Q 1. Define Crop Improvement / plant breeding & write down major specific breeding objectives.

Ans ⇒ Crop Improvement / plant breeding

A science an Art and Technology which deals with genetic improvement of crop plant in relation to their economic use for mankind.

Major objective of crop improvement.

The primary objectives is to develop superior plants over the existing on in relation to their economic use.

1. Higher yield
2. Improved quality
3. Biotic stress
4. Abiotic stress
5. Earlyness
6. Synchronous maturity
7. Desirable Agronomic characters
8. Photo & Thermo insensitivity
9. Wider Adaptability.

1. Higher yield

The ultimate aim of plant breeding is to improve the yield of economic produce. It may be grain yield, fodder yield, fibre yield, tuber yield case

or oil yield depending upon the crop species.

2. Improved quality

Quality of produce is another important objective in plant breeding. The quality character vary from crop to crop. Eg - grain size, colour, milling and backing quality in wheat. cooking quality in rice, malting quality in barley, size, colour and size of plant fruits.

3. Biotic Resistance

Crop plants are attacked by various diseases and insects, resulting in considerable yield losses. Resistance varieties are develop through the use of resistant donor parents available in the gene pool.

4. Abiotic Resistance

Crop plants also suffer from abiotic factors such as drought, soil salinity, extreme temperature heat, wind, cold & frost, breeder has to develop resistant varieties for such environmental conditions.

5. Earlyness

→ Earliness is the most desirable character which has several advantages. It requires less crop management period, less insecticidal sprays, permits new crop rotations and often extends the crop area. The breeding for early maturity crop varieties suitable for different date of planting.

6. Synchronous maturity.

It refers to maturity of crop species at one time. The character is highly desirable in crops like Greengram, cowpea, cotton, where several pickings are required for crop Harvest.

7. Desirable Agronomic characters.

It includes plant height, branching, tillering, capacity, growth habit, erect or trailing habit, etc. is often desirable.

8. Photo & Thermo Insensitivity

Development of varities insensitive to light & temperature helps in crossing the cultivation boundries of crop plants.

9. Wider Adaptability

Adaptability refers to suitability of a variety for general cultivation over a wide range of environmental condition.

10. Elimination of Toxic substance

It is essential to develop varieties free from toxic compounds in some crops to make them safe for human consumption.

Major Achivements of crop Improvement

1. Improvement of yield.
2. Improvement in quality
3. Resistance to biotic & Abiotic factors.
4. Earlyness
5. Adaptability.

Q2. Enlist conventional Breeding methods & modern innovative approaches of breeding & explain in detail.

Conventional breeding methods.

1. Mass selection
2. Pure line selection
3. Pedigree method
4. Bulk method
5. Backcross method.

Modern Innovative Approaches.

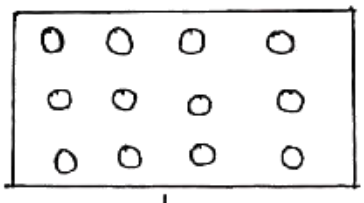
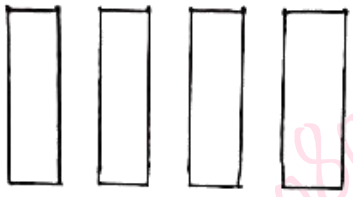
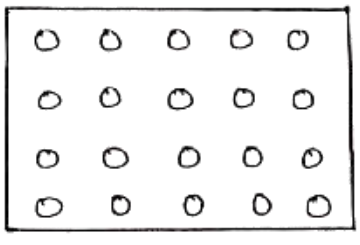
1. Somatic Hybridization
2. Transgenic breeding
3. Marker Assistance selection.

1. Mass selection

→ The variety is a mixture of several purelines.
→ It is practiced by the farmers unknowingly.
→ Practiced in self as well as cross pollinated crops
→ The variety is heterozygous hence not uniform and having genetic variation.
→ Progeny test is not carried out.
→ The varieties developed by mass selection have wider Adaptability & greater Stability.
→ About 5-7 years required for developing variety.

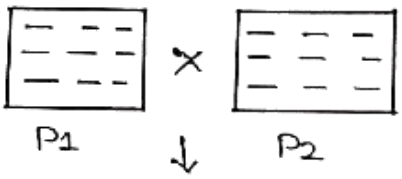
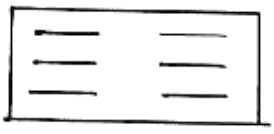
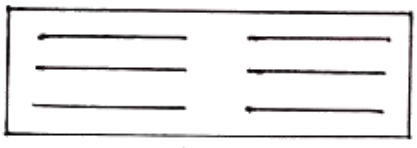
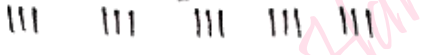
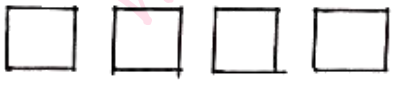
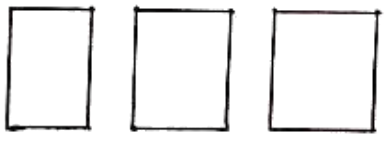
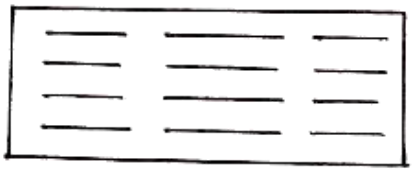
MASS SELECTION

It is a simplest common & oldest method of breeding in which large no. of similar phenotypes are selected & their seeds are mixed together to constituate new variety.

YEAR	GENERATION	FLOW DIAGRAM	EXPLANATION
FIRST YEAR -			i) From variable population 200 - 2000 plants with similar phenotypes selected. ii) Harvest seed in bulk.
second year	F_1.		i) Preliminary yield trial taken along with standard checks. ii) superior plant are selected by visual observation.
3rd - 5th year.	F_2 to F_4		i) superior plants are grown at several locations ii) If outstanding is found then it can be directly released as new variety.
sixth year	F_5.		i) seed multiplication & distribution to the farmers for growing next season.

