for human use.

Which of the statements given above are correct?

- (a) I and II (b) I and III
- (c) II and III (d) All of these

**134** Consider the following statements (I-IV) and select the option which includes all the correct ones only.

- I. Single cell *Spirulina* can produce large quantities of food rich in protein, minerals, vitamins, etc.
- II. Body weight-wise the microorganism *Methylophilus methylotrophus* may be able to produce several times more proteins than the cows per day.
- III. Common button mushrooms are a very rich source of vitamin-C.
- IV. A rice variety has been developed which is very rich in calcium.
  (a) III and IV
  (b) I, III and IV

(c) II, III and IV (d) I and II

**135** Strategic steps for inbreeding are

- I. identify superior male and superior female of the same breed.
- II. identified animals are then mated in pairs.
- III. evaluate the progeny obtained from the mating to identify superior males and females.
- IV. in cattle, superior female is the cow or buffalo that produce more milk per lactation and superior male is the bull that gives rise to superior progenies.
- V. superior progenies obtained are further mated.

Arrange the above given steps in correct sequence and select the correct answer.

- (a)  $\mathrm{I} \rightarrow \mathrm{III} \rightarrow \mathrm{II} \rightarrow \mathrm{IV} \rightarrow \mathrm{V}$
- (b)  $I \rightarrow II \rightarrow III \rightarrow IV \rightarrow V$
- (c) III  $\rightarrow$  I  $\rightarrow$  II  $\rightarrow$  IV  $\rightarrow$  V
- (d)  $III \rightarrow II \rightarrow I \rightarrow V \rightarrow IV$
- **136** Read the given statements about outcrossing.
  - I. It is the breeding between animals within the same breed which do not have common ancestors on either side of their pedigree up to 4-6 generations.
  - II. It is done to increase milk production and growth rate in animals.
  - Which of the statement(s) given above is/are correct?
  - (a) Only I (b) Only II
  - (c) I and II (d) None of these

- **137** Read the given statements.
  - I. Beehives are mostly kept close to crop fields of sunflower.
  - II. Bee-keeping is a labour-intensive method.
  - III. Beeswax is used in cosmetic industry.
  - IV. Apis indica is the most common bee species.
  - Choose the incorrect statement.
  - (a) II and III (b) Only II
  - (c) Only IV (d) None of these
- **138** Read the given statements. Which of them are correct about testing, release and commercialisation of new cutlivars.
  - I. The newly selected lines are evaluated for their yield, quality and disease resistance.
  - II. The evalution is done by recording their performance under ideal fertiliser, irrigation, etc.
  - III. After evaluation, crops should be grown in farmer's fields for at least three growing seasons.
  - IV. The crop is evaluated in comparison to the best available local crop cultivar.
  - (a) I and II (b) I, II and III
  - (c) Only I (d) All of these
- **139** When the breeders want to incorporate desired
  - characters into the crop plants. They should
  - I. increase and improve yield.
  - II. increase tolerance to salinity.
  - III. resistance to pathogen viruses, fungi and bacteria.

(b) I, II and III

- IV. increased tolerance to insect pests.
- Choose the correct option.
- (a) I and II
- (c) II, III and IV (d) All of these
- **140** Given below are four statements (I-IV). Which two of the following statements are correct?
  - I. It is estimated that more than 70% of the world livestock population is in India and China.
  - II. Maintaining cleanliness and hygiene (both of the cattle and the handlers) is important while milking, storage and transport of the milk and its products.
  - III. Outbreeding is the breeding between animal of the same breed only.
  - IV. Crosses between different breeds are called inbreeding.

Choose the correct option

- (a) I and II
- (b) III and IV
- (c) I and IV
- (d) II and III

- **141** Mutation breeding is carried out by
  - I. inducing mutations in plants by high energy rays.
  - II. screening the plant for resistance.
  - III. selecting the desirable plant for multiplication and breeding.

Choose the correct option.

(a)	) I and	II	(	b	)	I an	d.	Π	I	
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- (c) II and III (d) All of these
- **142** Read the given statements.
  - I. High aspartic acid, low nitrogen and sugar content in maize leads to resistance to maize stem borers.
  - II. Pusa Sadabahar is a food variety resistant to chilli mosaic virus.
  - III. Norman E Borlaug developed a semidwarf variety of wheat.
  - IV. Germplasm collection is the collection of all sexual genes of an individual.

Choose the incorrect statements.

- (a) I and IV (b) II and III
- (c) Only IV (d) II, III and IV
- **143** Which of the following statement (s) is/are correct?
  - I. The shift from grains to meat diets creates more demand for cereals.
  - II. SCP provides a protein rich supplement.
  - III. SCP can be produced by using bacteria, blue- green algae and fungi.
  - IV. SCP helps to minimise environmental pollution.
  - V. 3-10 kg of grains are required to produce 1 kg of meat by animal farming.

Choose the correct option.

- (a) I, II and III
- (b) Only III
- (c) Only IV
- (d) All of the above
- **144** Consider the following statements. Which of them are the advantages of tissue culture/ micropropagation?
  - I. A large number of plants can be grown in short time.
  - II. Disease free plants can be recovered from diseased plants.
  - III. Genetically variable plants can be produced.
  - IV. Somatic hybrids such as pomato can be raised.

Choose the correct option.

