MISSION MBBS

Date: 20/10/2022

Subject: BOTANY

Topic : Strategies for Enhancement in Food Production L5

Class: Standard XII

1. Assertion: A diverse germplasm collection is a very important prerequisite for plant breeding.

   Reason: Genetic variability is the root of plant breeding programme.

   - ✓ **A.** Both assertion and reason are correct and the reason correctly explains assertion
   - ✗ **B.** Both assertion and reason are correct but the reason is not the correct explanation for assertion
   - ✗ **C.** Assertion is correct but reason is incorrect
   - ✗ **D.** Both the assertion and reason are incorrect

   Plant breeding is the purposeful manipulation of plant species so as to create new improved varieties that are better suited for cultivation, give better yield and are resistant to pests and pathogens.

   One of the initial steps in the plant breeding programme is germplasm collection.

   Germplasm refers to the seeds, plants, or plant parts having all possible alleles for all the genes in a given crop. Collection of the diverse germplasm ensures that plant breeders have the whole range of possible genetic variabilities of a crop plant. Genetic variability is the root of the plant breeding programme as it enables the plant breeder to choose the right combination of superior characteristics that they would like to develop in an improved crop.

   In the next step of plant breeding, the whole available germplasm is screened for desirable traits that are to be incorporated into the new variety. The plants with desirable combinations of characters are identified and selected as parents. These are then artificially cross-pollinated to obtain hybrid progeny. The progeny which will exhibit superior characteristics of both the parents will be selected and propagated to produce an improved crop variety.

   Thus, both assertion and reason are correct and the reason correctly explains the assertion.

2. Pest resistance in crop plants may be due to:

I. Physiological characteristics

II. Biochemical characteristics

III. Morphological characteristics

A. I only

B. I and II only

C. I and III only

D. I, II and III

Agricultural pests are organisms that attack agricultural crops and destroy them, leading to huge crop losses. Some crop plants naturally develop resistance to pests as a result of morphological, physiological or biochemical characteristics in them.

Some examples are listed below:

- Presence of hairy leaves provides resistance to jassids (sap-sucking insects) in cotton and cereal leaf beetles in wheat. Wheat varieties with strong solid stems are not preferred by stem sawfly (insect). These are morphological adaptations that provides pest resistance.
- Nectar is a sweet sugary fluid secreted by special glands called nectaries present in the plant. Nectar often attracts insects towards the plant as the insects feed on it. Nectar-less varieties of cotton do not attract bollworms, a common pest that infests cotton plants. This is a physiological adaptation that provides pest resistance.
- In maize crop certain biochemical characteristics like low nitrogen, low sugar and high aspartic acid content helps resist against maize stem borers.

3. Read the following statements (A -D) regarding testing, release and commercialisation of cultivars during a plant breeding programme? Select the correct option stating true (T) and false (F).

A. The new cultivars are evaluated for their traits by growing them in the research fields.
B. Performance of new cultivars is recorded under ideal fertiliser application, irrigation and other crop management practices.
C. In farmer's fields, testing of cultivars is done for one growing season.
D. The new cultivar is compared with the reference cultivars.

✔ **A.** A - T, B - T, C - F, D - T

✘ **B.** A - T, B - F, C - F, D - T

✘ **C.** A - F, B - T, C - F, D - F

✘ **D.** A - T, B - T, C - T, D - F

Plant breeding is the purposeful manipulation of plant species in order to create desired plant types that are better suited for cultivation.

The major steps in breeding a new variety of a crop are collection of variability, selection of parent plants with desirable combination of characteristics, cross hybridisation of selected parents, selection of superior hybrid progeny and finally the testing, release and commercialisation of new cultivars. Cultivar refers to a plant variety which is a product of plant breeding.

Hence, testing, release and commercialisation of cultivars is the last step in plant breeding.

In this step, the new cultivars are first evaluated for their yield and other desirable qualities like disease resistance and tolerance to environmental stresses (salinity, extreme temperatures, drought). The evaluation is performed by growing them in research fields under conditions like ideal fertiliser application and other crop management practices.

Hence statements A and B are true.