2. PEDIGREE METHOD

In which relationship between parents their offspring is maintained generation after generation is called Pedigree method.

YEAR	FLOW DIAGRAM	EXPLANATION.
1st year		i) select two parent i.e. P_1 & P_2. ii) selected parents are planted in a crossing block. iii) Harvest their seeds in bulk.
2nd year		i) 10-30 plants are space planted. ii) Harvest their seeds in bulk.
3rd year		i) 2000-10,000 plants are space planted. ii) 100-150 superior plants are selected by visual observation.
4th year		i) Individual plant progeny are grown (100-150). ii) superior plants are selected.
5th year.		i) same as fourth year.
6th year		i) Individual plants progeny grown in multi row fashion with recomended seed rate. ii) superior plants are selected.
7th year.		i) same as sixth year.
8th year		i) preliminary yield trial taken. ii) quality tests are done by using check iii) superior plants are selected by V.O.
9-10-11 year.		i) superior plants are grown at multiplication. ii) Disease & quality tests are done. iii) superior plants selected & released as new variety.
12th year		i) seed multiplication & distribution to the farmers for growing next season.

Advantages of pedigree method

1. It take less time than bulk method to develop new variety.
2. Unpromising material is rejected in earlier generation.
3. Well suited for improvement of charecters.
4. We can get information about inheritance
5. It gives maximum opportunity to breeder to use his skill.

Disadvantages / Demerits.

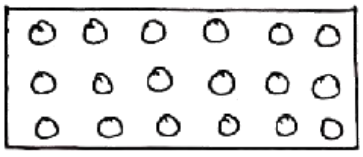
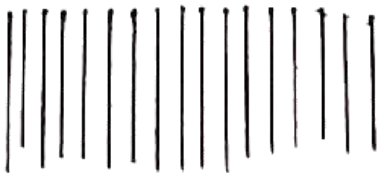
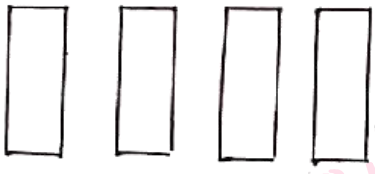
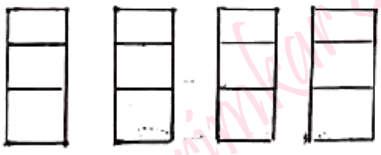
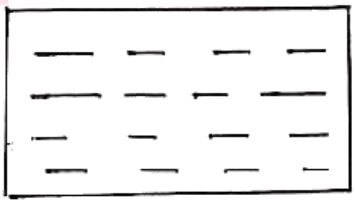
1. This method is more time consuming.
2. This method is laborius & expensive.
3. The sucess of this method is largely depend upon the skill of breeder.
4. selection for yield F2 & F3 generation is ineffective

Practical Achivement of pedigree method.

1. Wheat :- NP-52, NP-120, NP-80-5.
2. Rice :- Jaya & padma.
3. cotton :- Laxmi (Gadag x CO2)
4. Tomato :- Pusa early dwarf (Meeruti x red cloud).
5. chickpea :- T1, T2, T3, T5.

4. Pureline selection.

Pureline is a progeny obtained from single plant through self fertilization process.

Year	Generation	Flow diagram	Explanation
1st year			i) 200-3000 plants are selected on the basis of their phenotype.
2nd year	F1.		i) Individual plant progenies are grown. ii) superior plants are selected by visual observation. iii) May be repeated for next 2 years if necessary.
third year	F2		i) Preliminary yield trial taken. ii) superior plants are selected by V.O.
4th - 6th year	F4		i) superior plants are grown at multilocations ii) Inferior progenies are rejected. iii) Disease resistance & quality tests are done. iv) superior plants are directly released as new variety.
7th year	F5.		i) seed multiplication & distrubution to the farmers for growing next season.

Advantages of pureline selection.

1. pureline varieties are extremely uniform.
2. It is easier than hybridization.
3. Require less skill.
4. Use for developing inbred lines.
5. Easily identification in seed certification programme.

Disadvantages

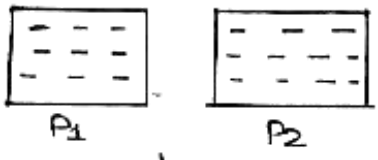
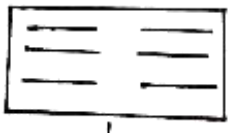
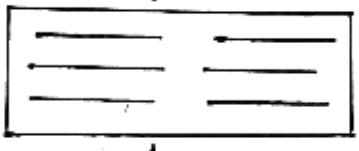
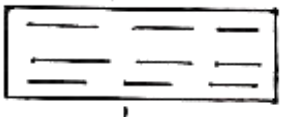
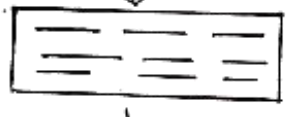
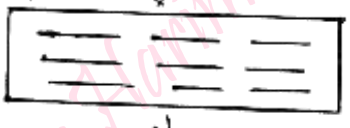
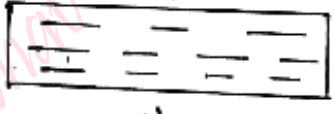
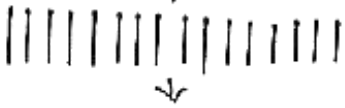
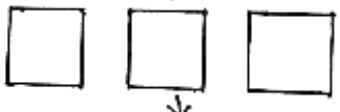
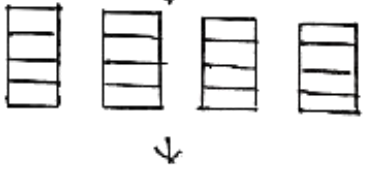
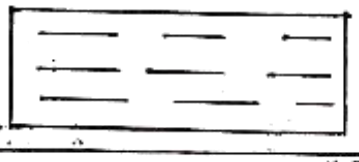
1. Not practiced in cross pollinated crops.
2. It is expensive & laborious than mass selection.
3. It has narrow adaptability.
4. It requires more time to develop new variety than mass selection.
5. The variety can't be easily maintained by farmers.
6. Breeder has to devote more time to pureline selection than mass selection.

practicle Achievement of pureline selection method.

