CHAPTER 27

BIOLOGY AND HUMAN WELFARE

Key Concepts

27.1 Vaccination and Integrated disease management
27.2 Animal Husbandry
27.3 Latest technique applied to enhance crop and fruit yields
27.4 Home Gardening
27.5 Role of Microbes in Human Welfare

EXERCISE

SECTION I: Multiple Choice Questions

Select the correct answer from the following choices.

1. The artificial active immunity is achieved by injecting small amount of antigen called:
   (a) antibodies (b) toxin (c) vaccine (d) serum

2) Polio virus lives in the ---------- of man.
   (a) mouth and throat (b) stomach and intestine
   (c) mouth and intestine (d) throat and intestine

3) Measles is an infectious viral disease that occurs most often in:
   (a) late winter and autumn (b) late winter and summer
   (c) late winter and spring (d) winter and rainy days

4) The best way to prevent a tetanus iş:
   (a) antibiotic (b) medication
   (c) vaccination (d) cleanses

5) Hybridization in plants is the technique of introducing desirable species into a hybrid by means of:
   (a) pollination (b) selection
   (c) emasculation (d) micropropagation

6) Which of the following is/are the method of crop improvement?

(a) selection (b) hybridization
(c) polyploid breeding (d) all of these

Answer

1	(c)	2	(d)	3	(c)	4	(c)	5	(a)
6	(d)								

SECTION II: Short Questions

Give short answers of the following questions.

Q1. Define vaccination, animal husbandry, acclimatization, selection, hybridization, back cross. Also briefly explains them.

Answer

i. **Vaccination:** is the administration of vaccine to stimulate the immune system of an individual to develop artificial induced active immunity against an infectious disease. Vaccination is generally considered to be the most effective method of preventing infectious disease that were once common in many countries, including polio, measles, mumps and tetanus.

ii. **Animal Husbandry:** deals with the care of livestock like cows, buffaloes, sheep, goats, chickens, and horses etc.. Taking care of these animals involves feeding and watering them daily and keeping their living space clean. Breeding and birthing the animals for example, helping deliver a baby calf is called calving, is also a big part of the job. Baby animals must be properly monitored and weaned (to accustom a young animal to nourishment other than milk) from their mothers in a timely manner. Another side of animal husbandry includes preparing the livestock for sale or slaughter and making sure they are ready to go to market. Other necessary tasks include medicating sick animals, monitoring the general health of the animals, herding and branding etc.. Animal husbandry is the agricultural practice of breeding and raising livestock.

iii. **Acclimatization:** The process of introducing new plants from their growing place to new locality with different climate is termed as plant introduction. The adjustment of such plants to their new locality is called acclimatization.

iv. **Selection:** Selection is an important step in all breeding experiments and has been practiced by man since the early days of agriculture. The selection involves picking up the better ones out of the entire crop plants. The selected plants are separated from the inferior ones and are favored by reproducing them under controlled conditions. There are three pattern of selection, mass selection, single plant or pure line selection, clonal selection.

v. **Hybridization:** Hybridization is the technique of introducing characters of two

Hybrids are first generation (F_1) crosses between generally different parents. The term hybrid is used to describe the individuals that are heterozygous even for a single gene. Hybrids are known for their vigour, growth, size and yield. As a result of hybridization, hybrid varieties of cereals, oil seeds, pulses beet, onion, tomato and fruits have been developed.

vi. **Backcross:** Backcrossing is a crossing of a hybrid with one of its parents or an individual genetically similar to its parent, in order to achieve offspring with a genetic identity which is closer to that of the parent. It is used in horticulture, animal breeding and in production of gene knockout organisms. Backcrossed hybrids are sometimes described with acronym "BC", for example, an F_1 hybrid, and crossed with one of its parents (or a genetically similar individual) can be termed a BC_1, hybrid, and a further cross of the BC_1 hybrid to the same parent (or a genetically similar individual) produces a BC_2 hybrid.

Q2. What is meant by integrated disease management? What is its procedure and objectives?

Answer

Integrated Disease Management (IDM)

Effective control of a particular disastrous or all the common diseases of a population can be achieved by using all relevant, appropriate methods of disease control. Such an approach of disease control is known as integrated disease management.

Procedure

Combating disease by utilizing all methods, as and when required, ensuring the participation of community in this program is very useful way of disease control. This requires an awareness of the community about the severity of the problem, its causes and its remedies. Public awareness can be ensured by using print and electronic media, by arranging seminars in the schools and colleges, or by person to person communication. In integrated disease management, every available method of disease control is used like preventive measures, drugs treatment, vaccination and different kinds of therapies.

Objectives

Actually the real objective is to stop the further spread of disease and to prevent its new onset. This is proved very effective program for elimination and control of the dangerous disease from the human society.

Q3. What is the importance of vaccination?

Answer

Vaccination is the administration of vaccine to stimulate the immune system of an individual to develop artificial induced active immunity against an infectious disease.

A **Vaccine** may be intact but inactivated (non-infective) or an attenuated (with reduced infectively) form of the causative pathogens (bacteria or viruses), or purified components of the pathogen that have been found to be highly immunogenic (e.g., the outer coat proteins of a virus particle). When the body is exposed to the weak or dead

agents are weak or dead, the body does not actually suffer the disease, but an immune response is initiated. Now the body is fully equipped to fight the actual causative agent like virus or bacteria that attack the body later in life.

Vaccination is generally considered to be the most effective method of preventing infectious disease that were once common in many countries, including polio, measles, mumps and tetanus.

Q4. List some common diseases against which vaccination is required.

Answer

- Vaccination against measles
- Vaccination against polio
- Vaccination against hepatitis
- Vaccination against tetanus (lockjaw)

Disease	Vaccine	Type	Age group
Polio	OPV (Oral Polio Vaccine)	Live vaccine	From birth to 5 years of age
Hepatitis	Hepatitis-B Vaccine	Subunit vaccine	At any age
Measles + Mumps + Rubella	Measles + Mumps + Rubella (MMR)	Conjugate vaccine	Up to one year of age
Diphtheria + Tetanus	Diphtheria toxoid (DT) vaccine + Tetanus toxoid (TT) vaccine	Toxoid vaccine	Generally in childhood

Q5. List the outstanding milk production breeds of cows.

Answer

S. #	Name of the cow	Milk yield per lactation cycle
1	Holstein-Friesian	12,700 L
2	Friesen	7800 L
3	Ayrshire	7,711 L
4	Jersey	7,260 L

Q6. List the outstanding milk production breeds of buffaloes.

Answer

S.#	Name of the buffalo	Milk yield per lactation cycle
1	Nili-Ravi	1500 to 2300 L
2	Jaffarabadi	1000 to 1200 L
3	Godavari	1200 to 1500 L
4	Bhadawari	800 to 1000 L

Q7. Identify some seasonal vegetables for home gardening.

Answer

The Seasonal Vegetables for Home Gardening

In order to eat fresh fruits and vegetables, its good to know when and what is available fresh. Here is a seasonality chart that will help you in choice for home gardening. This chart could be slightly different in different parts of the country.

Winter January, February	Cabbage, Cauliflower, Celery Root, Grapefruit, Mandarin Oranges, Sweet Oranges, Spinach, Sweet potatoes.
Spring March, April, May	Asparagus, Basil, Beans, Berries, Broccoli, Cabbage, Cucumbers, Radish, Okra, Peas.
Summer June, July, August	Corn, Cucumbers, Chile Peppers, Sweet Peppers, Plums, Tomatoes, Watermelon Okra.
Fall Sep., Oct., Nov.	Cabbage, Cauliflower, Cranberries, Cucumbers, Peppers, Sweet Peppers, Spinach, Sweet Potatoes.