- (a) I, II and III
- (b) II, III and IV
- (c) I, II and IV
- (d) All of the above

### **III. Matching Type Questions**

**145** Match the following columns.

		Colur (Categ	<b>nn I</b> gory of	animals)			<b>Column</b> (Exampl	II es)		
	А.	Meat	Meat animals				Beef, sheep and cattle			
-	B.	Poult	Poultry animals				Cows and buffaloes			
-	C.	Milk animals			3.		Chickens, turkeys and ducks			
	D.	Dome	esticated	1 animal	4.		Horse a	nd cam	els	
Co	odes									
	А	В	С	D		А	В	С	D	
(a)	) 1	3	2	4	(b)	3	2	4	1	

2

(	(c)	2	4	1	3	(d)	4	1	3

**146** Match the following columns.

		Col (Bre	<b>umn</b> eeding	I g types)		Columi (Feature	n II es)				
A	۱.	Ou	tcross	ing	1.	Exposes usually	s har elim	mful reo inated b	cessive y selec	genes	that are
В	3.	Cro	oss-br	eeding	2.	Mating breeds	of a	nimals t	elongi	ng to di	fferent
C		Inte hyt	erspec pridisa	cific ation	3	Mating having side of	of a no c their	nimals c ommon pedigre	of same ancesto e for 4	breed b ors on e -6 gene	out ither rations
D	).	Inb	reedii	ng	4	Mating	of a	nimals c	of diffe	rent spe	cies
Co	od	es									
	ŀ	A	В	С	D	)	А	В	С	D	
(a)	1		2	3	4	(b)	4	3	2	1	
(c)	3	3	2	4	1	(d)	2	4	3	1	

**147** Match the following columns.

	Colum (Terms	n I			Colum (Relate	n II ed to)
А.	Blue re	evolution		1.	Fish	
В.	Green	revolution		2.	Agricu	ılture
C.	White	revolution		3.	Milk	
Codes	5					
А	В	С		А	В	С
(a) 1	2	3	(b)	2	3	1
(c) 3	2	1	(d)	1	3	2

**148** Match the following columns.

	Column I (Terms)		<b>Column II</b> (Features)
А.	Pisciculture	1.	Rearing of fishes
В.	Aquaculture	2.	Rearing and management of economically useful aquatic plants and animals
C.	Apiculture	3.	Concerned with maintenance of honeybees

Codes						
А	В	С		А	В	С
(a) 3	2	1	(b)	2	3	1
(c) 2	1	3	(d)	1	2	3

Match the following columns.

	(	C <b>olumn</b> Breeding	I g types)		Column II (Used for)
А.		MOET		1.	It is done to increase milk production, growth rate in beef cattle
В.		Interspec hybridisa	cific ation	2.	For herd improvement
C.	C. Cross-breeding		3.	The progeny may be of considerable economic value	
D.		Outcross	ing	4.	The progeny hybrid animals may be used for commercial production
Cod	de	s			
	А	В	С	D	
(a)	2	4	3	1	
(b)	2	3	4	1	
(c)	3	4	1	2	
(d)	4	1	2	3	

Match the following columns.

	<b>Column I</b> (Plant diseases)		<b>Column II</b> (Infectious agents)
А.	Brown rust of wheat	1.	Xanthomonas oryzae
B.	Bacterial blight	2.	Phytophthora infestans
C.	Red rot of sugarcane	3.	Puccinia graminis tritici
D.	Late blight of potato	4.	Colletotrichum falcatum

	А	В	С	D		А	В	С	D
(a)	4	1	3	2	(b)	1	4	2	3
(c)	2	4	1	3	(d)	3	1	4	2

Match the following columns.

	<b>Column I</b> (Plants)		<b>Column II</b> (Name of improved variety)
А.	Wheat	1.	Pusa Sadabahar
В.	Cauliflower	2.	Pusa Komal
C.	Cow pea	3.	Pusa Shubhra
D.	Chilli	4.	Himgiri

#### Codes

А	В	С	D
(a) 4	3	2	1
(b) 3	2	1	4
(c) 2	1	4	3
(d) 1	4	3	2

#### Match the following columns.

	Column I (Plants)		<b>Column II</b> (Nutrient present)
А.	Carrot, spinach and pumpkin	1.	Protein
В.	Bitter gourd, mustard and tomato	2.	Iron and calcium
C.	Spinach and bathua	3.	Vitamin-C
D.	Broad bean, lablab, French-bean and garden pea	4.	Vitamin-A

#### Coucs

А	В	С	D
(a) 4	2	3	1
(b) 3	2	1	4
(c) 2	1	4	3
(d) 4	3	2	1

Match the following columns.

	Co (Pla	<b>lumn</b> ants)	Ι			<b>Column II</b> (Improved variety name)						
А.	Со	tton			1.	Erectiferum and Erectoids						
В.	Rio	ce			2.	NP-836						
C.	Wl	heat			3.	Reimi and Jagannath						
D.	Ba	rley			4.	Indore-2						
Codes												
1	4	В	С	D		А	В	С	D			
(a) 1	l	2	3	4	(b)	4	3	2	1			
(c) 3	3	4	1	2	(d)	2	1	4	3			

Match the following columns.