Once the new cultivars are grown successfully in the research field, they are now grown in farmer's fields for at least three growing seasons across different parts of the country representing the various agroclimatic zones. So, statement C is false.

The new cultivar is evaluated in comparison to the best available local crop cultivar (check or reference cultivar) in terms of quality and cost. Hence statement D is true.

4. Complete the given analogy.
Pusa Shubhra: cauliflower :: Parbhani kranti: _____

- **A.** wheat
- **B.** cowpea
- **C.** okra
- **D.** chilli

Infectious diseases in plants can be viral, bacterial or fungal and can result in 20-30% or sometimes even total crop loss.

Thus, producing high-yielding cultivated varieties of plants that are resistant to one or more diseases would immensely help in increasing crop production.

A plant's resistance to a particular pathogen is a function of its genetic composition and enables it to prevent the pathogen from establishing an infection.

Disease resistance in high-yielding cultivated crop varieties can be developed by conventional breeding.

Many wild plants that are genetically related to cultivated varieties possess the disease resistance genes but give a poor yield. The gene providing disease resistance to a wild variety can be introduced into a high yielding cultivated variety. The wild variety of plant (resistant to diseases) is artificially crossed with a high yielding variety (having poor resistance to diseases).
The progeny obtained from such a cross can be screened for the selection of the hybrids that exhibit a combination of the desired characters, i.e., high yield and disease resistance. The selected varieties are self-pollinated for several generations until they become pure lines. These newly developed varieties are evaluated by growing in the research fields and recording their performance under ideal fertiliser application, irrigation, and other crop management practices.

- One such variety of okra (*Abelmoschus esculentus*) developed is Parbhani Kranti which is both high yielding and resistant to diseases like yellow mosaic caused by yellow mosaic virus. Okra is also called bhindi.

Pusa Shubhra is a variety of cauliflower that is resistant to the bacterial diseases such as black rot and curl blight black rot.

Himgiri is a wheat variety that is resistant to fungal infections such as leaf and stripe rust and hill bunt.

Pusa Komal is a cowpea variety that is resistant to bacterial blight.

Pusa sadabahar is a variety of chilli that is resistant to chilli mosaic virus, tobacco mosaic virus and chilli leaf curl virus.

5. Match column I with column II and select the correct option.

Column I		Column II	
A	Black rot	1	Wheat
B	Brown rust	2	Sugarcane
C	Red rot	3	Crucifers

A. A - 3, B - 1, C - 2

B. A - 2, B - 1, C - 3

C. A - 3, B - 2, C - 1

D. A - 2, B - 3, C - 1

In the given question the common plant diseases and the corresponding plants affected are given.

Black rot is a bacterial disease caused by *Xanthomonas campestris* which affects crucifers. Crucifers belong to the family Brassicaceae (cruciferae) e.g, cabbage, cauliflower, etc.

Brown rust of wheat is a fungal disease caused by *Puccinia triticina.* Orange-brown pustules are formed on the leaf surface.

Red rot of the sugarcane is caused by the fungus *Colletotrichum falcatum (Glomerella tucumanensis).*

Hence, the correct matching is as follows.

Column I		Column II	
A	Black rot	3	Crucifers
B	Brown rust	1	Wheat
C	Red rot	2	Sugarcane

6. Pusa Sadabahar is a disease resistant variety of the plant belonging to the family ___(A)_____and Pusa Sadabahar is resistant to____(B)_____.

A. (A)-Poaceae, (B)-virus

B. (A)-Solanaceae, (B)-virus

C. (A)-Fabaceae, (B)-bacteria

D. (A)-Brassicaceae, (B)-bacteria

In order to overcome crop losses by infectious diseases caused by pathogens, the Indian Agricultural Research Institute (IARI) has developed many disease resistant crop varieties by conventional plant breeding programmes.

Pusa Sadabahar is a disease resistant variety of chilli. Pusa Sadabahar is resistant to tobacco mosaic virus, chilli mosaic virus and leaf curl virus. These viruses cause huge crop losses. The Chilli plant belongs to the family Solanaceae.