1. Wheat - NP-4, NP-6, NP-12.
2. Mung - T1, B1.
3. Rai - L18
4. cotton - MCU-1, combodia coimbatore-2.
5. Rice - Mtu1, Mtu2, Mtu7.
6. Tobacco - Harrison special-9, chaltbam.

4. Bulk method

Bulk method of breeding first used by Nilsson ehle 1908.

Year	Generation	Flow diagram	Explanation.
1st year			i) select two parents. ii) selected parents are planted in a crossing block fashion.
2nd year	F_1		i) more than 20 plants are space. planted. ii) Harvest their seed in bulk.
Third year	F_2		i) F_2 generation is planted at commercial seed rate. ii) Harvest their seed in bulk.
Fourth year	F_3		
Fifth year	F_4		
Sixth year	F_5		same as third year.
Sevent year	F_6		
Eight year	F_7		i) 30,000 - 50,000 plants are space planted. ii) 1000-1500 superior plants selected. iii) seed harvested separately.
Nineth year	F_8		i) Individual plant progeny grown. ii) superior plants are selected.
10th year	F_9		i) Preliminary yield trial & quality test are done. ii) superior plants are selected.
11 to 13 year	F_{10} - F_{12}		i) superior plants are grown for multiplication. ii) If outstanding is found it can be released as new variety.
14th year	F_{13}		seed multiplication & distribution to the farmers.

Advantages / Merits of Bulk Method.

1. It is simple, convinient & inexpensive method.
2. No pedigree record to be kept.
3. Less work & attention is required.
4. Artificial selection may be practiced.

Disadvantages

1. It takes much longer time to develop new variety.
2. It provides little opportunity to breeder to use his skill.
3. Unpromising material is maintained in earlier generation.
4. A large no. of progenies have to be selected.
5. Information of Inheritance cannot be obtained.

Varieties

1. Barley - Arival, Beecher, Glacier.
2. Brown mustard - Narendra rai.

Back Cross Method.

1. It is proposed by Harlan & Pope in 1922 as a method of breeding small grain crops.
2. A cross between F_1 hybrid and one its parents is known as backcross.
3. The recipient parent is repeatedly used in the back cross programme, it is also known as recurrent parent.
4. The donor parent is known as the nonrecurrent parent because it is used only once in the breeding programme for producing F_1 wild varieties.
5. Generally 6-7 back crosses are necessary to recover the genotypes of the recurrent parent.
6. The main objectives of back crossing is to improve one or two specific defects of a high yielding variety which is well adapted to the areas and has other desirable characteristics.

Application

1. This method commonly used for the transfer of disease resistance from one variety to other also used for transfer of quantitative character.
2. It is applied in both self & cross pollinated crops.
3. Inter-varietal transfer of simply inherited characters governed by one or two major genes such as disease resistance, seed colour & plant height, etc.

Q3. Write in detail about Centre of origin, Distribution of spp. wild relatives of different crops.

SR.	Common name.	B.N	Family	CH.No.	origin	Wild relatives.
1.	Rice.	Oryza sativa	Poaceae	2n=39		O. nivara O. rufipogon O. barthii O. minuta.
2.	Maize	Zea maize	Poaceae	2n=20	Mexico	
3.	sorghum	sorghum bicolor	Poaceae	20, 40	Asia	i) cheeto sorghum. ii) Hetero -//- iii) para- -//- iv) stipo -//-
4.	pearl millet (Bajra)	Pennisetum typoids	Poaceae	2n=14	Africa	P. orientale P. clandestinum P. ciliare P. setaceum.
*	PULSES *					
1.	pigeonpea	cajanus cajan	Legumi-naceae	2n = 22	India	i) cajanus cajanifolia ii) cajanus acutifolis.
2.	Black Gram	vigna mungo	Legumi-naceae	2n = 22	India & central asia	vigna mungo x vigna radiata.
3.	Mung bean	vigna radiata	Legumi-naceae	2n = 22	India.	
4.	cow pea	vigna unguiculata	Legumi-naceae	2n = 22	Africa	
5.	soyabean	Glycine max	Legumi-naceae.			

Oilseeds.

SR.	C. Name	Botanical Name	Family	Origin	Wild relatives.
1.	Groundnut	Arachis hypogea	Fabaceae (2n = 20)	southern Bolivia	A. cardenassi A. benensis A. cardenasii
2.	Castor	Ricinus communis	Euphorbiceae (2n = 20)	Ethiopian Region	
3.	Sisamum	sesamum Indicum	Pedaliceae (2n = 26)	India	S. orientale S. occidentalis S. africanum.
4	Safflower	Carthamus tinctorius	Asteraceae (20, 24, 44)		C. palaestinus Eig. C. oxyacanthus Bieb.
	Fodder crops				
1.	Berseem	Trifolium alexandrium	Fabaceae (2n = 16)	syria	T. fragiferum T. patens T. philistaem.
2.	Lucern	Medicago sativa	Fabaceae (2n = 14, 16)	French	M. afganica M. coerulea M. media
3.	Rice bean	Vigna umbellata	Leguminaceae	Indochina	vigna mungo vigna radiata.
	Cash crops.				
1.	cotton	Goshypium sp.	Malvaceace (26, 52)	India & pakistan	G. bickii G. longicalyx G. Tolphyllum
2.	Tobacco	Necotina spp.	Nigutshade (2n = 4x = 48)		

Vegetable & Horticultural crops.

