Animal Husbandry

The growing world population is accompanied by many problems, the most important being a shortage of food materials. Scientists all over the world are engaged in finding out new methods for enhancement in food production. One focus regarding this is animal husbandry. Let us take a look.

Animal Husbandry

It is a branch of agriculture concerned with rearing breeding and feeding animals to obtain useful products. Animals are basically reared for various products like:

- Meat- animals include cattle, Sheep, goat, etc
- Milk- animals include cows, buffaloes, camels, goats, etc
- As manual labor in farms- these include horses, bull, yaks,
- For egg- Poultry birds like hen, geese, duck, etc

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Management of Farm and Farm animals

1. Dairy Farm Management

Most common diary animals include cows buffaloes sheep and goat. Milk and Milk products rich in fat, protein, carbohydrate, vitamin A, B, D and E, Minerals like calcium and phosphorous. Certain points to be taken care of a dairy farm.

- Good breeds of an animal should be selected as quality and quantity of product depends upon the breed of the animal.
- An animal must be housed well and fed properly.
- Good sanitary conditions and hygienic environment is to be maintained in the cattle farms as well as the milking areas.
- Hygiene of cattle handlers is also as important.
- Cattle should be vaccinated against diseases and regular check-up should be maintained.

2. Poultry Farm Management

Management includes the domestication of birds like hens, turkey, geese, duck, etc. They are reared for high-quality meat and eggs. Management of poultry includes proper cleaning and maintaining proper hygienic conditions in the cages.

Animal breeding

An important part of animal husbandry is the breeding of animals. Breeding is the crossing of two animals to improve the desirable qualities by choosing two animals having better traits. A group of animals related by descent and similar in most characters such as general appearance, features, size, etc.

Aims of breeding

- To increase the yield of animals.
- To improve desirable qualities in a produce.

Types of Breeding

Inbreeding

In animal husbandry, the mating of more closely related individuals of the same breed for four generations is known as inbreeding. Superior

females and superior males of closely related individuals are identified and mated. The outcomes of inbreeding are as follows

- Develops homozygous pure lines of the animal.
- Exposes recessive genes for undesirable characters which may be eliminated.
- Leads to accumulation superior genes and elimination of undesirable genes.
- Continued inbreeding leads to reduced fertility and productivity of the animal. This is called inbreeding depression. It can be overcome by mating the animal with an unrelated superior animal of the same breed.

Outbreeding

Animals of different breeds are crossed it is called outbreeding. It includes out-crossing, cross-breeding, and interspecific hybridization.

- *Out-crossing:* It is the mating between animals of the same breed, but not having common ancestors for 4 − 5 generations. It is usually used for animals, which have below average

productivity and growth rate. It helps to overcome inbreeding depression

- *Cross-breeding*: It is the mating between a superior male of one breed with a superior female of another breed. Superior qualities of both the breeds combine and this is known as hybrid vigour. The progeny so formed is called a hybrid. A hybrid may be used as it is or may be further subjected to inbreeding. Example: Hisardale sheep is a hybrid of Bikaneri ewes and Marino rams.
- *Interspecific Hybridization:* Males and females of different, but related species are mated. Progeny has desirable features of both the species. Example − Mule is an interspecific hybrid of donkey and horse. It is swifter and stronger than donkeys and more disease resistant than a horse.

Controlled Breeding Techniques

1. Artificial Insemination

Semen is collected from the male and injected into the reproductive tract of the female. Semen can be frozen for later use or used immediately.

2. Multiple Ovulation Embryo Transfer (MOET) Technology

The cow is administered with an FSH-like hormone, which induces follicular maturity and superovulation. In superovulation, instead of one egg/cycle, 6 − 8 eggs are produced per cycle. The cow is either naturally mated with a superior bull or artificially inseminated. A fertilized egg is recovered at 8 − 32 cell stages non-surgically and transferred to a surrogate mother.

The genetic mother is again available for another cycle of superovulation. Using this technique, high milk-yielding breeds of females and lean meat-yielding bulls have been bred successfully.

Apiculture

Another form of animal husbandry is apiculture. Apiculture is the practice of bee-keeping. It includes maintenance of beehives for the production of honey. Honey is a very useful product with varied uses. It has a high nutritive value and medicinal value. Honeybees also produce beeswax that is used in the preparation of polishes and cosmetics.

Most commonly reared species of the honeybee is Apis Indica. Bee-keeping is not labour intensive. It is relatively easy but requires some specialized knowledge about –

- nature and habits of bees
- selection of a suitable location for keeping beehives. Proper care should be taken while selecting the place for bee farm it

should be close to fruit orchards or cultivating farms for the availability of nectar. This is called the pasturage.

- catching and hiving of swarms.
- beehive management during different seasons.
- handling and collection of honey and beeswax.

Fisheries

Include catching, processing, and selling of fishes, shellfishes, and other aquatic animals (prawn, crab, lobster, etc.)