Q8. Identify some seasonal fruit plants for home gardening.

Answer

The Seasonal Fruit Plants for Home Gardening

In order to eat fresh fruits, it's good to know when and what is available fresh. Here is a seasonality chart that will help you in choice for home gardening. This chart could be slightly different in different parts of the country.

Table. Seasonal fruits	
Winter January, February	Grapefruit, Mandarin Oranges, Sweet Oranges, Pears, Sweet Potatoes
Spring March, April, May	Mangoes, Okra, Sweet, Oranges, Papayas, Peas.
Summer June, July, August	Dates, Figs, Grapes, Mangoes, Okra, Peaches, Chile Peppers, Sweet Peppers, Plums, Tomatoes, Watermelon.
Fall Sep., Oct., Nov.	Apples, Dates, Grapes, Pears, Chile Peppers, Sweet Peppers, Sweet Potatoes.

Q9. What is hybrid?

Answer

Hybrids are first generation (F_1) crosses between generally different parents. The term hybrid is used to describe the individuals that are heterozygous even for a single gene. Hybrids are known for their vigour, growth, size and yield. As a result of hybridization, hybrid varieties of cereals, oil seeds, pulses, beet, onions, tomatoes and fruits have

desirable species into a single offspring (hybrid) by means of artificial pollination.

Q10. What is a mass selection?

Answer

Mass Selection

This is the most common and old method of crop selection. In this selection, a number of similarly appearing plants are selected for the desired trait and their seeds are mixed together. The mixture of seeds so obtained is sown to raise the new crop.

Q11. List the methods of crop improvement.

Answer

There are several methods of plant breeding technique which can be used for crop and fruit improvements. Some of common methods are:

1) Acclimatization
2) Selection
3) Hybridization
4) Backcross

SECTION III: Extensive Questions

Q1. Explain integrated disease management.

Answer

One of the important contributions of biology for the w.lfare of mankind is the human disease control. There are several methods of disease control that have been discovered and are being used.

Integrated Disease Management (IDM)

Effective control of a particular disastrous or all the common diseases of a population can be achieved by using all relevant, appropriate methods of disease control. Such an approach of disease control is known as integrated disease management.

Procedure

Combating disease by utilizing all methods, as and when required, ensuring the participation of community in this program is very useful way of disease control. This requires an awareness of the community about the severity of the problem, its causes and its remedies. Public awareness can be ensured by using print and electronic media, by arranging seminars in the schools and colleges, or by person to person communication. In integrated disease management, every available method of disease control is used like preventive measures, drugs treatment, vaccination and different kinds of therapies.

Objectives

Actually the real objective is to stop the further spread of disease and to prevent its new onset. This is proved very effective program for elimination and control of the dangerous disease from the human society.

Q2. Describe the role of vaccines in preventing polio, measles, hepatitis, and tetanus.

Answer

Vaccination is the administration of vaccine to stimulate the immune system of an individual to develop artificial induced active immunity against an infectious disease.

A **Vaccine** may be intact but inactivated (non-infective) or an attenuated (with reduced infectively) form of the causative pathogens (bacteria or viruses), or purified components of the pathogen that have been found to be highly immunogenic (e.g, the outer coat proteins of a virus particle). When the body is exposed to the weak or dead organisms (vaccine), the body is triggered to produce antibodies. Since the injected agents are weak or dead, the body does not actually suffer the disease, but an immune response is initiated. Now the body is fully equipped to fight the actual causative agent like virus or bacteria that attack the body later in life.

Vaccination is generally considered to be the most effective method of preventing infectious disease that were once common in many countries, including polio, measles, mumps and tetanus.

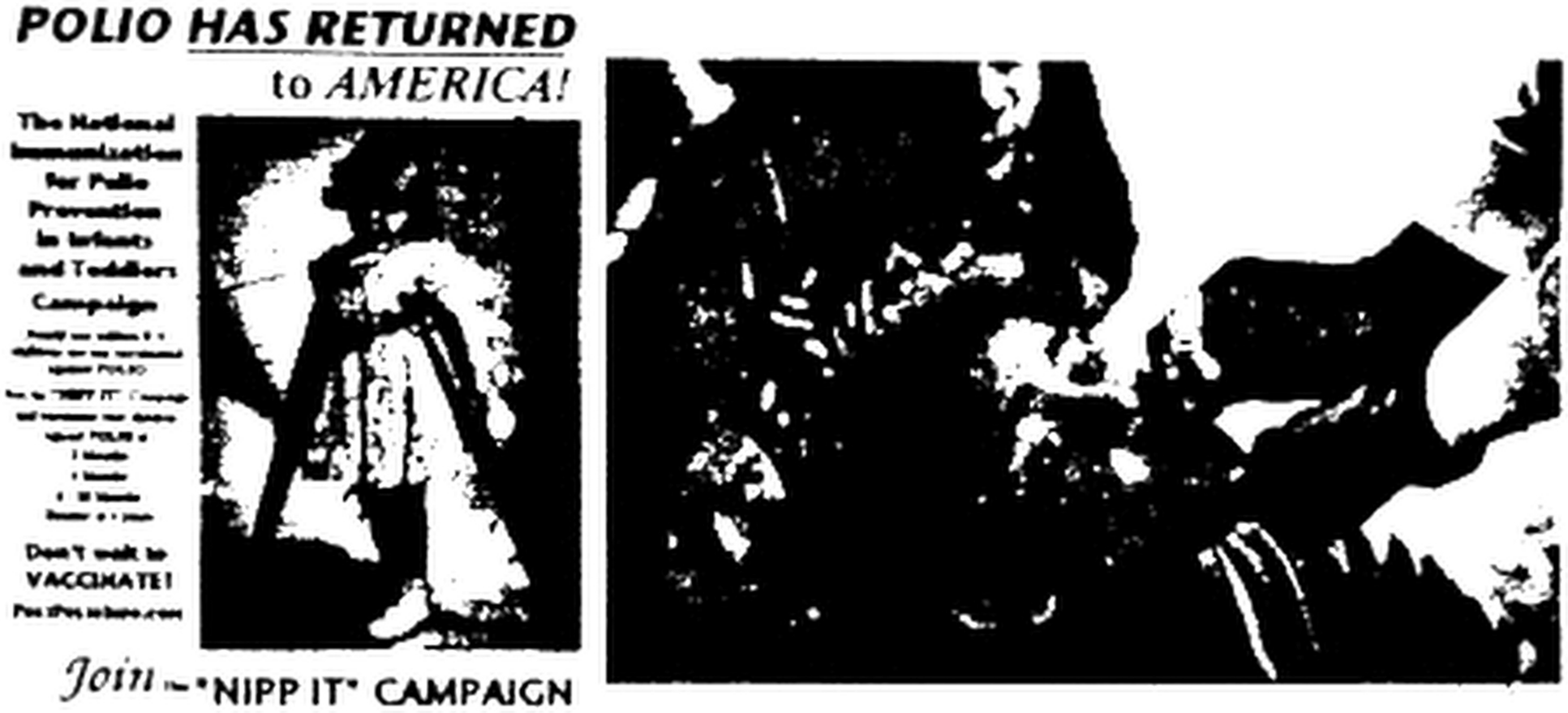
1	Hepatitis A	HepA vaccine protects against hepatitis A
2	Hepatitis B	HepB vaccine protects against hepatitis B
3	Flu	Flu vaccine protects against influenza.
4	Measles, Mumps and Rubella	MMR vaccine protects against measles.
5	Polio	OPV and IPV vaccine protects against polio.