SR.	C. Name	B. Name	Family	origin	wild relatives.
1.	Ridge gaurd	Luffa spp.	cucurbitaceae (2n=26)	India	L. acutangula L. echinata L. graveolens
2.	Bottle gaurd	Lagenaria siceraria	cucurbitaceae (2n=22)	America	L. sphaerica L. abyssinica L. Ruffa.
3.	Snake gaurd	Trichosanthes cucumerina	cucurbitaceae (2n=24)	south-easten-Asia	T. dioica T. multiloba T. kirilowii.
4.	Bitter gaurd	Momordica charantia	cucurbitaceae (2n = 22)	Brazil	M. murica wild. M. operculata. M. elegans salisb.
5	Mango	Magnifera indica	Anacardiaceae (2n =40)	Asia	M. zeylanica. M. lauriga.
6.	cashewnut	Anacardium occidentale	Anacardiaceae (2n=24,30)	Brazil	A. Mediterranum A. Brasillense
7	Citrus	citrus sinensis	Rutaceae (2x = 18)	China & India	C. limonum C. Nobilis.
8.	Pomogranate	punica grantum	Lythraceae (2n= 16, 18)	Iran & India	P. florida salibs P. nana. L.
9.	Gauva	Psidium	Myrtaceae (2n=22,18	Mexico America.	

Q4. Define PGR - Plant genetic resource, Gene pool, Germplasm, Genetic erosion & write about germplasm collection & conservation types & methods.

Plant genetic Resource

The sum total of genes in a crop species is referred as genetic resources.

Gene pool

Gene pool refers to a whole library of different alleles of a species.

Germplasm

Germplasm refers to the total variability found in a plant species.

OR- The some total of genes in crop species is refers to as genetic resource / Gene pool / genetic stock / Germplasm.

Genetic erosion

The loss of variation in crops due to the modernization of agriculture has been describe as genetic erosion.

IMPORTANT FEATURES OF PGR.

i) Gene pool represent entire genetic variability available in a crop species.

ii) Germplasm consist of land races modern cultivars, obsolete cultivars, breeding stock, wild forms, and wild species of cultivable crops.

iii) Germplasm include both cultivated or wild species or relatives of crop plant.

iv) Germplasm is collected from centre of diversity, gene bank, markets and seed companies, Gene centuries, farmer fields.

v) Germplasm is the basic material for lounching a crop improvement programme.

vi) Germplasm may be indigious or Exotic.

Kinds / Types of Germplasm

1. Land Races

It include old varieties, and Ancestors.

2. obsulate cultivars

Improved varieties of recent past are known as obsulate cultivors, eg- wheat, - K-68, K65, PB 591 are tall varieties.

3. Modern cultivators

The currently cultivated high yielding varieties are called modern cultivator. also called improve cultivators. This variety have high yield potential and uniformality.

4. Advance Breeding Line

pre- released plant which have been develop by plant breeder for use in modern scientific plant breeding is called advance breeding line.

5. Wild forms of cultivated species

→ such plant have generally high degree of resistance to biotic & Abiotic stress & utilize breeding programme.

→ For genetic improvement of resistance to biotic and abitic stress.

6. Wild relatives

Are the important source of resistance to biotic & Abiotic [drought, cold, frost, salinity, stresses]

7. Mutant / Mutation

Mutation breeding is used when the desire charecter is not found in genetic stock of cultivated species & their wild relatives

eg- Mutant gene pool.

Rice gene :- Dee - Geo - Woo - Gen

Wheat :- NORINTEN

* Types of Germplasm collection. / seed collection

Based on the use and duration of conservation seed collection are of three types.

1. Base collections.
2. Active collections.
3. Working collections.

1. Base collection.

→ It is also known as principle collection. These consist of all the accessions present in the germplasm of a crop. They are stored at about 18 - 20°c with 5 ± 1 % moisture content. They are distributed only for regeneration.

→ When the germination of an accession is regenerated for reasons of safety, duplicates of base collections should be conserved in other germplasm banks as well as. High quality orthodox seeds can maintain good viability upto 100 years.

2. Active collection.

The accessions in an active collection are stored at temperature below 15°c & seed moisture is kept at 5 %. The storage is for medium duration i.e. 10 - 15 years. Germination test is carried out after every 5 - 10 years to assess the reduction in seed viability.

3. Working collection

The accessions being actively used in crop improvement programmes constitute working collection. Their seeds are stored for 3 - 5 years at less than 15°c and they usually contain about 10 % moisture. This collections are maintains by the breeders.

* Germplasm conservation

Conservation refers to protection of genetic diversity of crop plants from genetic erosion. There are two important methods of germplasm conservation or preservation viz,

1. In - situ conservation.
2. Ex - situ conservation.

1. In - situ collection

Conservation of germplasm under natural habitat is referred as in situ conservation. This is achive by protecting this area from human interference: such as area is often called as national park, biosphere reserve or gene sanctuary.

Demerits

1. Each protected area will cover only very small portion of total diversity of a crop species, hence several areas will have to be conserved for a single species.
2. The management of such areas also posses several problems.
3. This is a costly method of germplasm conservation.

Merits

A gene sanctuary not only conserves the existing genetic diversity present in the population, it also allows evolution to continue. As a result, new alleles & new gene combination would appear with time.

2. Ex - situ conservation.

Conservation of germplasm away from its natural habitat is called ex-situ germplasm conservation.

Advantages

1. It is possible to preserve entire genetic diversity of a crop species at one place.
2. Handling of germplasm is also easy.
3. This is a cheap method of germplasm conservation.
4. It is most common and easy method, relatively safe, requires minimum space & easy to maintain.

Q5. What is Biotic stress tolerance Breeding for disease and Insect Resistance.

Ans :-

Stress :- constraining influence, force, pressure or adverse conditions for crop growth caused by biological or environmental factors.

Biotic :- Adverse side effects due to pests and diseases abiotic stresses.

Abiotic :- Adverse effects on host due to environmental factor. eg, Drought, cold,-

Host :- Plant effected by a disease or which can accommodated pathogen.

Pathogen :- An organism that produce disease.

Disease :- An abnormal conditions in plant caused by an pathogen.

Mechanism of Disease Resistance.

There are different ways of disease resistance viz, disease escape, disease endurance or tolerance disease resistance & Immunity.