				-		
	Col (Org	<b>umn I</b> ganisat	ions)		<b>Column II</b> (Location)	
А.	Ind Res	ian Ag earch	ricultur Institute	1.	Hyderabad	
В.	Inte Res Arie	ernation earch i d Trop	nal Crop Institute ics (ICF	2.	New Delhi	
C.	Nat Eng Inst	ional H gineerin itute (1	Environ ng Rese NEERI)	3.	Shimla	
D.	Cer Inst	tral Po itute (	otato Re CPRI)	4.	Nagpur	
Co	des					
	А	В	С	D		
(a)	4 2		1	3		
(b)	2	1	4	3		
(c)	3	2	1	4		
(d)	1	2	3	4		

# **NCERT Exemplar** MULTIPLE CHOICE QUESTIONS

- **155** The chances of contacting bird flu from a properly cooked (above 100° C) chicken and egg are
  - (a) very high
  - (b) high
  - (c) moderate
  - (d) negligible
- **156** A group of animals which are related by descent and share many similarities are referred to as
  - (a) breed (b) race
  - (c) variety (d) species
- **157** Inbreeding is carried out in animal husbandry because it
  - (a) increases vigour
  - (b) improves the breed
  - (c) increases heterozygosity
  - (d) increases homozygosity
- **158** Sonalika and Kalyan Sona are varieties of (a) wheat (b) rice (c) millet (d) tobacco
- 159 Which one of the following is not a fungal disease?(a) Rust of wheat(b) Smut of bajra(c) Black rot of crucifers(d) Red rot of sugarcane
- **160** In virus-infected plants, the meristematic tissues in both apical and axillary buds are free of virus because
  - (a) the dividing cells are virus resistant
  - (b) meristems have antiviral compounds
  - (c) the cell division of meristems is faster than the rate of viral multiplication
  - (d) viruses cannot multiply within meristem cell(s)
- **161** Several South Indian states raise 2-3 crops of rice annually. The agronomic feature that makes this possible is because of
  - (a) shorter rice plant
  - (b) better irrigation facilities
  - (c) early yielding rice variety
  - (d) disease resistant rice variety
- **162** Which one of the following combination would a sugarcane farmer look for in the sugarcane crop?
  - (a) Thick stem, long internodes, high sugar content and disease resistant
  - (b) Thick stem, high sugar content and profuse flowering
  - (c) Thick stem, short internodes, high sugar content, disease resistant
  - (d) Thick stem, low sugar content and disease resistant

- **163** Use of certain chemicals and radiation to change the base sequences of genes of crop plants is termed
  - (a) recombinant DNA technology
  - (b) transgenic mechanism
  - (c) mutation breeding
  - (d) gene therapy
- **164** The scientific process by which crop plants are enriched with certain desirable nutrients is called (a) crop protection (b) breeding
  - (c) biofortification (d) bioremediation
- **165** Lysine and tryptophan are
  - (a) proteins
  - (b) non-essential amino acids
  - (c) essential amino acids
  - (d) aromatic amino acids
- **166** The term 'totipotency' refers to the capacity of a
  - (a) cell to generate whole plant
  - (b) bud to generate whole plant
  - (c) seed to germinate(d) cell to enlarge in size
  - (d) cell to enlarge in size
- **167** An explant is
  - (a) dead plant
  - (b) part of the plant
  - (c) part of the plant used in tissue culture
  - (d) part of the plant that expresses a specific gene
- **168** The biggest constraint of plant breeding is
  - (a) availability of desirable gene in the crop and its wild relatives
  - (b) infrastructure
  - (c) trained manpower
  - (d) transfer of genes from unrelated sources
- **169** Micropropagation is
  - (a) propagation of microbes in vitro
  - (b) propagation of plants in vitro
  - (c) propagation of cells in vitro
  - (d) growing plants on smaller scale
- **170** Protoplast is
  - (a) another name for protoplasm
  - (b) an animal cell
  - (c) a plant cell without a cell wall
  - (d) a plant cell
- **171** More than 70% of livestock population is in
  - (a) Denmark (b) India
  - (c) China (d) India and China

172	To isolate protopla	st in plants, one needs
	(a) pectinase	(b) cellulase
	(c) Both (a) and (b)	(d) chitinase

- 173 Which one of the following is a marine fish?(a) Rohu(b) Hilsa(c) Catla(d) Common carp
- 174 The agriculture sector of India employs(a) 50% of the population(b) 70% of the population(c) 30% of the population(d) 60% of the population
- **175** 33% of India's Gross Domestic Product comes from
  - (a) industry
  - (b) agriculture
  - (c) export
  - (d) small-scale cottage industries
- **176** A collection of all the alleles of all the genes of a crop plant is called

1 1	
(a) germplasm collection	(b) protoplasm collection
(c) herbarium	(d) somaclonal collection

- **177** Given below are a few statements regarding somatic hybridisation.
  - I. Protoplasts of different cells of the same plant are fused.
  - II. Protoplasts from cells of different species can be fused.
  - III. Treatment of cells with cellulase and pectinase is mandatory.
  - IV. The hybrid protoplast contains characters of only one parental protoplast.
  - Choose the correct option.
  - (a) I and II (b) I and III (c) I and IV (d) II and III
- 178 Fungicides and antibiotics are chemicals that(a) enhance yield and disease resistance(b) kill pathogenic fungi and bacteria, respectively(c) kill all pathogenic microbes
  - (d) kill pathogenic bacteria and fungi, respectively
- 179 Which one of the following products of apiculture is used in cosmetics and polishes?(a) Honey(b) Porp oil(c) Wax(d) Royal jelly