Vaccine is a non-virulent strain of actual causative agents that can develop immunity in the body against infectious diseases. Vaccines play a very significant role in preventing disease.

Vaccination Against Polio

Polio is an infectious disease caused by a virus that lives in the throat and intestinal tract. There are two types of vaccine that protect against polio: inactivated polio

to complete elimination of polio cases in some countries e.g., United States, UK. IPV is a shot given in the leg or arm, depending on age. It may be given at the same time as other vaccines. OPV is given to the children up to the age of 5 years in the form of drops orally.



Vaccination against Measles

Measles is an infectious viral disease that occurs most often in the late winter and spring. Prior to 1963, almost everyone got measles; however, after the measles vaccine became available, the number of measles cases dropped by 99% and the epidemic cycles diminished drastically. Therefore, the best prevention of measles in the measles vaccine i.e. MMR. The MMR vaccine is a live attenuated, combination vaccine that protects against measles, mumps and rubella viruses.

Vaccination against Hepatitis

Hepatitis means inflammation of the liver and also refers to a group of viral infections that affect the liver. The most common types are Hepatitis A, Hepatitis B, Hepatitis C. Vaccines for hepatitis A and hepatitis B are available but there is currently no vaccine available for hepatitis C because of the structural characteristics of this virus. Hepatitis A vaccine is made from inactivated whole virus of hepatitis A. Hepatitis B vaccine is a

recombinant DNA vaccine.

Vaccination against Tetanus (lockjaw)

Tetanus (lockjaw) causes painful tightening of the muscles, usually all over the body. It can lead to "locking" of the jaw so the victim cannot open his mouth or swallow. Tetanus leads to death in about 1 in 10 cases. Several vaccines are used to prevent tetanus among peoples of varying age groups. For example Td (tetanus diphtheria) vaccine is used for children and adolescents while TD is given to the adults. Vaccination is the best way to prevent a tetanus infection caused by *Clostridium tetani.*

Schedule of Vaccination of Common Infectious Diseases

The recommended immunization schedule is designed to protect infants and children early in life, when they are most vulnerable and before they are exposed to potentially life-threatening diseases.

Disease	Vaccine	Type	Age group
Polio	OPV (Oral Polio Vaccine)	Live vaccine	From birth to 5 years of age
Hepatitis	Hepatitis-B Vaccine	Subunit vaccine	At any age
Measles + Mumps + Rubella	Measles + Mumps + Rubella (MMR)	Conjugate vaccine	Up to one year of age
Diphtheria + Tetanus	Diphtheria toxoid (DT) vaccine + Tetanus toxoid (TT) vaccine	Toxoid vaccine	Generally in childhood

Q3. Describe animal husbandry and the role of life stock in national economy.

Answer

Animal husbandry deals with the care of livestock like cows, buffaloes, sheep, goats, chickens, and horses etc.. Taking care of these animals involves feeding and watering them daily and keeping their living space clean. Breeding and birthing the animals – for example, helping deliver a baby calf is called calving, is also a big part of the job. Baby animals must be properly monitored and weaned (to accustom a young animal to nourishment other than milk) from their mothers in a timely manner. Another side of animal husbandry includes preparing the livestock for sale or slaughter and making sure they are ready to go to market. Other necessary task include medicating sick animals, monitoring the general health of the animals, herding and branding etc.. Animal husbandry is the agricultural practice of breeding and raising livestock.

The Role of Life Stock In National Economy

The animal husbandry plays vital role in national economy. Being a country that has a largely rural and agriculture based industry; animal husbandry plays an important role in the economy of Pakistan and is a major source of livelihood for many farmers. It is estimated that there are between 30 to 35 million people in Pakistan's current labour

animal nutrition, reproduction, breeding and management is tremendously improving the animal husbandry.

Livestock Products

There are many livestock products which are being used our daily lives. These products mainly include milk and milk products, meat and meat products, poultry and dung for fuel. In addition the other animal products as eggs, wool, leather goods etc. also contribute to the national economy. Dung excreted by cattle is a vital resource for supplying cooking fuel and soil fertilizers. Sheep are found throughout the grazing lands of central and northern Pakistan. Their wool is exported in large quantities.

Table. Some of outstanding breeds of milk producing cows.

S.#	Name of the cow	Milk yield per lactation cycle
1	Holstein-Friesian	12,700 L
2	Friesen	7800 L
3	Ayrshire	7,711 L
4	Jersey	7,260 L

Table. Some of outstanding breeds of milk producing buffaloes.

S.#	Name of the buffalo	Milk yield per lactation cycle
1	Nili-Ravi	1500 to 2300 L
2	Jaffarabadi	1000 to 1200 L
3	Godavari	1200 to 1500 L
4	Bhadawari	800 to 1000 L

Jersey breeds of milk producing cow

Breeds of milk producing buffaloes.

Importance of Livestock Sector for Pakistan

The contribution of livestock to the national economy is estimated in billions. The livestock sector constitutes about 11% of Pakistan's GDP and employs about 17% of the workforce, including most of the poorest people in the country. The livestock sectors of Pakistan can singlehandedly become a game changer for our economy.

Q4. Describe different methods adopted for plant improvement.

Answer

Plant breeding started in the beginning of 20th century after the discovery of Mendel's work. Today plant breeding has become a specialized technology on genetics.

Methods of Plant Breeding for Crops Improvement

There are several methods of plant breeding technique which can used for crop and

(3) Hybridization (4) Backcross.

Acclimatization

The process of introducing new plants from their growing place to new locality with different climate is termed as plant introduction. The adjustment of such plants to their new locality is called acclimatization.

Plant introduction has been an important basis of agriculture development throughout the world. For example, groundnut was introduced in this subcontinent in the beginning of 19th century from Philippines, papayas from West Indies, potato from South America, date-palm from Brazil. Custard apple, coffee, tea, tobacco etc. have been successfully introduced in this subcontinent.

Selection

Selection is an important step in all breeding experiments and has been practiced by man since the early days of agriculture. The selection involves picking up the better ones out of the entire crop plants. The selected plants are separated from the inferior ones and are favored by reproducing them under controlled conditions. There are three pattern of selection, mass selection, single plant or pure line selection, clonal selection.

Mass Selection

This is the most common and old method of crop selection. In this selection, a number of similarly appearing plants are selected for the desired trait and their seeds are mixed together. The mixture of seeds so obtained is sown to raise the new crop.