7. Pusa Sem 2 is a variety of ___A___ which is developed by ___B____.

A. A: okra, B: CDRI

B. A: mustard, B: IARI

C. A: flat bean, B: NDRI

D. A: flat bean, B: IARI

Agricultural pests are organisms that attack agricultural crops and destroy them, leading to huge crop losses. Developing pest resistant crops can provide a permanent solution to this problem and is one of the major objectives of the plant breeding programmes in India.

Pusa Sem-2 is an improved variety of flat bean. It is resistant to jassids, aphids and fruit borers. Jassids and aphids are sap sucking insects. Fruit borers infest the pod of flat bean.

Pusa Gaurav is a pest resistant variety of *Brassica* (rapeseed mustard) which is resistant to aphids.

Pusa Sawani and Pusa A-4 are pest resistant varieties of okra (bhindi) that are resistant to stem and fruit borers.

All these Pusa varieties have been developed by the Indian Agricultural Research Institute (IARI).

CDRI stands for Central Drug Research Institute which is located at Lucknow. This institute is primarily involved with drug research.

NDRI or the National Dairy Research Institute is involved with dairy research.

8. In_____, resistance to yellow mosaic virus was developed by mutation breeding.

A. cauliflower

B. cowpea

C. mung bean

D. chilli

To overcome the problem of pathogens that cause serious infections in plants, the plant breeders have developed certain techniques like conventional breeding and mutation breeding.

In conventional breeding, the plants having disease resistance genes are selected and are crossed with plants that are high yielding but have poor resistance to pathogens. The aim of this cross hybridisation is to have the hybrids which will have a combination of desired characteristics from both the parents (disease resistance and high yield). The superior hybrids among the progeny are selected and tested for various agronomic traits and finally these varieties are released into the market.

But due to the limited number of disease resistance genes in various crop varieties or wild relatives, it is often not possible to generate plants through conventional breeding. To overcome this problem, mutation breeding is carried out. Mutation is a process by which variations are generated through changes in the base sequences within the genes. The new characters obtained through mutations are not found in the parent plant. Mutation breeding is a process by which the mutations can be induced in plants by exposing them to certain radiations.

Yellow mosaic disease is a plant disease caused by yellow mosaic virus. It infects crops like mung bean. Breeders had attempted to make mung bean resistant to yellow mosaic disease by inducing mutations via gamma radiations. They successfully produced mung bean resistant to yellow mosaic virus.

9. Study the given table and choose the correct option.

Crop	Variety	Insect pest
A	Pusa Gaurav	Aphids
Flat bean	B	Jassids

A. A: Okra, B: Pusa Sawani

B. A: *Brassica*, B: Pusa Sem 3

C. A: *Brassica*, B: Pusa A-4

D. A: Wheat, B: Pusa Sem 2

Agricultural pests are organisms that attack agricultural crops and destroy them, leading to huge crop losses. Through various plant breeding programmes, the Indian Agricultural Research Institute (IARI) has developed various pest resistant crop varieties. These varieties can hugely overcome the problem of crop losses due to pest infestation.

Pusa Gaurav is a crop variety of *Brassica* (rapeseed mustard*)* which is resistant to aphids. They are small sap-sucking insects which damage the crops.

Pusa Sem 2 and Pusa Sem 3 are crop varieties of flat bean which are resistant to jassids, aphids and fruit borers. Jassids and aphids suck the plant sap to destroy it while fruit borers infest the pod of flat bean making holes in it.

Pusa sawani and Pusa A-4 are pest resistant varieties of okra (Lady's finger). They are resistant to fruit and shoot borers.

Himgiri is a disease resistant variety of wheat developed by the IARI that is resistant to the fungal diseases such as leaf and stripe rust and hill bunt.

Hence, option b is correct.

10. Plant variety Himgiri is resistant to which disease?

- ✔ **A.** Hill bunt
- ✘ **B.** White rust
- ✘ **C.** Black rot
- ✘ **D.** Bacterial blight

Himgiri is an improved wheat variety which is resistant to fungal diseases like leaf and stripe rust, hill bunt.

White rust is a fungal infection of crops like mustard, cauliflower, etc caused by *Albugo candida.*

Black rot is a bacterial disease which affects crucifers.

Bacterial blight affects cowpea.