#### > Mastering NCERT with MCQs

1	<i>(a)</i>	2	(d)	3	(d)	4	(c)	5	<i>(a)</i>	6	<i>(a)</i>	7	(d)	8	(d)	9	(d)	10	<i>(d)</i>
11	<i>(d)</i>	12	(c)	13	<i>(a)</i>	14	<i>(a)</i>	15	<i>(a)</i>	16	(d)	17	<i>(b)</i>	18	<i>(a)</i>	19	<i>(a)</i>	20	<i>(d)</i>
21	<i>(a)</i>	22	<i>(b)</i>	23	(c)	24	<i>(a)</i>	25	<i>(a)</i>	26	<i>(b)</i>	27	(d)	28	<i>(b)</i>	29	<i>(a)</i>	30	<i>(a)</i>
31	<i>(d)</i>	32	<i>(a)</i>	33	<i>(b)</i>	34	(c)	35	<i>(a)</i>	36	(d)	37	(d)	38	<i>(a)</i>	39	(d)	40	<i>(d)</i>
41	(d)	42	<i>(b)</i>	43	<i>(a)</i>	44	(d)	45	(d)	46	<i>(b)</i>	47	(d)	48	<i>(a)</i>	49	(d)	50	<i>(a)</i>
51	(c)	52	(c)	53	<i>(b)</i>	54	<i>(a)</i>	55	<i>(b)</i>	56	<i>(a)</i>	57	(a)	58	(c)	59	(d)	60	(c)
61	<i>(a)</i>	62	<i>(b)</i>	63	<i>(b)</i>	64	<i>(a)</i>	65	(c)	66	<i>(b)</i>	67	(d)	68	(d)	69	(d)	70	<i>(a)</i>
71	(c)	72	(d)	73	(d)	74	(d)	75	(d)	76	<i>(a)</i>	77	(d)	78	(d)	79	<i>(a)</i>	80	( <i>d</i> )
81	<i>(b)</i>	82	<i>(d)</i>	83	<i>(b)</i>	84	<i>(d)</i>	85	<i>(a)</i>	86	<i>(d)</i>	87	<i>(a)</i>	88	<i>(d)</i>	89	<i>(d)</i>	90	<i>(a)</i>
91	<i>(b)</i>	92	<i>(a)</i>	93	(c)	94	<i>(d)</i>	95	<i>(a)</i>	96	<i>(b)</i>	97	<i>(a)</i>	98	<i>(a)</i>	99	(c)	100	<i>(d)</i>
101	<i>(b)</i>	102	<i>(b)</i>	103	<i>(a)</i>	104	<i>(a)</i>	105	<i>(a)</i>	106	(c)	107	<i>(d)</i>	108	<i>(a)</i>	109	<i>(a)</i>	110	<i>(a)</i>
111	(b)																		
> NI	EETS	Specia	ıl Ty	pes Que	estic	ons													
112	(c)	113	(a)	114	(c)	115	<i>(d)</i>	116	(c)	117	<i>(a)</i>	118	(a)	119	<i>(a)</i>	120	<i>(a)</i>	121	<i>(a)</i>
122	<i>(b)</i>	123	<i>(d)</i>	124	<i>(a)</i>	125	<i>(a)</i>	126	<i>(d)</i>	127	<i>(d)</i>	128	(c)	129	<i>(d)</i>	130	(c)	131	(c)
132	<i>(d)</i>	133	<i>(a)</i>	134	( <i>d</i> )	135	<i>(b)</i>	136	(c)	137	<i>(b)</i>	138	( <i>d</i> )	139	<i>(d)</i>	140	<i>(a)</i>	141	( <i>d</i> )
142	(c)	143	<i>(d)</i>	144	(c)	145	<i>(a)</i>	146	(c)	147	<i>(a)</i>	148	( <i>d</i> )	149	<i>(b)</i>	150	<i>(d)</i>	151	(a)
152	(d)	153	<i>(b)</i>	154	(b)														
> N(	CER	T Exerr	nplo	ar Questi	ions	6													
155	( <i>d</i> )	156	(a)	157	( <i>d</i> )	158	(a)	159	(c)	160	(c)	161	(c)	162	(a)	163	(c)	164	(c)
165	(c)	166	(a)	167	(c)	168	<i>(a)</i>	169	<i>(b)</i>	170	(c)	171	( <i>d</i> )	172	(c)	173	<i>(b)</i>	174	( <i>d</i> )
175	<i>(b)</i>	176	<i>(a)</i>	177	( <i>d</i> )	178	<i>(b)</i>	179	(c)										