Single Plant or Pure Line Selection

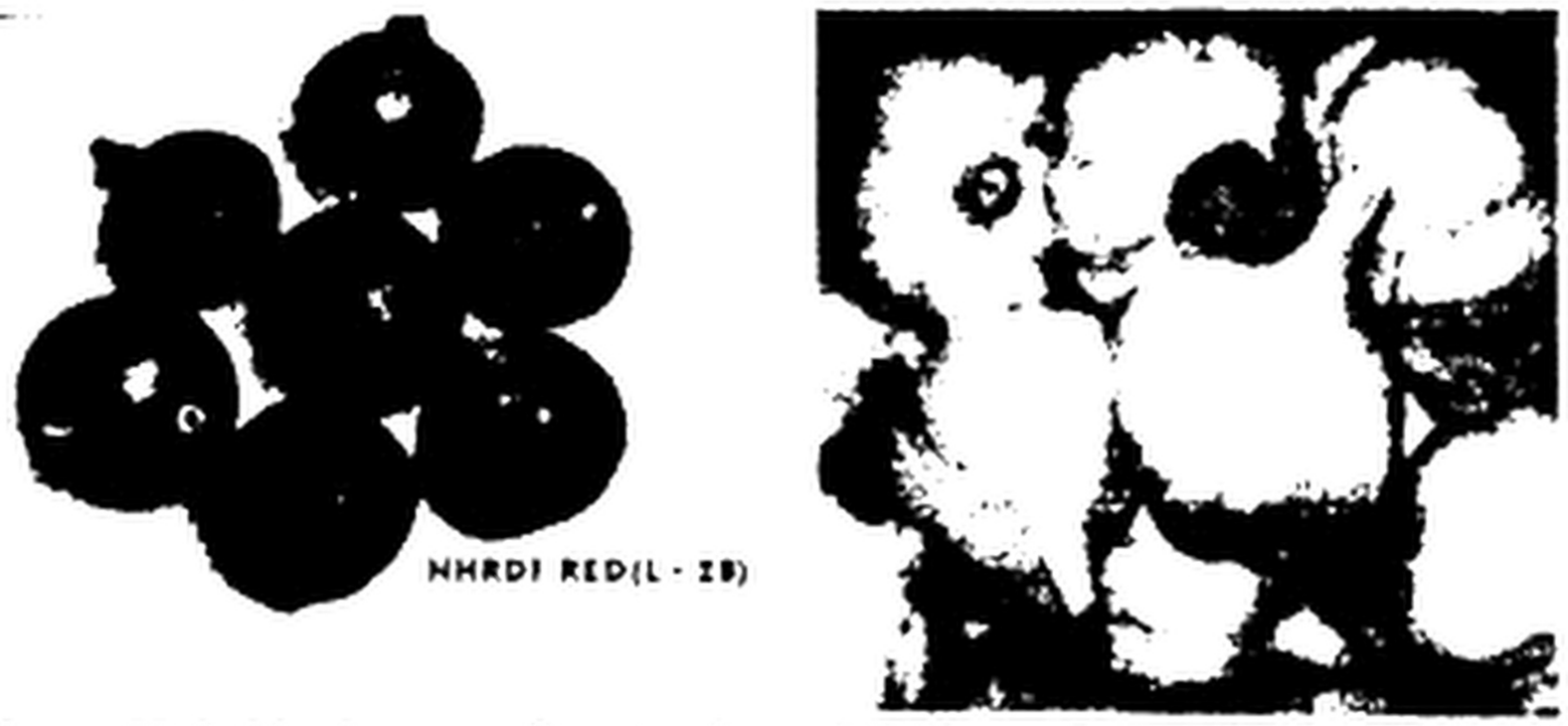
The single plant with desired trait or traits is selected out of the variable population in the field. Seeds from selected plants are sown in separate rows to produce a progeny. Desired plant is again selected from this progeny. This is continued for several generations. The inferiors are eliminated in each generation.

Clonal Selection

It is practiced in vegetatively propagated plants like sugarcane, banana, and potato etc.. In this method the best plant based on phenotypic characters is selected. It is then multiplied vegetatively and supplied to the farmers. A population of plants raised from a single vegetatively propagated plant is called clone.

Hybridization

Hybridization is the technique of introducing characters of two desirable species into a single offspring (hybrid) by means of artificial pollination. Hybrids are first generation (F_1) crosses between generally different parents. The term hybrid is used to describe the individuals that are heterozygous even for a single gene. Hybrids are known for their vigour, growth, size and yield. As a result of hybridization, hybrid varieties of cereals, oil seeds, pulses beet, onions, tomatoes and fruits have been developed.



Heterosis or Hybrid vigour refers to the exhibition of superiority of the hybrid over both of its parents in one or more traits. It is based on the ability to give higher yield, and disease and pest resistance. It is best suited to plants which can be vegetatively propagated, e.g., sugarcane, mango, apple, guava, rose, dahlias, chrysanthemum, etc.. In these plants, the heterohybrids retain their desirable characters indefinitely since there is no chance of segregation as they are multiplied vegetatively.

Backcross

Backcrossing is a crossing of a hybrid with one of its parents or an individual genetically similar to its parent, in order to achieve offspring with a genetic identity which is closer to that of the parent. It is used in horticulture, animal breeding and in production of gene knockout organisms. Backcrossed hybrids are sometimes described with acronym "BC", for example, an F_1 hybrid, and crossed with one of its parents (or a genetically similar individual) can be termed a BC_1, hybrid, and a further cross of the BC_1 hybrid to the same parent (or a genetically similar individual) produces a BC_2

Q5. Corelate the role of biotechnology and genetic engineering in crop improvement.

Answer

Genetic engineering, also called genetic modification is the direct manipulation of an organism's genome using biotechnology. New DNA may be inserted in the host genome by first isolating and copying the genetic material of interest using molecular cloning methods to generate a DNA sequence, or by synthesizing the DNA, and then inserting this construct into the host organism. Genes may be removed, or "knocked out", using a nuclease.

Genetic engineering techniques have been applied in numerous fields including research, agriculture, industrial biotechnology, and medicine. Enzymes used in laundry detergent and medicines such as insulin and human growth hormones.

