Chapter-9

Strategies for Enhancement in Food Production

IMPORTANT scientist and his contribution-Norman E Borlaug ---Developed semi dwarf variety wheat

IMPORTANT TERMS

1.MOET - MULTIPLE OVULATION EMBRYO TRANSFER TECHNOLOGY

2.SCP - SINGLE CELL PROTEIN

3. **Breed**: Group of animals similar in most of the characters and related in descent

4. Superior female: Cow or buffalo that produces more milk per lactation.

5 .Superior male: Bull that gives rise to superior progeny

6.somaclones – A group of plants that are genetically identical

Animal Breeding-objectives: 1.Increasing yield 2..To improve desirable qualities.

Methods: i).**Inbreeding**:-Breeding between same breed for 4-6 generations. Eg.- cows, buffaloes, poultry **Inbreeding depression**- continued in breeding increases homozygosity of harmful recesive genes.

METHODS TO OVERCOME INBREEDING DEPRESSION

ii) **Outbreeding**- breeding between unrelated animals of two types –

1.) **Out crossing**- mating within the same breed but not having ancestors.

2.) **Crossbreeding**- superior males of one breed are mated with superior females of another breed to get better progeny. eg.. **Hisardale**- is a new breed of sheep developed in Punjab by crossing Bikaneri Eves and Marino Rams.

3*)* **Interspecific hybridization**- male and female animals of two different species are mated. E.g.- mule is crossbreed of male donkey and female horse.

.**CONTROLLED BREEDING EXPERIMENTS**

(a)Artificial insemination- semen of superior male is collected and injected unto the reproductive tract of selected female. The spread of certain diseases can be controlled by this method.

(b) **MOET-** Technique for herd improvement by successful production of hybrids.

Steps-MOET

i) Hormone(FSH) are administered to the cow for inducing follicular maturation and super ovulation. ii)

Cow produces 6-8 eggs instead of one egg & is either mated with elite bull or artificially inseminated. iii) Fertilised egg at 8-32 cell stage are recovered non-surgically & transferred to surrogate mother. iv)

Done in cattle, sheep, rabbits etc.

Bee keeping(apiculture) is the maintenance of hives of honey bees for production of honey and beeswax.

Important points of bee keeping

1.Knowledge of the nature and habits of bees

2.selection of suitable location for keeping the beehives

3.Catching and hiving of swarms

4.Management of bee hives during different seasons

5.Handling of honey and beeswax.

Fisheries: An industry devoted to catching ,processing or selling fish ,shellfish or other aquatic animals

Types

1.Pisciculture: Breeding ,hatching and rearing of fish under controlled conditions

2.Aquaculture : Cultivating freshwater and saltwater organisms under controlled conditions

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

Steps in Plant breeding:-

1 **Collection of variability**-Collection and preservation of all different wild varieties, species, relatives of cultivated species etc. It is also called germplasm collection.

2.**Evaluation and selection of parents**-Germplasm is evaluated to identify plants with desirable traits.

3.**Cross hybridization among the selected parents**-Two plants having two desired characters are hybridized to get new hybrid having superior characters.

4.**Selection and testing of superior recombinants**-Selection of recombinant having desired character combinations.

5.**Testing, release and commercialization of new cultivars**-Newly selected lines are evaluated for their yield, agronomic traits, disease resistance etc. and released into the market.

Green revolution - Development in Crop production.

Blue revolution - Development in Fish production

Plant breeding for disease resistance : Breeding and development of cultivars resistant to diseases.

Advantages: Increased productivity, reduced dependence on use of fungicides and bactericides

Types

1.Conventional breeding: Involves hybridization and selection.

Steps are - germplasm collection, screening the germplasm for disease resistance, hybridization, selection and evaluation of hybrids, testing and release of new varieties.

2.Mutational breeding

It involves inducing mutations artificially through use of chemicals or radiations and selecting and using the plants that have desirable characters as source in breeding

Eg. mung bean resistant to yellow mosaic virus and powdery mildew

: Limited number of disease resistant genes in crop varieties are in their wild relatives

Eg. Parbhani kranti(bhindi) resistant to yellow mosaic virus.

Plant breeding for developing resistance to insect pests

Insect resistance is due to morphological, biochemical or physiological characteristics of the crop variety

Eg. 1.Hairy leaves offers resistance to insect pests like jassids

2.Solid stem in wheat resists attack by saw fly 3. Smooth leaves and nectar rless condition resist cotton bollworms.