# **Answers & Explanations**

- **9** (*d*) High yielding potential under the climatic conditions of that area and resistance to diseases are two most important quality to be considered while selection of good breeds.
- **13** (*a*) Bird flu is a viral disease affecting poultry birds. It resembles influenza and caused by a virus  $H_5N_1$ .
- 14 (a) The improved breeds shown in the diagram are Jersey (A) and Leghorn (B). Jersey is an exotic cattle breed from Island of Jersey in english channel. Leghorn is a Mediterranean breed of chicken. Other options like Sangamneri, jamunapari and sirohi are breeds of goat. Marwari is a horse breed and beetal is a type of insect.
- **15** (*a*) Anthrax is an infectious bacterial disease found in cattle, buffaloes, sheeps and goats. Other options like tick fever is a protozoan poultry disease. Necrosis is a form of premature cell death. Rinderpest is an infectious disease of cattle caused by virus.
- **17** (*b*) The term 'breed' refers to a group of animals related by descent and similar in most characters like general appearance, features, size, configuration, etc.
- **18** (*a*) Inbreeding refers to the mating of more closely related individuals within the same breed for 4-6 generations. The breeding strategy is as follows–superior males and superior females of the same breed are identified and mated in pairs. The progeny obtained from such matings are evaluated and superior males and females among them are identified for further mating.
- 21 (a) When closely related animals of same breed are crossed continuously for few successive generations, it results in increase of homozygosity. Thus, homozygous purelines in cattles can be obtained by this method.
- (c) Outbreeding is an important strategy of animal husbandry because it is useful in overcoming inbreeding depression. It is the breeding of stocks or individual animals that are not closely related with each other. Inbreeding depression is the condition in which the fertility and the productivity of animals is reduced due to the continuous inbreeding in same species. Thus, outbreeding helps to restore the fertility and yield.
- **24** (*a*) Outbreeding refers to the mating of unrelated animals belonging to
  - Individuals of the same breed but having no common ancestors on either side for at least 4-6 generations (outcrossing).
  - Individuals of the different breeds (cross-breeding).
  - Individuals of different species (interspecific hybridisation).
- **26** (*b*) The interspecific hybridisation is the mating or cross between male and female animals of two different related species belonging to same genus. This combines the desirable features.
- **28** (*b*) Controlled breeding experiments are carried out using artificial insemination (and MOET). In this

process semen from chosen male is injected into reproductive tract of chosen females. By this desirable matings are performed.

- **29** (*a*) MOET stands for Multiple Ovulation Embryo Transfer technology. It is the programme for herd improvement in animals like cattles, sheeps, rabbits, buffaloes, mares, etc.
- **30** (*a*) In MOET, the selected cow is administered with a hormone having follicle stimulating hormone like activity to induce follicular maturation and superovulation. Due to this instead of one egg, which they normally yield per cycle, they produce 6-8 eggs.
- **31** (*d*) During MOET fertilised eggs at 8-32 cells stages, are recovered non-surgically and transferred to surrogate mothers. The genetic mother is available for another round of superovulation. This technology has been demonstrated for cattle, sheep, rabbits, buffaloes, mares, etc.
- **37** (*d*) Keeping beehives in crop fields during flowering period increases pollination efficiency and improves the total yield, which is beneficial in terms of crop yield and honey yield.
- **38** (*a*) Fisheries is an industry devoted to the catching, processing or selling of fish, shell fish (prawns and molluscs) or other aquatic animals such as crabs, lobster, edible oyster, etc.
- **42** (*b*) Pisciculture and aquaculture has contributed towards increased production of aquatic organisms. Aquaculture involves production of useful aquatic plants and animals such as fishes, prawns, shrimps, lobsters, crabs, molluscs (edible and pearl oysters) by proper utilisation of small and large bodies of water. The production of fishes is called pisciculture. It involves proper utilisation of fresh water, brackish water and coastal areas. Quick growing fishes are selected for this purpose.
- **43** (*a*) The by products of fisheries are as follows
  - Isinglass Gelatinous substance obtained from the air bladder of perches and salmons used for clarification of wine and beer.
  - Fishoil It is extracted from the liver of sharks, etc., and has medicinal value.
  - Manure or fishmeal It is obtained from non-edible (waste) part of fishes, i.e. fins and tails. It is a good source of protein and given to poultry as food.
  - Shagreen It is the skin of sharks and rays having pointed scales used in polishing wood and other materials.
- **44** (*d*) During the mid 1960s, Green revolution in India was witnessed, i.e. a rapid increase in the production of agricultural products (particularly wheat). It was possible due to the introduction of high yielding varieties, increased irrigation facilities, application of fertilisers and pesticides, multiple cropping and better agricultural management.

- **45** (*d*) Green revolution was dependent mainly on plant breeding techniques for development of high yielding and disease resistant varieties of wheat, rice and maize. This was all done by the efforts of Prof. MS Swaminathan who is also called as the father of green revolution in India.
- **48** (*a*) Genetic variability is the root of any breeding programme. Pre-existing genetic variability is collected from wild varieties, species and relatives of the cultivated crop species and preserved for later evaluation.
- **50** (*a*) The main aim of germplasm evaluation in plant breeding programme is to identify the plants with desirable combination of characters.

The identified plants are then propagated and used in the process of hybridisation to create improved progeny or purelines.

- **62** (*b*) The sugarcane, *Saccharum barberi* was originally grown in North India, but had poor sugar content and yield.
- **63** (b) Tropical cane grown in South India is *Saccharum* officinarum had thicker stems and higher sugar content. Both varieties of sugar cane, i.e. *Saccharum barberi* and *Saccharum officinarum* were successfully crossed to get sugar cane varieties combining the desirable qualities of high yield, thick stem, high sugar and ability to grow in the sugar cane areas of North India.
- **65** (*c*) Black rot of crucifer is a bacterial disease. Tobacco mosaic and turnip mosaic are viral diseases and late blight of potato is caused by fungi.
- **66** (*b*) Hairy root disease of dicot plants is caused by *Agrobacterium rhizogene*. *Agrobacterium tumefaciens* causes stem gall of coriander.