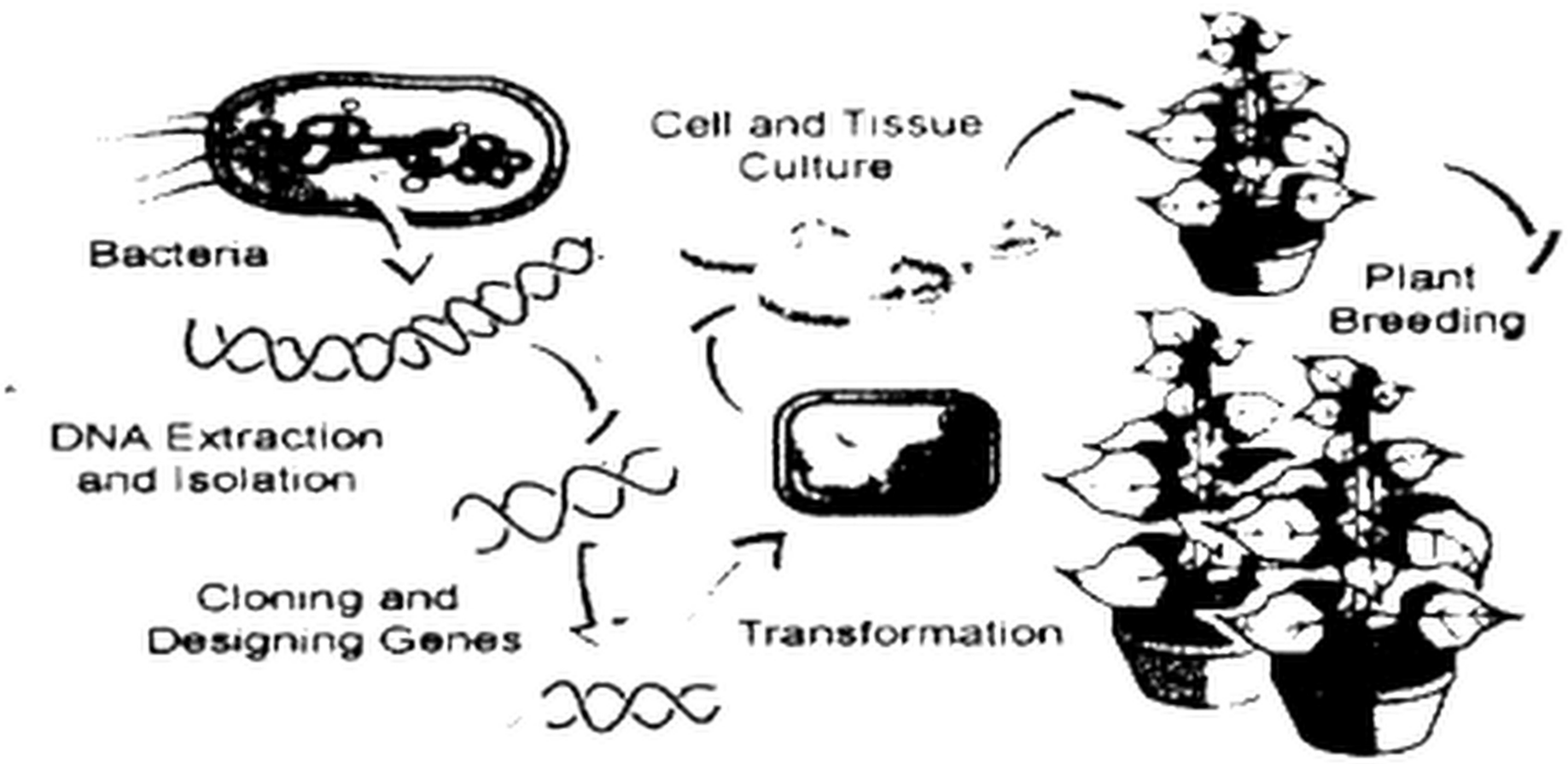


Fig. Showing the steps for genetic engineering in plants

Agriculture

One of the best-known and controversial applications of genetic engineering is the creation and use of genetically modified crops or genetically modified organisms, such as genetically modified fish, which are used to produce genetically modified food and materials with diverse uses.

The availability of efficient transformation systems for crop species is of intense interest to biotechnology, agrichemical, and seed companies for the application of this technology to crop improvement. Initial research has been focused on the engineering of traits that relate directly to the traditional roles of industry in farming, such as the control of insects, weeds, and plant diseases. Progress has been rapid, and genes conferring these traits have already been successfully introduced into several important crop species. Genetically engineered soybean, cotton, rice, corn, oil see drape, sugar beet, tomato, and alfalfa crops are expected to enter the market place between 1993 and 2000.Weed control E. engineering herbicide tolerance into crops represent\s a new alternative for conferring selectivity and enhancing crop safety of herbicides. Research has largely concentrated on those herbicides with properties such as high unit activity, low toxicity, low soil mobility, and rapid biodegradation and with broad spectrum

activity against various weeds. The development of crop plants that are tolerant to such herbicides would provide more effective, less costly, and more environmentally attractive weed control. The commercial strategy in engineering herbicide tolerance is to gain market share through a shift in herbicide use (33)-not to increase the overall use of herbicides, as is popularly held. Herbicide-resistant plants will\have the positive impact of reducing overall herbicide use through substitution of more effective and environmentally acceptable products.

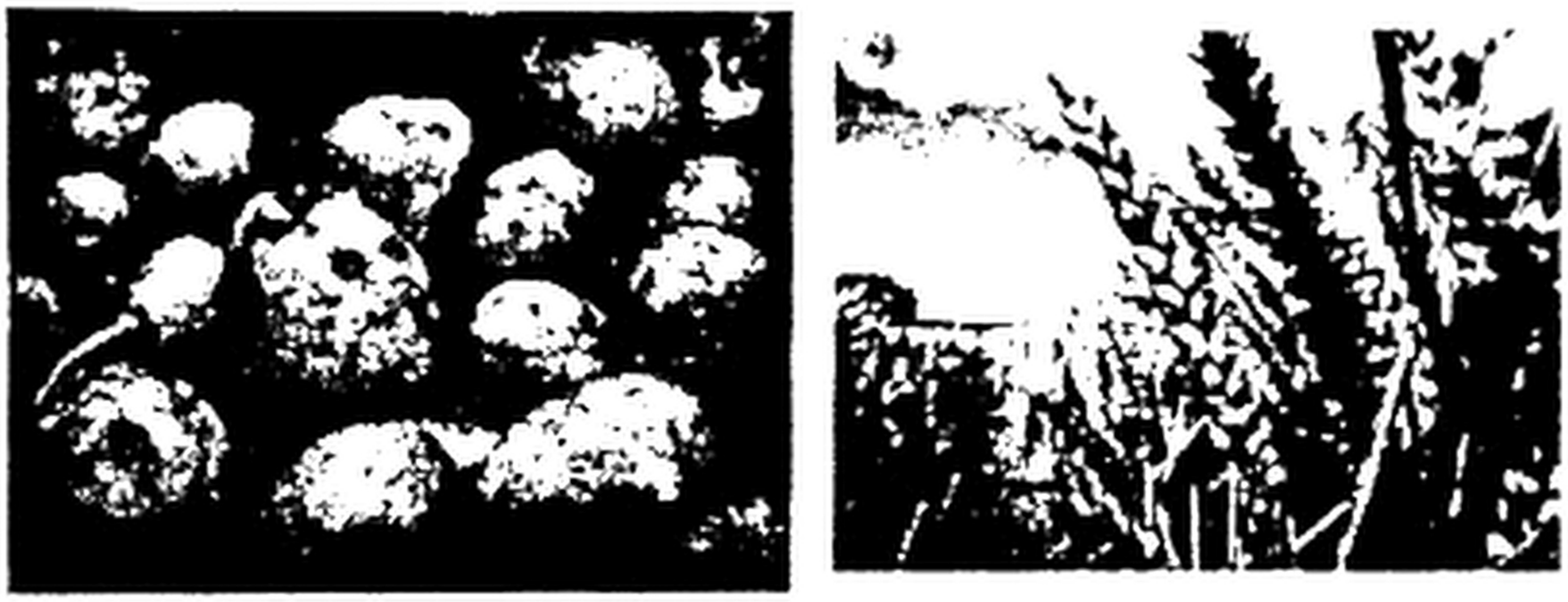


Fig. Genetically engineered potato and wheat species

There are four main goals in generating genetically modified crops by using biotechnology and genetic engineering.

One goal, and the first to be realized commercially, is to provide protection from environmental threats, such as cold (in the case of Ice-minus bacteria), or pathogens, such as insects or viruses, and/or resistance to herbicides. There are also fungal and virus resistant crops developed or in development. They have been developed to make the insect and weed management of crops easier and can indirectly increase crop yield.

Another goal in generating GMOs is to modify the quality of produce, for instance, increasing the nutritional value or providing more industrially useful qualities or quantities. The Amflora potato, for example, produces a more industrially useful blend of starches. Cows have been engineered to produce more protein in their milk to facilitate cheese production. Soybeans and canola have been genetically modified to produce more healthy oils.

Q6. Explain home gardening and its importance.

Answer

The home garden is an integrated system which comprises different things in its small area: the family house, a living / playing area, a kitchen garden, a mixed garden, a fish pond, stores , an animal house and of course, people. The home garden can be defined as a farming system which combines different physical, social and economic functions on the area of land around the family home.