- Capture fishery- Catching fishes from natural water sources like oceans Seas rivers
- Culture fishery- fishes are cultured in ponds and collected water.
- Mariculture – Culturing of marine fishes like Hilsa, pomfrets, and sardines
- Aquaculture– Culturing of freshwater fishes like Catla and Rohu

The fisheries industry is flourishing in our country and ‘Blue Revolution’ is on the verge of being implemented.

Solved Question for You

Q. Interspecific crosses are rare in nature and intergeneric crosses almost unknown. Why?

Ans. Interbreeding is a major criterion for members of any species. If two individuals cannot breed, they cannot be termed to belong to the same species. Hence, interspecific crosses are rare in nature. Some logic applies to intergeneric crosses.

The main reason lies in the difference in the number of chromosomes in the cells of different organisms. Due to this, a viable zygote cannot be formed by two gametes having different numbers of chromosomes. But artificial hybridization is being frequently used to produce interspecific and intergeneric crosses; especially for producing better varieties of plants.

Plant Breeding

Did you know we can actually change the biological makeup of plants and crops to increase their yield and usefulness? In fact, most of the crops grown in India, such as wheat and rice, have undergone plant breeding during the Green Revolution. Let us take a look.

Plant Breeding Definition

Plant breeding is a method of altering the genetic pattern of plants to increase their value and utility for human welfare. It is a purposeful manipulation of plants to create desired plant types that are better suited for cultivation, give better yield and are disease resistant. Plant breeding is done for the following objectives –

- Increase the crop yield
- Improve the quality of the crop
- Increase tolerance to environmental conditions like salinity. extreme temperatures and drought
- Develop a resistance to pathogens
- Increase tolerance to the insect pest

Steps for Different Plant Breeding Methods

The main steps of the plant breeding program are as follows-

1. Collection of Variability

Wild varieties species and relatives of the cultivated species having desired traits should be collected and preserved. The entire collection having all the diverse alleles for all genes in a given crop is called *germplasm collection*. Germplasm conservation can be done following ways-

- In situ conservation – It can be done with the help of forests and Natural Reserves.
- Ex situ conservation- it is done through botanical gardens, seed banks.

2. Evaluation and Selection of Parents

The germplasm collected is evaluated to identify the plants with desirable characters. It is made sure that only the pure lines are selected. The selected plants are multiplied and used in the process of hybridization.

3. Hybridization

The Pollen Grain from one desired parent plant selected as a male parent is collected and dusted over another plant which is considered as the female parent.

4. Selection and Testing of Superior Recombinants

Progeny obtained after crossing are evaluated for the desired combination of characters.

These are self-pollinated for several generations till there is a state of uniformity so that the characters will not segregate further.

5. Testing Release and Commercialization of New Cultivars

The selected plants are evaluated by growing the plants in an experimental field and the performance is recorded. This is done for at least 3 growing Seasons at different locations in the country.

Indian Hybrid Crops

1. Wheat and Rice

In the 1960s, wheat and rice production increased tremendously. Norman E. Borlaug developed semi-dwarf varieties of wheat. *Sonalika* and *Kalyan Sona* are two of the hybrid wheat varieties grown in India. Semi-dwarf wheat varieties were taken from IR−86 (International Rice Research Institute) and Taichung native−I (from Taiwan). *Jaya* and *Ratna* are the better-yielding, semi-dwarf rice varieties that were later introduced.

2. Sugarcane

- *Saccharum Barberi* is a native of North India and officinarum belongs to South India.

- *Officinarum* has thicker stems and higher sugar content, but it does not grow well in North India.
- These two varieties were crossed to get the desirable qualities of both (Higher sugar content, thicker stems and the ability to grow in North India).

3. Millets

- Hybrid maize, J*owar*, and B*ajra* have been successfully developed in India.
- These varieties are high yielding and resistant to water stress.

Plant Breeding for Disease Resistance

Some of the diseases caused by plants are-

Fungi	Brown rust of wheat
	Red rot of sugarcane
	Late blight of potato

Bacteria	Black rot of crucifers
Viruses	Tobacco mosaic turnip music

The basic objective of breeding for disease resistance is to develop inherent quality in the plant to prevent the pathogen from causing the disease. Such varieties of plants are called resistant plants. The basic method is the same as normal hybridization. For hybridization resistant plant should be available for breeding.

Some diseases resistant plants developed are –

Crop	Variety	Resistant to Disease
wheat	Himgiri	Leaf & stipe rust
Brassica	Pusa Swarnim	White rust
Cauliflower	Pusa Shubra	Black rot and curl blight

Chilli	Pusa Sadabahar	Chilli mosaic virus

Mutation Breeding

If resistant variety is not available, the resistance can be developed by inducing mutations in the plant through diverse means and then by screening the plant material for resistance.

Mutation is changed in the base sequence of the genes, induced by certain Chemicals or radiations. The resistant plants developed can be multiplied directly or can be used in other breeding experiments.