1. Disease escape

The ability of susceptible host plants to avoid attack of disease due to environmental conditions factors, early varieties, change

in the date of planting, change in the site of planting, balance application of NPK etc.

Eg :- Early varieties of groundnut and potato may escape 'Tikka' and 'Late blight' diseases respectively since they mature before the disease epidemic occurs.

2. <u>Disease Endurance or tolerance</u>

The ability of the plants to tolerate the invasion of the pathogen without showing much damage. This endurance is brought about by the influence of external characters. Generally tolerance is difficult to measure since it is confounded with plants

3. <u>True resistance</u>

It is the ability of host plant to resist or withstance the attack of a pathogen. True resistance is inheritable and much less subject to environmental influence. It is specific in character.

→ Functional nature of resistance is determined by opening of stomata, time of opening of flowers and time of maturity, rate of cork formation and cambial activity.

Methods of breeding for disease resistance.

1] selection

2] Introduction

3] Hybridization

i) pedigree method

ii) Backcross method

iii) Bulk method.

4] Marker assisted selection.

5] Genetic engineering.

Types of Disease resistance.

Vertical resistance

Horizontal resistance.

1] vertical resistance.

→ control by major genes (1 or 2 genes).

→ Genes are readily transferred from one genotype to another.

→ presence of genes can be determined by exposing plants to particular races

eg → leaf rust resistance in wheat.

2] Horizontal resistance.

→ control by many genes each with minor effects.

→ can control a broad range of races due to fact that many loci are involved

→ Difficult to transfer resistance from one genotype to another.

Q6. Breeding for Insect Resistance. Write in brief.

Ans **Introduction**

1. Insects are important factor of biotic stress in crop plants.
2. Insects attack all the crop plant and lead to considerable losses in yield as well as quality.
3. Insect attack leads to various types of damages –
   i) Reduction in plant growth or stunting.
   ii) Damage of vegetative & reproductive parts.
   iii) Premature defoliation.
   iv) Wilting of plants.

Mechanism of Insect Resistance.

There are four mechanisms of insect resistance, viz

1] No preference
2] Antibiotic
3] Tolerance
4] Avoidance or escape

The first three mechanism given by painter (1951) & fourth added subsequently.

1. Non - Preference

Non- preferance refers to various features of host plant make the host undesirable for unattractive to insects for food, shelter, or reproduction.

→ This types of insect resistance is also known as non - acceptance and antixenosis.

→ In some cases, non preferance is so strong that insects migrated from resistant plants, for eg- aphid resistance in raspberry.

2] Antibiotics

Antibiotics refers to the adverse effect of host plants on the development and reproduction of insect pest which feed on resistance plant.

→ Resistance plants retard the growth and rate of reproduction of insect pest. In some cases, antibiotics may lead even to death of an insect.

→ An antibiotics is considered as the true form of resistance to insect pests,

→ In cotton, antibiotics is related with high level of gossypol, tannis, heliocides and silica contents, antibiotics may involve morphological, physiological & biochemical features of the host plant.

3. Tolerance

Tolerance refers to the ability of a variety to produce greater yield than suceptible variety at the same level of insect attack. In other words, a tolerant variety will give higher yield than susceptible one despite the insect attack. The tolerance is measured in terms of rejuvenation potential, healthy leaf growth, flowering compensation potential and superior plant vigour.

4. Avoidance & Escape.

Avoidance refers to escape of a variety from insect attack either due to earliness or its cultivation in the season where insect population is very low.

eg:- Early maturing cotton varieties escape pink bollworm infestation which occurs late in the season. Avoidance is also an effective means of protecting crop from the damage of insect pests.

Factors for Insect - resistance.

1. Morphological
   (hairiness, colour, thickness & toughness)

2. Physiological

3. Biochemical features

Genetics of Insect resistance.

1. oligogenic resistance
2. Polygenes
3. cytoplasmic genes.

1. **Oligogenic resistance.**

Insect resistance is governed by one or few major genes or oligogenes, each genes having a large and identifiable individual effect on resistance. Oligogenic resistance may be conditioned by the dominant or the recessive allele of the concerned gene. The difference between resistance and susceptible plants are generally large and clear - cut. In several cases, resistance is governed by a single gene (monogenic resistance.

2). **Polygenic Resistance:-** It is governed by several genes, each gene producing a small and usually cumulative effect. such cases of resistance.

* source of Insect resistance

1. cultivable variety
2. A related wild species.
3. Germplasm collection
4. An unrelated organisms.

Breeding methods for Insect Resistance.

1. Introduction
2. selection
3. Hybridization
4. Genetic Engineering

Problems in Breeding for Insect Resistance.

1. Breeding for resistance to one insect pest may leads to the susceptibility to another pest.

   eg:- Glabrous strains of cotton are resistance to bollworms but susceptible to jassids.

2. Reduction is quality or make unfit for consumption.
3. Linkage between desirable & undesirable genes.
4. screening for resistance is the most critical and difficult step is a breeding programme It necessitates a close co-ordination among scientists.
5. It is long term programme.

Q7. Define Abiotic stress and write down breeding mechanism for drought resistance.

Abiotic stress

Abiotic stress is the negative impact of non-living factors on the living organisms in a specific environment.

Introduction.

→ Drought is a period or condition of unusually dry weather within a geographic area where there is a lack of precipitation.

→ Drought is governed by various factors, the most prominent being extremes in temperature, photon irradiance & paucity of water.

Mechanism of Drought Tolerance

1. Drought Escape

It is defined as the ability of a plant to complete its life cycle before supply of water in soil is depleted and form dormant seeds before the onset of dry season. These plants are known as drought escaper since they escape drought by rapid development.

2. Drought Avoidance

It is the ability of plant to maintain relatively high tissue - water potential despite a shortage of soil - moisture.

Drought avoidance is performed by maintainance of turgor through roots grow deeper in the soil, stomatal control of transpiration and by reduction of water loss through reduced epidermal i.e. reduced surface by smaller and thicker leaves.