4.High aspartic acid ,low nitrogen and sugar content resists attack by stem borer(maize)

Biofortification-Breeding crops with higher levels of proteins, vitamins and minerals eg., Vit A enriched carrots and spinach , Vit C rich bitter gourd, mustard, tomato; protein rich beans lablab etc.

Eg. Atlas 66 Maize variety having high protein content Iron fortified rice

SCP (Single cell protein)-

Protein rich cell biomass from microbes such as bacteria, yeast, algae are used as alternative food.

Eg-Spirulina can be grown in waste water (from potato processing plant) to produce protein rich biomass treated as food.

Eg. 250g Methylophilus methylotrophus produces 25 tonnes of protein

Advantages : i) Provides protein rich food supplement ii) Reduces pressure of conventional agricultural production iii)Use of Waste water reduces pollution level iv) High rate of biomass production in short period.

Tissue culture-

Technique of in vitro regeneration of whole plant by growing any plant part called **explant** in culture medium under aseptic condition. includes following methods:

1.Micropropagation-

Tissue culture technique used for rapid vegetative multilication of ornamental plants and fruit trees by using small explants. The process generates somaclones.

2.Meristem culture -helps in the recovery of healthy plants from diseased plant parts.

3 .**Somatic hybridisation**.-fusion of isolated protoplasts(cells without cell wall- naked cells) from two different varieties of plants. eg. Fusion of tomato and potato cells

Crop varieties resistant to diseases

CROP	VARIETY	RESISTANCE TO DISEASES
WHEAT	HIMGIRI	LEAF AND STRIPE RUST,HILLBUNT
BRASSICA	PUSA SWARNIM	WHITE RUST
CAULI FLOWER	PUSA SHUBHRA PUSA SNOWBALL	BLACK ROT. CURL BLIGHT BLACK ROT
COWPEA	PUSA KOMAL	BACTERIAL BLIGHT
CHILLI	PUSA SADABAHAR	CHILLY MOSAIC VIRUS, TOBACCO MOSAIC VIRUS, LEAF CURL

LIST OF HIGH YIELD VARIETIES OF PLANTS OF IMPORTANCE

Sl. No.	Plants	Name of breed	Distribution	Type of varieties
01.	Rice	IR-8	Philippines	Semi-dwarf
		Taichung Native-1	Taiwan	Semi-dwarf
		Jaya	India	Semi-dwarf
		Ratna	India	Semi-dwarf
02.	Wheat	Sonalika	India	High yield
		Kalyan sona	India	Disease resistant

Crop varieties resistant to INSECT PESTS

CROP	VARIETY	INSECTPESTS
Brassica	Pusa gaurav	aphids
Flat bean	Pusa sem 2 Pusa sem3	jassids,aphids
Okra(bhindi)	Pusa sawani Pusa A 4	Shoot and plant borer

Questions

I MARK

Q1.Name two techniques involved in controlled breeding experiments.

Q2.What is blue and green revolution?

Q3. What is inbreeding depression?

Q4. What is 'Heterosis' or hybrid vigour?

Q5 .What is Pomato?

Q6.Name the algae used as protein rich food.

Q7. Expand- MOET and SCP.

Q8.What is cultivar?

2 MARKS

Q1. What is Biofortification?

Q2.Which part of the plant is best suited for making virus free plants?

Q3.What is breed? What are the objectives of animal breeding?

Q4.Define out-crossing? Suggest an advantage.

Q5.What is artificial insemination? What is its importance?

Q6. What are the differences between aqua and pisciculture?

Q7. What is animal husbandry?

Q8. Name the most common species of honey bees of India? What are the products from the honey bees?

Q9 What is germplasm? How it is maintained?

3 MARKS QUESTIONS

Q1.What does inbreeding mean? Suggest its advantages. What is the danger of inbreeding?

Q2.Name the methods employed in animal breeding. Which method is the best? Why?

Q3. Explain the procedure of MOET technique in cattle.

Q4. What is interspecific hybridization ? Give one example of crop in which it is practiced and mention one advantage.

Q5. What is cross-breeding ? What advantages does it have? Give an example

5 MARKS QUESTIONS

Q1. Explain the points that have to be considered for successful bee- keeping?

Q2. Write the scientific name of sugarcane grown in north and south India respectively. Mention their characteristic features. Mention the characteristic of the hybrid produced by crossing these two varieties .

Hint :North – Saccharum barberi. South – Saccharum officinarum . High yield ,thick stems , higher sugar content , ability to grow in both North and South India

Q 3. Describe various steps involved in plant breeding.

Hint: Collection of variability, Evaluation and selection of parents, Cross hybridisation among the selected parents, Selection of testing of superior Recombinants, Testing , release and commercialization of new cultivars