Importance of Home Gardening

It provides fuel for cooking, wood for building, food, medicinal plants, herbs, spices and flowers. It produces enough nutritious food, including some staple foods, for all the family year round. Sale from home garden produce can make a substantial

flavour of home grown produce, which comes immediately from the plant to the dinner table. Home gardening produces relatively large amounts of food with marginal labour on areas of land too small for field agriculture.

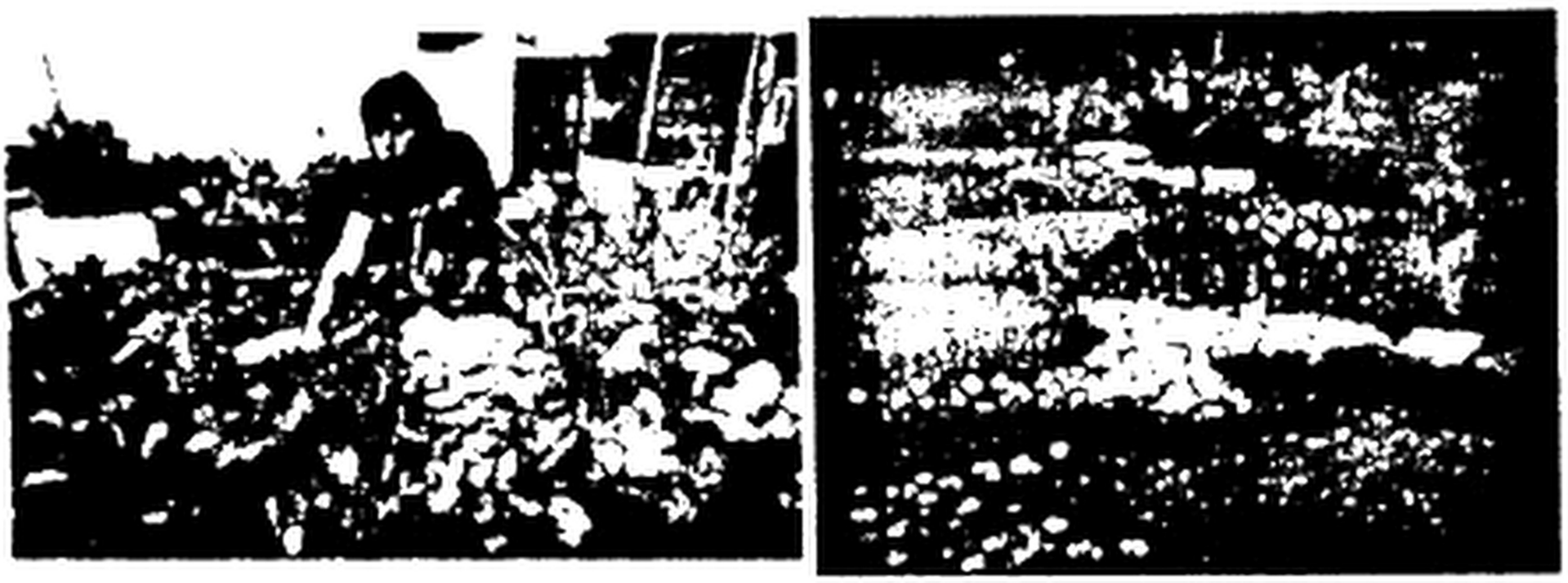


Fig: Home Gardening

The seasonal Vegetable and Fruit Plants Suitable for Home Gardening:

In order to eat fresh fruits and vegetables, it's good to know when and what is available fresh. Here is a seasonality chart that will help you in choice for home gardening. This chart could be slightly different in different parts of the country.

Winter January, February	Cabbage, Cauliflower, Celery Root, Grapefruit, Mandarin Oranges, Sweet, Oranges, Pears, Spinach, Sweet Potatoes.
Spring March, April, May	Asparagus, Basil, Beans, Berries, Broccoli, Cabbage, Cucumbers, Radish, Mangoes, Okra, Sweets, Oranges, Papayas, Peas.
Summer June, July, August	Corn, Cucumbers, Dates, Figs, Grapes, Mangoes, Okra, Peaches, Chile Peppers, Sweet Peppers, Plums, Tomatoes, Watermelon.
Fall Sep., Oct., Nov.	Apples, Cabbage, Cauliflower, Cranberries, Cucumbers, Dates, Grapes, Pears, Chile Peppers, Sweet Peppers, Spinach, Sweet Potatoes.

Microorganisms have a great impact on many areas of biology and general human welfare. Some are beneficial to man while others are harmful. The beneficial functions include production of bread, cheese, antibiotics, vaccines, vitamins, enzymes and many other products. Microorganisms occupy an important position in the ecosystem. They are required for the various cycles of nature such as carbon, nitrogen, oxygen, and sulphur that take place in the ecosystem.

Q7. Explain the role of microbes in household food processing.

Answer

Role of Microbes in Household Food Processing

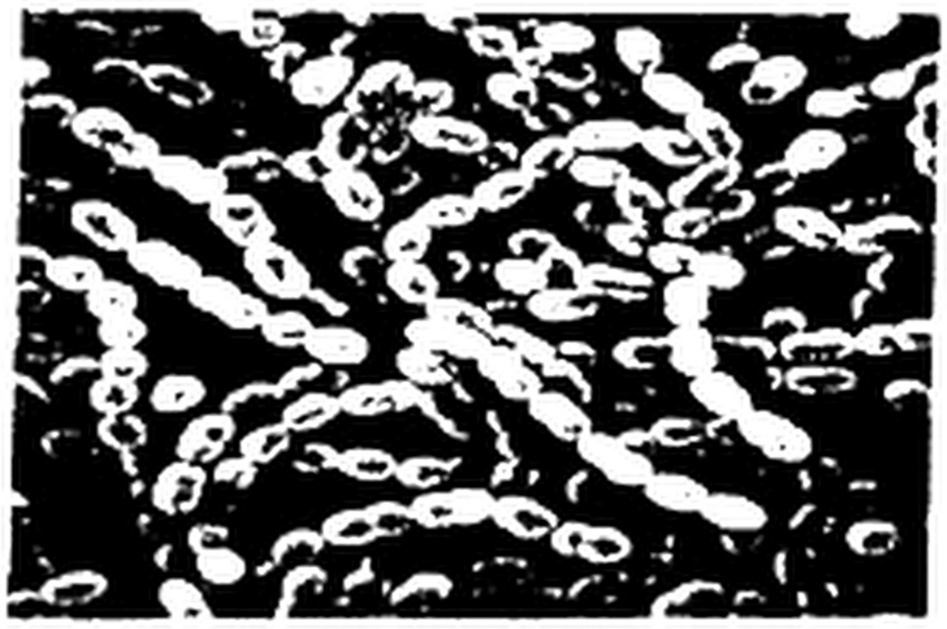
There are many useful applications of microorganisms in the food processing industry. They influence the quality, availability and quantity of food. Microorganisms are used

cheese, sugar to wine and bread.

Yoghurt Making

The pasteurized milk is fermented by adding starter culture of bacteria, usually a mixture of ***Streptococcus thermophillus*** and ***Lactobacillus vulgaricus***. These bacteria act on milk sugar, lactose and convert it to lactic acid which, in turn coagulates the milk protein, casein, to produce the thick creamy consistency of yoghurt.