3. Drought Tolerance

→ It is the ability to withstand water-deficit with low tissue water potential.

→ Drought tolerance is the maintenance of turgor through osmotic adjustment increase in elasticity in the cell and decrease in cell size.

* Effect of drought stress

1. Effect on growth

Reduction in turgor pressure, due to cell sizes will be smaller

2. Effect on photosynthesis

photosynthesis decreases due to disruption of PS II, stomatal closure, decrease in electron transport.

3. Decrease in nuclear acids and proteins.

protease activity ↑, free aa ↑, RNAase activity ↑, RNA hydrolysis, DNA content falls down.

4. Effect on Nitrogen metabolism.

Nitrate reductase activity ↓, nitrate reductase activity insentive

5. Effect on carbohydrate metabolism.

Loss of Starch and increse in simple sugars, carbohydrate translocation decreases.

Q8. Breeding for salinity and write in detail about salt tolerance breeding.

High salinity affects plants

- Water stress
- Ion toxicity.
- Nutritional disorders.
- oxidative stress.
- Alteration of metabolic processes, membrane disorganization.
- Reduction of cell division and expansion.

Salinity occurs through natural or human-induced processes that result in the accumulation of dissolved salts in the soil water to an extent that inhibits plant growth.

Salinity can be overcome by.

1. soil reclamation

   costly, time consuming & short lived.

2. Resistance varieties

   Less costly; more effective, long lasting but require longer period to develop.

Mechanism of salt tolerance

1. salt tolerance

   → By accumulating salt, generally in their cells

or glands or roots.

→ Halophytes show tolerance by ion accumulation mechanism.

2] Salt Avoidance

By maintaining their cell salt concentration unchanged either by water absorption (eg- Rice, chenopodiaceae) or by salt exclusion [eg- tomato, soybean, citrus, wheat grass).

Glycophytes own their resistance primarily to avoidance eg- barley.

characteristics of plant to salt.

→ Land races more tolerant than yielding varieties.

→ salt tolerance capacity differs from species to species.

→ Different plants show differential respone to salinity.

source of salinity resistance

- cultivated variety
- Germplasm collection
- Related species
- somaclone
- transgenes

classified based on salt tolerance

1. High tolerant crops

   sugar beet, Barley, cotton, Date palm,

2. Moderately tolerant

   Barley, Rye, sorghum, wheat, safflower, soy bean.

3. Moderate sensitive

   Rice, corn, Fox-tail millet, cowpea, peanut, sugarcane, Tomato, potato Raddish, cabbage

4. Extremely sensitive

   Citrus, strawberry, melon, peas, carrot, okra, onion.

Varieties Identified for salinity tolerance

- Rice :- CSR-49, CSR-36, CSR-30, CSR-27, CSR-23, Mohan, Lupishree.
- Wheat :- KRL-213, KRL-210, KRL-19, KRL-1-4.
- Indian Mustard :- CS-56, CS-54, CS52.
- Chick pea :- Karnal chana-1.
- Dhaincha :- CSD-137, CSD-123.

Q9 Breeding for quality, what is quality traits, nutrition & nutrient

Quality

quality refers to many aspects like colour, size, nutrient content, self life and suitability for processing.

Quality Trait

" A trait defines aspects of quality of produce".

Classification of quality traits.

1] Morphological
2] Organoleptic
3] Nutritional
4] Biological
5] Other

1] Morphological Traits

→ Related to produce apperance mainly concerned with size & colour of the produce eg:- grain/fruit size, grain/fruit colour, etc.
→ Easily observable
→ Usually play the main role in determining consumer acceptance of the produce.

2] Organoleptic Traits

→ concerned with palatability of the produce.
eg:- Taste, aroma, smell, juiceness, softness, etc.

→ Easily detected.

→ very important in influencing consumer preferences.

3. Nutritional Quality

→ Determine the value of the produce in human/ animal nutrition.

→ Include protein content & quality, oil content & quality, vitamin content, mineral content, etc.

4. Biological quality traits

→ The traits include in this group define the actual usefulness of the produce (human) when consumed by experimental animals.

→ Example:- protein efficiency ratio, biological value, body weight, etc.

Source of quality traits

1] A cultivated variety,

2] A germplasm line,

3] A spontaneous or induced mutant.

4] A somatic variant

5] A wild relative

6] A transgene.

Breeding for low toxic substance

* In some grain legumes, oilseeds, vegetable, fruits & forage crops toxic substances are found.
* These toxic substances have adverse effects on human & animal health.
* Feeding of forage with toxic substance will adversery effect when consumed by animals.
* Therefore, It is essential to develop varieties of forage & food crops with low level of toxic substance so that should not have adverse effect when consumed by animals.
* Breeding for reduction in toxic substances requires lot of chemical analysis.
* Hence development of simple, cheap, rapid & reliable methods of chemical analysis is essential.

Breeding methods

1. Back cross
2. pedigree method
3. single seed descent
4. Recurrent selection
5. progency selection
6. Mutation breeding.

Practical Achivements

* varieties with improved quality have been developed in several food crops in many countries.
* In common bean, seed protein has been increased from 21.9 to 24.6 & in soyabean seed from 42.8 to 46.1 %.
* In sunflower, seed oil content has been increased from 32% to almost 50 % in USSR, and safflower from 37 to 50 %.
* In maize, seed oil content has been increased from 4.7 - 17 % protein content from 10.9 to 23.5 %.
* In wheat, Atlas - 66 is an important source of high protein which is being used in breeding programmes for improvement of protein content.

Q 10. Define Ideotypes & Write about the types of Ideotypes, characteristics, steps, & In detail about Ideotype in Rice, Wheat, sorghum,

Ideotype (Donald 1968).

In broad sense an Ideotype is a biological model which is excepted to perform or behave in a predictable manner within a defined environment.

More specifically, crop Ideotype is a plant model which is excepted to yield greater quantity of grains, fibre, oil or other useful product when developed as a cultivar.

The term Ideotype was first proposed by Donald in 1968 working on wheat.