Plant Breeding for Developing a Resistance to Insect Pest

Resistance can be developed by following ways –

- Development of morphological characters like hairy leaves in cotton and wheat develop vector resistance from jassids beetle.
- Solid stem in wheat lead to resistance from stem borers.
- Biochemical characters provide resistance to insects and pests. For example, the high aspartic acid and low nitrogen and sugar content in maize leads to resistance to maize stem borers.

- Smooth leaves and nectarless cotton develop resistance from bollworms.

Some pest-resistant varieties are-

Crop	Variety	Insect pest
Brassica	Pusa Gaurav	Aphids
Flat bean	Pusa sem	Jassids, aphids
Okra	Pusa Sawni	Shoot and fruit bores

Plant Breeding for Improved Food Quality

Biofortification is a method in which crops are bred for higher levels of vitamins, minerals, and fats. Due to this problem of malnutrition can be overcome. Following objectives were considered for the breeding program-

- Protein content and quality

- Oil content and quality
- Vitamin content
- Micronutrient content and quality

Some examples of biofortification-

- Fortified Maize having twice the amount of amino acids lysine and tryptophan
- Atlas 66 wheat has a high protein content
- Iron-fortified rice having 5 times more iron
- Vegetable crops like carrot and spinach have more vitamins and minerals.
- Vitamin C enriched bitter gourd.

Solved Questions for You

Q1. In the area of plant breeding, it is important not only to preserve the seeds of the variety being cultivated but also to preserve all its wild relatives. Explain with a suitable example.

Ans. Preservation of the seeds of the cultivated variety and its wild varieties helps in making a good germplasm collection. Many high yielding and disease-resistant varieties of wheat, rice, and maize have been produced by selective breeding of plants. This could be possible because of a better germplasm collection.

Q2. Name a man-made cereal? Trace how it was developed and where is it used?

Ans. Triticale is the first man-made cereal. Triticale is a hybrid of wheat and rye. It was first bred in a laboratory in the late nineteenth century in Scotland and Sweden. It combines the yield potential and grain quality of wheat and resistance qualities of rye and mainly used as fodder.

SCP and Tissue Culture

Did you know that microorganisms can actually be a source of protein for plants and animals? In fact, microorganisms are capable of producing large amounts of proteins despite their simple cellular

structure. Let us take a look at Single Cell Protein and Plant Tissue Culture.

Single Cell Protein (SCP)

Single cell protein is one of the alternate sources of protein for animal and human nutrition. The idea of obtaining vitamins from microorganisms like mushrooms and yeast was developed to solve the problem of hunger and malnutrition.

Microorganisms, despite being very small, are capable of producing tonnes of proteins due to their higher rates of biomass production. Microbes are grown on an industrial scale on materials like waste water from potato processing plant. straw molasses, animal manure, sewage etc.

Some Common Microbes used as SCP Producers:

- Bacteria Methylophilus, Methylotrophus, Brevibacterium
- Cyanobacteria spirulina
- Yeast Saccharomyces cerevisiae, candida utilize
- Filamentous fungi Fusarium Graminearum

- Algae chlorella

Advantages of SCP

- Microorganisms show rapid growth so it can be grown in a large amount in a small period of time.
- We can grow on a wide range of raw materials and can be easily harvested.
- We have relatively higher protein content as compared to other healthy food items

Source: http://passel.unl.edu

Plant Tissue Culture

It is a method of growing cell tissue or organ in a nutrient media under controlled conditions. Part which is used for culturing is called

explant. Explant is first sterilized by using Clorox water. Explant can be cultured on liquid, solid or semi-solid medium. The nutrient medium includes inorganic nutrients, organic nutrients, growth hormones etc.

Cellular totipotency is the ability of a plant cell to give rise to an entirely new plant is called cellular totipotency. Explant is grown in culture medium at appropriate temperature and aeration. This method of producing thousands of plants through tissue culture is called *micropropagation.*

Practical Applications of Plant Tissue Culture

- A large number of commercially useful plants can be grown in short period of time
- These plants are genetically same as the parent plant from which the explant is collected.
- Production of disease-free plants- Healthy copies of a diseased plant can be produced with the help of this technique. Shoot tips of an infected plant when grown in culture media produces healthy plants.

Somatic Hybridization

Scientists are capable of getting naked protoplast by dissolving the cell walls of a single cell. Isolated protoplast from two different varieties of plants having desirable traits can be fused to form a hybrid protoplast.

- These hybrids are called somatic hybrids
- Protoplasts of potato and tomato have been actually fused to form a Pomato, but this plant is not commercially viable.

Solved Questions for You

Q1. Why is it easier to culture meristems compared to permanent tissues?

Ans. Cells of meristem have the capability of cell division while cells of permanent tissues do not have this capacity. Hence, it is easier to culture meristems compared to permanent

Q2. A person who is allergic to pulses was advised to take a capsule of Spirulina daily. Give the reasons for the advice.

Ans. Spirulina is a good source of protein which contains all essential amino acids. The protein content of Spirulina is much higher than pulses. Hence, it can be a better source of protein; especially for those who are allergic to pulses.