Lactose ⟶ pyruvic acid ⟶ lactic acid



Streptococcus thermophillus

Lactobacillus bulgaricus

Cheese Making

Cheese is made from milk, by fermenting it with special types of bacteria i.e., ***Streptococcus*** and ***Lactobacillus***. The characteristic flavors of cheese comes from the type of milk used and from the action of microbes during manufacture and storage. Turning milk into cheese considerably extends its strong life.

Vinegar Making

Different species of ***Penicillium*** can oxidize a variety of organic compounds to produce organic acids. Some of these species are used in the production of vinegar from beer, cider or wine. First yeast is used to produce a rough kind of beer called **gyle**. The gyle is then incubated with ***Acetobacter***. Most of the ethanol in the gyle is

Soya Sauce Making

It is made from a mixture of wheat and soya beans crushed with water. The fungus ***Aspergillus orzae*** is introduced to digest the starches to sugars. The mixture is then mixed with salt water and fermented using lactic acid bacteria i.e., ***Lactobacillus*** and yeast.

Bread Making

Bread is made from cereal grains ground into flour. Leavened bread is softer due to the action of yeast. Strains of the yeast, ***Saccharmromyces cerevisiae*** contributes both to the texture and flavor of bread.

Q5. Explain the role of microbes in industrial production, sewage treatment and energy production.

Answer

Role of Microbes In Industrial Production

Microorganisms are particularly suitable for industrial processes as (a) they produce higher yields and have higher specificity than conventional processes. (b) a wide range

and specific isomers (Such as L-amino acids) can be produced.

Bacteria in Industry

In industries, bacteria are used to produce antibiotics, chemicals, dyes, numerous vitamins and enzymes, and a number of insecticides. Today, they are used in genetic engineering to synthesize certain pharmaceutical products that cannot be produced otherwise. Specific bacteria carry out the oxidation of alcohol to acetic acid in the production of vinegar. Organic compounds, such as acetone, isopropanol, and butyric acid, are produced in fermentation by various ***Clostridium*** species and can been prepared on an industrial scale.

Bacteria can be Used to Mine Gold

Thiobacillus ferrooxidans can concentrate gold trapped in rock minerals. Therefore, many mining companies are now applying these bacteria in the gold mining industry.

Preparation of Antibiotics

The bacteria are also used in the preparation importance antibiotics. A large number of antibiotics have prepared which are of great in the medical world. Streptomycin, Aureomycin, and Terramycin are some well-known antibiotics.

Biopolymers

A huge variety of biopolymers, such as polysaccharides, polyesters, and polyamides, are produced by microorganisms. These products range from viscous solutions to plastics. In industrial microbiology, microorganisms can be used for the biosynthesis of xanthan, alginate, cellulose, organic acids, oligosaccharides and polysaccharides.

Health-care and Medicine

Microorganisms are used to produce human or animal products such as insulin, growth hormone and antibodies. Diagnostic assays that use monoclonal antibody, DNA probe technology or real-time PCR are used as rapid tests for pathogenic organisms in the clinical laboratory.

Role of Bacteria In the Sewage Treatment Process

Sewage treatment or domestic wastewater treatment is the process of removing contaminates from wastewater and household sewage, both runoff (effluents) and domestic. It includes physical, chemical and biological processes to remove physical, chemical and biological contaminates. Its objective is to produce an environmentally-safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer). A sewage treatment plant is nothing more than a giant microbial culture breeding facility where microbes are engaged to work for our benefit. Sewage treatment generally involves three stages, called primary, secondary and tertiary treatment.