Steps in Ideotype Breeding

1]. Development of conceptual theoretical model.

2]. selection of base material

3] Incorporation of desirable characters into single genotype.

4] selection of ideal or model plant type.

1] Development of conceptual theoretical model.

* Ideotype consist of various morphological and physiological traits. The values of various

of various morphological and physiological traits are specified to develop a conceptual theoretical model.

* For eg :- i) plant height is important in fodder crops.
  ii) Maturity duration is important in rainfed.
  iii) similarly leaf number, leaf angle, leaf size, photosynthetic rate, etc.

Selection of Base Material

* selection of base material is an important step after development of conceptual model of ideotype.
* Genotype to be used in devising a model plant type should have broad genetic base and wider adaptability so that the new plant type can be successfully grown over a wide range of environmental condition with stable yield.
* Genotypes for plant stature, maturity duration, leaf size, and angles are selected from the global gene pool of the environmental condition with stable yield.
* Genotype resistant or tolerant to drought, soil salinity, alkalinity, disease and insects are selected from the gene pool with the cooperation of physiologist, soil scientist, pathologist and entomologist.

3. Incorporation of Desirable Traits.

→ The next important step is combining of various morphological and physiological traits from different selected genotype into single genotype.

→ Knowledge of the association between various character is essential before starting hybridization programme, because it help in combining of various characters.

→ Linkage between procedures, viz single cross, three way cross, multiple cross, backcross, composite crossing eg:- mutation breeding, heterosis breeding, etc.

4. Selection of Ideal plant Type.

→ plant combining desirable morphological and physiological traits are selected in segregating population and intermated to achive the desirable plant type.

→ morphological features are judged through visual observation and physiological parameters are recorded with the help of sophisticated instruments.

→ Finally, genotypes combining traits specified in the conceptual model are selected, multiplied, tested over several locations & release for cultivation.

Merits of Ideotype Breeding

1. Ideotype breeding is an effective method of enhancing yield through manipulation of various morphological & physiological crop characters, Thus, It exploits both morphological and physiological variation.

2. In this method of various morphological and physiological traits are specified and each character or trait contributes towards enhanced yield.

3. Ideotype breeding involves experts from the discipline of plant breeding, physiological, biochemistry, entomology & plant pathology.

4. Ideotype breeding is an effective method of breaking yield barriers through the use of genetically controlled physiological variation for favorable characters.

5. Ideotype breeding provides solution to several problems.

6. It is effective method of developing cultivars for specific or environment.

Demerits of Ideotype breeding.

1. Incorporation of several desirable morphological and physiological and disease resistance traits from different sources into a single genotype is difficult task.

2. Ideotype breeding is a slow method of cultivar development.
3. Ideotype breeding is not a substitute for traditional or convential breeding.
4. Ideotype is a moving object which changes with change in knowledge, new requirements, national policy, etc.

Ideotype breeding for wheat.

1. A short strong stem. It imparts lodging resistance and reduces the losses due to lodging.
2. Erect leaves. such leaves provide better arrangement for proper light distrubution resulting in high photosynthesis or CO_2 fixation.
3. Few small leaves, leaves are the important site of photosynthesis, respiration, and transpiration, few & small reduce water loss due to transpiration.
4. Larger ear, It will produce more grain/ear.
5. A presence of awns. Awns contribute towards photosynthesis.

Maize

In 1975, Mock & Pearce proposed ideal type of maize, In maize, higher yield were obtained.

from the plants consisting of -

1) Low tillers
2) Large cobs
3) Angled leaves for good light interception.

Q 11 Define Emasculation, Pollination, qualitative & quantitative characters, Pleitropy.

Pollination

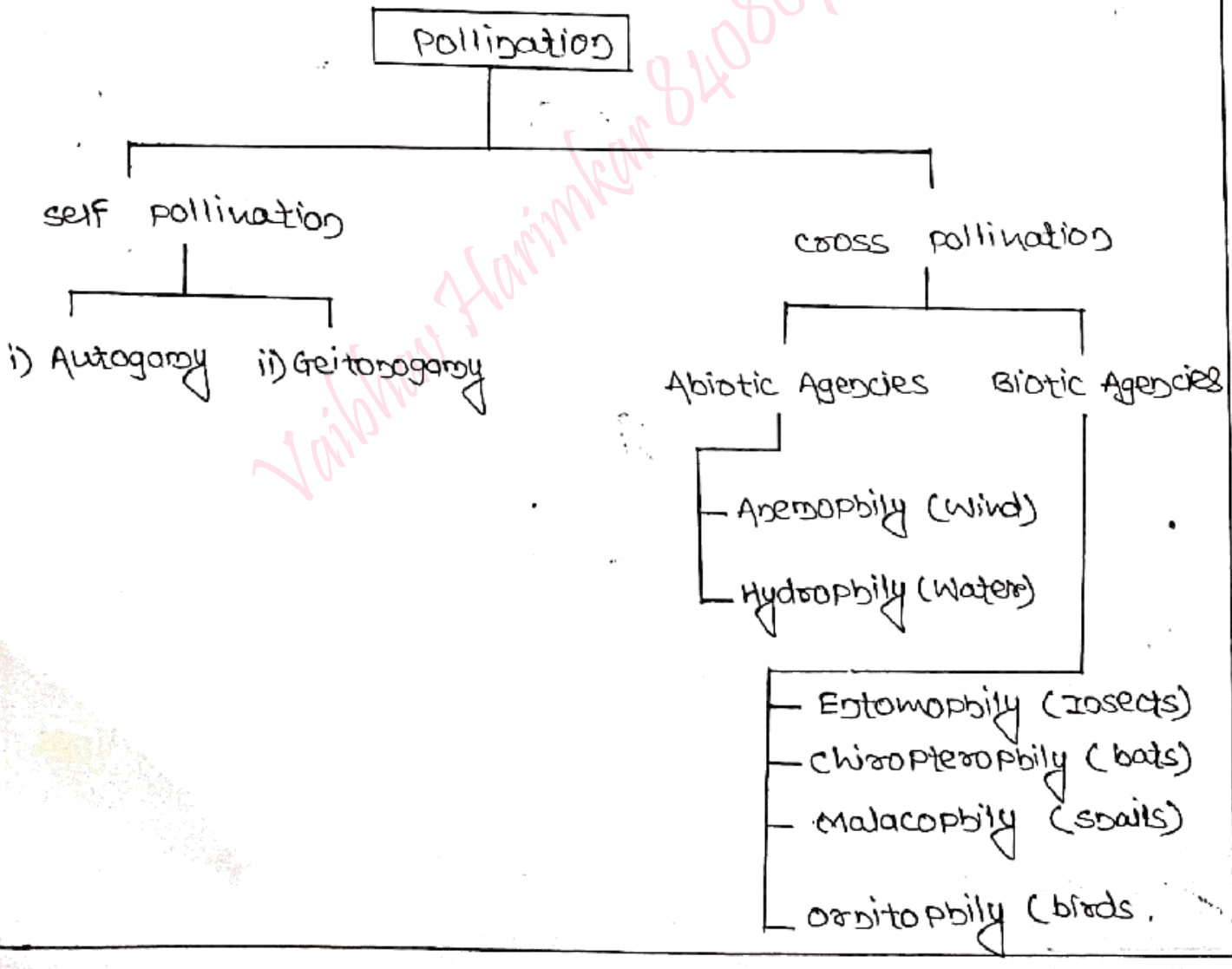
The transfer of pollen grains from the anther to the stigma of a flower.