*Bacillus thuringiensis* is soil dwelling Gram positive bacterium, now being using as pesticide against cotton stem borer insect.

*Meloidgyne incognita* causes root knot disease in tomato and brinjal.

- **67** (*d*) Plant breeding is carried out by the conventional breeding techniques or by mutation breeding. The conventional method of breeding for disease resistance is that of hybridisation and selection. Mutation breeding is defined as the process of breeding by artificially inducing mutations using chemicals (like aniline) or radiations like (gamma radiation).
- **68** (*d*) The conventional method of breeding for disease resistance includes screening of germplasm for resistant sources and hybridisation of selected parents. Whereas, induction of mutation is done under mutation breeding technique.
- **71** (c) Intergeneric crosses are made between plants belonging to different genera of the same family. The hybrids produced by this method are both scientifically as well as agronomically significant. For example, *Triticale* the first man made cereal crop is an allopolyploid, which was produced by intergenic hybridisation between wheat (*Triticale*) and rye (*Secale*).

- **72** (*d*) All measures can be taken to cultivate disease free chickpea crop. Bacterial blight of chickpea is caused by bacterium *Xanthomonas campestris*. The stem and the leaves of infected plant give blighted or burnt up appearance. Control measures include roguing 3-years crop rotation, disease-free seeds, spray of copper fungicides (bordeaux mixture) and use antibiotics besides sowing disease resistant varieties.
- **73** (*d*) Mutation is the process by which genetic variations are created through changes in the base sequence within genes. It results in the creation of a new character or trait not found in the parental type.
- **75** (*d*) Mutations to create a new character or trait can be artificially induced through the use of chemicals (like hydrazine, methyl methane sulphonate, etc.) or radiations (like X-rays, UV-rays and γ-rays, etc). These agents are called as mutagens.
- **79** (*a*) Hairy leaves of many plants are associated with resistance to insect pests. For example, resistance to jassids in cotton and cereal leaf beetle in wheat.
- **84** (*d*) All options are not the disease resistant varieties. These all are insect pest resistant varieties. Pusa Gaurav is the variety of *Brassica* which resistant to aphids, Pusa Sem-2 is the variety of flat bean and resistant to jassids, aphids and fruit borer, while Pusa Sawani is the variety of okra which is resistant to shoot and fruit borers.
- **85** (*a*) Hidden hunger is indicated as the lack of protein, vitamins and micronutrients deficiencies in the food. This is because not all people can afford to buy adequate vegetable, fruits, legumes, fish and meat. Thus, more than 840 million people in the world suffering from hidden hunger.
- **86** (*d*) Majority of people suffer from hidden hunger or malnutrition because their food does not contain essential micronutrients particularly iron, iodine, zinc and vitamin-A.
- **88** (*d*) Biofortified crops are the crops with high nutritive value. These crops have high levels of vitamins and minerals or higher proteins and healthier fats. They are developed by the process of biofortification.
- **90** (*a*) Atlas 66 is a biofortified wheat crop having high amount of amino acid and protein content.
- **92** (*a*) One of the alternate sources of protein for animal and human nutrition is single cell protein. It is the production of edible proteins on a large scale by cultivation of microorganisms.
- 93 (c) Single cell proteins are formed from certain beneficial microorganisms like
   Bacteria — Methylophilus methylotrophus Cyanobacteria — Spirulina.
- **94** (*d*) Microbes are being grown on an industrial scale as source of good protein. Blue-green algae 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.

- **95** (*a*) The microorganisms used in the production of SCP use substrates like sewage, animal manure, etc., which cause pollution. Therefore, by utilisation of such kind of substrates in the production of SCP helps in reduction of environmental pollution.
- **96** (*b*) 250 g of microorganism like *Methylophilus methylotrophus*, because of its high rate of biomass production and growth, can be expected to produce 25 tonnes of protein.
- **98** (*a*) Explant is used in plant tissue culture. It is an excised plant part which has the potential to give rise to whole new plant, e.g. leaves, shoot, roots, nodes, etc. The plants obtained through this techniques are morphologically and genetically similar to each other and to their parents plant.
- **99** (*c*) Cellular totipotency is the ability of a explant to give rise to a complete plant, when cultured in a suitable culture medium at appropriate temperature and aeration conditions.
- **100** (*d*) The requirements of tissue culture are growth hormones (auxin, cytokinin), agar-agar, inorganic salts, vitamins, amino acids, carbon source like sucrose, etc. In plants tissue culture, the medium on which explants are cultured is known as nutrient or culture medium. It acts as a source of important nutrient required for proper development of explant.
- **102** (*b*) Somatic embryogenesis is a technique of micropropagation. It is the growing of plants from meristematic tissue of somatic cells of plants on suitable nutrient media under controlled conditions.
- **103** (*a*) Somaclones are plants produced from tissue culture which are genetically identical to the original plant from which they are grown. Somaclones are produced by micropropagation technique of tissue culture.
- **104** (*a*) Virus free plants can be formed by meristem cutlure. The reason behind this is that virus cannot propagate in rapidly dividing cells, so meristematic zones of plant always remain virus free.

For other options,

- Protoplast fusion technique is used for making somatic hybrids.
- Somatic cell culture technique is used to propagate plants from somatic cells using nutrient medium and combination of hormones.
- Callus culture is undifferentiated mass of tissue. Growing callus from plant organs is called callus culture.
- **105** (*a*) In floriculture, the practice of meristem culture is used. Floriculture refers to large scale production of flowers for economic purposes. Other options like aquaculture and pisciculture are related to fisheries.
- **106** (c) In virus infected plant, both apical and axillary meristems are free of virus and use for the healthy plant cultivation because of rapid cell divisions and strong interferon activity in this region. These tissues form a protective impermeable covering around themselves, which is non-penetrable by any pathogen. Hence, these

tissues are used in the production of diseased free plants by tissue culture.

- **107** (*d*) A protoplast is a cell without cell wall. It is a cell that had its cell wall completely or partially removed using either mechanical or enzymatic means.
- **108** (*a*) Somatic hybrids are produced by the fusion of protoplasts of two cells, each having a desirable character.
- (b) Pomato is a somatic hybrid obtained by a mating between potato and tomato whereas bomato is a somatic hybrid between brinjal and tomato.
- **112** (*c*) Assertion is true, but Reason is false. Reason can be corrected as

Bird flu is a disease of poultry caused by a virus  $H_5N_1$ . The virus enters the human body through contact with sick birds or their products.

- 113 (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.In tissue culture, somatic embryos or embryoids are non-zygotic embryo like structures that develop *in vitro* cultures from somatic cells of any type of tissue.Here 'totipotency' property of plants cells is used, which allow whole plant to be produced from any one plant cell.
- **114** (*c*) Assertion is true, but Reason is false. Reason can be corrected as

In interspecific crosses, male and female animals of the different related species are mated. The resultant progeny may combine desirable features of both the parents are infertile. Thus, are rare in nature. The same applies to intergeneric crosses. It is the crossing of two different animals/plants of different genus. It is almost unknown in nature as the gametes show species specificity.

- (d) Assertion is false, but Reason is true. Assertion can be corrected asProtoplast culture is an important technique of tissue culture and this technique results in the production of somatic hybrid plants.
- **116** (*c*) Assertion is true, but Reason is false. Reason can be corrected as

Virus-free plants can be produced from the virus infected plants by means of meristem tissue culture. In a diseased plant, both the apical and axillary meristems are free of virus.

- 117 (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.Inbreeding is breeding between animals of the same breed for 4-6 generations. Continued inbreeding causes homozygosity which produces purelines.
- 118 (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
  Heterosis (Hybrid vigour) is the phenotypic superiority of the hybrid over both of its parents in one or more traits. In other words, when two unrelated individuals or lines are crossed, the performance of F<sub>1</sub> hybrid is often superior to both its parents.

**119** (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Biofortification is breeding of crops with higher levels of vitamins and minerals or higher protein and healthier fats.

This increase nutrient value of crops. Since billions of people in the world suffer from nutrient deficiencies or hidden hunger. Biofortification of crops is the most practical approach to improve the health of these people.

**120** (*a*) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

Aquaculture is the breeding, rearing, harvesting and management of economically useful aquatic organisms like fishes, shellfish, molluscs, crustaceans and other aquatic plants. It is done to procure food and other commercial products, restore habitats and replenish the depleted stocks, etc.

**121** (*a*) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.

Light is an essential component of poultry farm management because it determines the quantity of egg production. An exposure to 14-16 hours of light period during daytime ensures optimum production of eggs.

**122** (*b*) Statement in option (b) is incorrect. It can be corrected as

Inbreeding does not select harmful recessive genes. It exposes harmful recessive genes that reduce fertility and productivity and these are eliminated by selection. Statement in other options are correct.

**123** (*d*) Statement in option (d) is incorrect. It can be corrected as

Inbreeding depression can be overcome by outcrossing. In this method, mating of animals within the same breed, but no common ancestor for 4-6 generations.

Statements in other options are correct.

- 124 (a) Statement in option (a) is incorrect about inbreeding. It can be corrected as Inbreeding depression decreases the productivity. Continued inbreeding, usually reduces fertility of animals and even their productivity. This condition is called as inbreeding depression.
- 125 (a) Only statement in option (a) is correct, while other are incorrect. These can be corrected asMating of individuals from entirely different breed is called cross-breeding. It is the method of breeding superior male of one breed with superior female of another breed in order to combine the desirable qualities of two different breeds in the progeny.
- 127 (d) Statements in option (a), (b) and (c) are correct, but (d) is incorrect. It can be corrected asAnimal breeding involves crosses between useful animal breeds aiming to increase the yield of animals and to improve the desirable qualities of the product. It has no concern with the development of resistance against diseases.

- **128** (*c*) Only statement in option (c) is correct, while the other statements are incorrect and can be corrected as
  - Hilsa, sardines, mackerel are marine fishes.
  - Catla and common carp are freshwater fishes.
  - Only the term pisciculture is used for rearing fishes only.
- **130** (c) Only statement in option (c) is correct. Rest other statements are incorrect. These can be corrected as
  - Pusa Gaurav is variety of *Brassica*, resistant to aphids.
  - Pusa A-4 is okra variety resistant to shoot and fruit borer.
  - Parbhani kranti is resistant to yellow mosaic virus.

**131** (*c*) Statements in option (a) and (b) are correct for Altas 66. It is a soft wheat that has been used since 1953 as a genetic source of higher protein in wheat. It has been used as a donor for cultivated wheat.

Statement in option (d) is incorrect. The correct form of this statement is

Protina, Shakti and Rattan are three lysine rich maize hybrids developed in India.