Types of Pollination.

Two types of Pollination

1] self - pollination

2] cross - pollination



self pollination

→ It is the transfer of pollen grains from the anther of a flower to the stigma of either the same or genetically similar flower.

→ Accordingly, self pollination is of two types, autogamy and geitonogamy.

i] AUTOGAMY

It is a type of self pollination in which an hermaphrodite or perfect flower is pollinated by its own pollen.

ii] GEITONOGAMY

It is a type of pollination in which pollen grain of one flower are transferred to the stigma of another flower belonging to either the same plant or genetically similar plant

→ In geitonogamy, the flowers often show modifications similar to ones found in xenogamy or cross pollination

Advantages of self- pollination

1. It maintains the parental characters or purity of the race indefinitely.
2. self pollination is used to maintain pure lines for hybridisation experiments.
3. The plant does not need to produce large number of pollen grains.

4. Flowers do not develop devices for attracting insect pollination.

Disadvantages of self pollination.

1. New useful characters are seldom introduced.
2. Vigour and vitality of the race decreases with prolonged self pollination.
3. Immunity to changed environment are reduced.

CROSS POLLINATION

Cross pollination is the transfer of pollen grains from the anther of one flower to the stigma of a genetically different flower.

Cross pollination is perform with the help of an external agency.

ANEMOPHILY

It is a mode of cross pollination or transfer of pollen grains through the agency of wind.

eg:- coconut palm, date palm, maize, many grasses, cannabis.

characteristics

→ The flowers are colourless, odourless and nectarless.

→ Pollens grains are light, small and winged or dusty, dry smooth, nonsticky and unwettable

→ stigma is hairy, feathery or branches to catch the wind - borne pollen grains.

→ pollen grains are produced in very large number.

Hydrophily (Water)

It is the mode of pollination or transfer of pollen grains through the agency of water.

Eg :- Zoostera, Vallisneria.

Characters

→ Flower are small and inconspicuous.

→ Nectar and odour are absent.

→ pollen grains are light and unwettable due to presence of mucilage cover.

→ Stigma is long, sticky but unwettable.

ENTOMOPHILY

The pollen grains are transferred to a mature through the agency of insects like moths, butterflies, wasps, bees, beetles.

ORNITHOPHILY

It is the mode of allogamy performed by birds. Only a few types of birds are specialised for this. They usually have small size and long beaks.

Q 12. Explain in detail

Ans :- Oligogenes :- such characters are generally governed by one or few genes with large easily detectable effects This genes are called oligogenes.

Qualitative characters

Oligogenes produce the characters having distinct classes These characters are called qualitative characters.

OR. In other words qualitative characters are such characters which show distinct classes, are little affected by environment are governed by one or few genes.

Polygenes

governed by several genes are called polygenes.

Quantitative characters

In other words, the quantitative characters show continuous distribution, are generally influenced by the environment and are controlled by several genes.

* Pleiotropy *

A single major genes i.e. oligogene generally governs a single character but there are many instances where an oligogene affects more than one character. such phenomenon of a single major gene affecting more than one character is known as pleiotropy and such a genes action is called pleiotropic gene action.

* Penetrance *

Penetrance is the ability of a gene to express itself in the individual carrying it in the appropriate genetype.

eg:- A gene that causes partial chlorophyll deficiency in the cotyledonary leaves of lima beans. But only about 10 % of the seedlings carrying such gene show chlorophyll deficiency.

It means such gene has 10 % penetrace i.e. It expresses itself in 10 % of the individuals carrying it.

Expressivity

Expressivity is the ability of gene to express itself uniformaly in all the individuals that carry it.

Threshold characters.

certain genes requires a specific environment for their expression, such characters are called threshold characters.

eg:- A mutant gene in barley produce albino seedlings at temperatures below 8°C.

Modifying genes

The genes modify the effects of other genes are called modifying genes.

Difference between

	Qualitative characters		Quantitative characters
1.	It deals with the inheritance of traits of kind, viz, form, structure colour, etc.	1.	It deals with the inheritance of traits of degree, viz, heights of length, weight, number etc.
2.	Discrete phenotypic classes occurs which display discontinuous variations.	2.	A spectrum of phenotypic classes occurs which contain continuous variation.
3.	Each qualitative traits is governed by two or many alleles of a single gene.	3.	Each quantitative trait is governed by many non-allelic genes or polygenes.
4.	It concerns with individual mating and their progency.	4.	It concerns with a population of organisms consisting of all possible kinds of matting.