- **133** (*a*) Statements I and II are correct for animal husbandry. Statement III is incorrect and can be corrected as Animal husbandry does not deal with breeding plants for human use. It is a component of plant breeding programmes.
- **134** (*d*) Out of the given statements I and II are correct, while III and IV are incorrect. The correct form of these statements is
  - Common button mushrooms are a very rich source of vitamin-B
  - A rice variety has been developed, by IARI which is rich in iron.
- **135** (*b*) Option (b) represents the correct answer. Inbreeding involves
  - Identification of superior males and superior females of the same breed.
  - Mating of the superior animals.
  - Progeny obtained from such mating are evaluated and assessed for the desirable traits.
  - It should be kept in mind that a superior cow or buffalo is that which gives more milk per lactation. Similarly, a superior bull is that which gives rise to superior progeny as compared to those of other bulls.
  - This process of mating of superior progenies is continued for 4-6 generations.
- **137** (*b*) Only statement II is incorrect, while the rest are correct. The incorrect statement can be corrected as Bee-keeping is not a labour-intensive method.
- **140** (*a*) Statements I and II are correct, while III and IV are incorrect. The correct form of these statement are
  - Outbreeding is the breeding between the animals of the same breed but no common ancestors or different breeds or different species.
  - Crosses between the same breeds are called inbreeding.

(*c*) Only statement IV is incorrect. The correct form of this statement is

Germplasm collection is the entire collection of plants or seeds having all the diverse alleles for all genes in a given crop.

Rest other statements are correct.

- 144 (c) Statements I, II and IV represent the advantages of tissue culture/micropropagation, while statement III is incorrect and can be corrected as Genetically, similar plants can be produced by the method of tissue culture.
- (*d*) The chances of contacting bird flu from a properly cooked (above 100°C) chicken and egg are negligible. Highly pathogenic strains of avian influenza can be found inside and on the surface of eggs. In an infected bird, it may spread to all the parts including the meat. However, proper cooking at or above 70°C, prior to eating, will inactivate the virus in the egg as well as in the meat.
- (*a*) A group of animals that are related by descent and are similar in most characters like general appearance, features, size, configuration, etc., are said to belong to a breed.
- (*d*) Inbreeding increases homozygosity, i.e. state of possessing two identical alleles, one inherited from each parent. It is necessary if we want to evolve a pureline in any animal.
- (*a*) Sonalika and Kalyan Sona are outstanding semi dwarf varieties of wheat possessing good yield potential and disease resistant. These were developed in 1963.
- (*c*) Black rot of crucifers is not a fungal disease. It is caused by a bacteria, *Xanthomonas campestris*. Other three diseases are caused by fungal pathogens.
- (*c*) Several South Indian states raise 2-3 crops of rice annually. The agronomic feature that makes this possible is early yielding rice variety. These varieties are a group of crops created intentionally during the green revolution to increase global food production.
- (*a*) In the sugarcane crop, a sugarcane farmer looks for a combination of thick stem, long internodes, high sugar content and disease resistance. In practice, *Saccharum barberi* and *Saccharum officinarum* are being crossed to develop such a combination.
- (*c*) It is possible to induce mutations artificially in crop plants through the use of chemicals or radiations (like gamma radiations), and then selecting and using those plants that have the desirable character as a source of further breeding. This process is called mutation

breeding. Use of radiations is not involved in other three options.

- (*c*) Biofortification is the scientific process by which crop plants are enriched with higher levels of vitamins and minerals or higher protein and healthier fats. It is the most practical means to improve public health.
- (*a*) The capacity of a cell or an explant to grow and develop into a whole plant is called 'totipotency'.
- (*c*) Any part of a plant used in tissue culture, which is taken out and grown in a test tube under sterile conditions in a special nutrient media is called an explant. A whole plant can be generated from an explant.
- (*a*) The biggest constraint of plant breeding (conventional) is the availability of limited number of disease resistance genes that are present and identified in various crop varieties or wild relatives.
- (*b*) Micropropagation is propagation of plants *in vitro* to achieve a large number of plants in very short duration. This results in the production of genetically identical plants and is widely used in forestry and floriculture.
- (*c*) A protoplast is a plant, bacterial or fungal cell whose cell wall is completely or partially removed using either mechanical or enzymatic means.
- (*c*) Both option (a) and (b) are correct. As the cell wall of plant cells consists of pectin and cellulose which can be removed by digestion with combination of enzymes pectinase and cellulase to isolate the protoplast.
- (*b*) Hilsa, sardines, mackerel and pomfrets are some of the marine fishes.Catla, rohu and common carp are freshwater fishes.
- (*a*) Germplasm collection is the entire collection of plants/seeds having all the diverse alleles for all genes in a given crop.
- (*d*) Statements II and III are correct, while I and IV are incorrect and can be corrected as
  - Protoplasts from two different varieties of plants are fused in the somatic hybridisation.
  - The hybrid protoplast contains characters of both parental protoplast.
- (*c*) Beeswax is the most common product of apiculture which finds many uses in industry, cosmetics and polishes of various kinds.

Honey is a food of high nutritive value and also finds use in the indigenous systems of medicine. Royal jelly, is the queenbees extraordinary source of food. It is rich in nutrition values and is believed to be a potent antioxidant. Prop oil is not a product of apiculture.