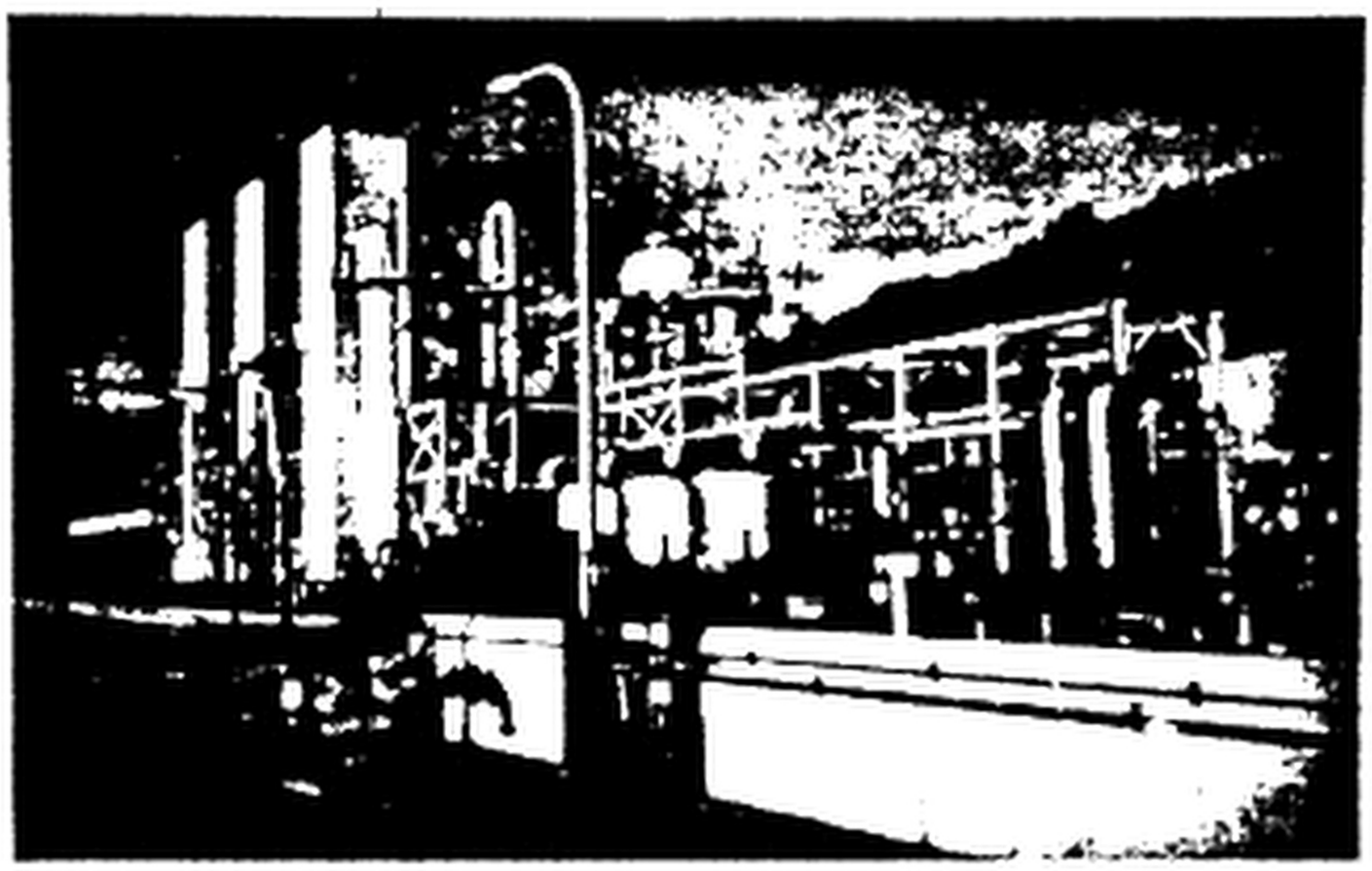


Fig. Sewage treatment plant

Primary Treatment

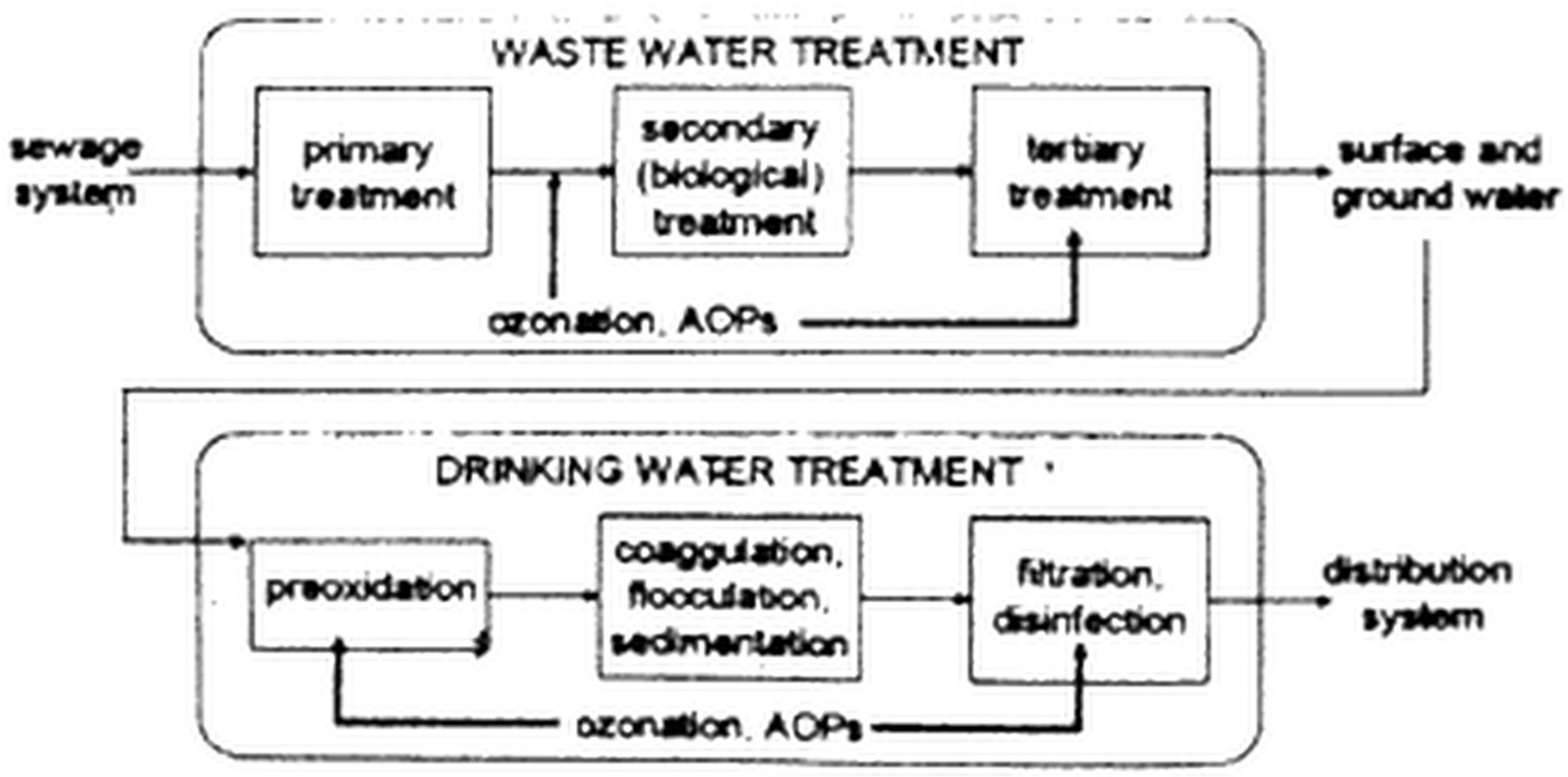
Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment.

Secondary Treatment

Secondary treatment removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. Secondary treatments require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.

Tertiary Treatment

In tertiary treatment the treated water is sometimes disinfected chemically or physically (for example, by lagoons and microfiltration) prior to discharge into a stream, river, bay, lagoon or wetland, or it can be used for the irrigation of a golf course, green way or park. If it is sufficiently clean, it can also be used for groundwater recharge or agricultural purposes.



Role of Microbes In Energy Production

There are microbes that clean sewage and generate electricity at the same time. Bacteria have evolved to utilize almost any chemical as a food source. The sludge is the precipitate produced by sewage treatment. If it is fed into large, enclosed tanks (anaerobic digesters) and heated initially to about 25^0C conditions soon become anaerobic and wide range of bacteria in the waste material digest the organic compounds to fatty acids, monosaccharide and amino acids. These are acted on by other bacteria to produce organic acids and alcohols. Finally methanogenic bacteria convert these to methane and water. The methane is drawn off and used as energy to provide the heat needed to start the reactions and there is usually substantial surplus for other purposes such as central heating or driving compressors for activated sludge.

ADDITIONAL QUESTIONS

Q9.a) What do you mean by microbial fuel cell or biological fuel cell?

b) Assess the impact of livestock in boosting up the national economy.

Answer

a) Microbial fuel Cell or Biological Fuel Cell:

A microbial fuel cell (MFC) or biological fuel cell is a bio-electrochemical system that drives a current by using bacteria. In the microbial fuel cell, bacteria form a biofilm, a living community that is attached to the electrode by a sticky sugar and protein coated biofilm matrix. When grown without oxygen, the by-products of bacterial metabolism of waste include carbon dioxide, electrons and hydrogen ions. Electrons produced by the bacteria are shuttled onto the electrode by the biofilm matrix, creating a thriving ecosystem called the biofilm anode and generating electricity.

b) Impact of Livestock In Boosting up the National Economy

Pakistan being an agriculture based economy has a great potential in livestock. Livestock has a share of 10.8% of Pakistan's total GDP. Livestock sector employs 35 million people and produce almost $500 million products. Vast majority is of small farms of less than 2 hectors that maintain herds of 1 to 3 animals. Pakistan is fortunate to be the home tract of some of the finest natural breeds of livestock as compared with other regional countries.

Q10.a) Justify the importance of vaccine campaign observed worldwide to curb the diseases.

b) List of the objectives of the institutions of the Federal Health Department and UNO working for Integrated Disease Management.

Answer

a) Importance of Vaccine Campaign Observed Worldwide to Curb the Diseases.

There are many lethal diseases which are threatening the health of humans throughout the world. Most of them are endemic or epidemic. Fortunately, vaccines are available for most of the diseases which were once thought to be non-curable. But is necessary that vaccination campaign should be worldwide, so that these diseases could be eradicated from the whole world. Otherwise, these diseases will spread from nation to nation and will remain threat to the whole world. For example, polio has been eradicated completely from most of the world; but in countries like Pakistan still many cases of polio are reported; world is concerned about it and compelling Government of Pakistan to start an extensive campaign of vaccination against this disease.

b) Objectives of the Institutions of the Federal Health Department and UNO Working for Integrated Disease Management.

Integrated Disease Management is a method to eradicate any disease by using all relevant, appropriate measuring of disease control. Combating the disease by utilizing all the methods, as and when required and ensuring the participation of community in this program is very useful way of disease control. This requires awareness among the community about the severity of the problem, its causes and remedies. Institutions of Federal Health Department and UNO working for Integrated Disease Management fulfill this objective of public awareness and then co-operate with different health departments to utilize all available resources and techniques to combat the disease.

KEY POINTS

- Vaccination is generally considered to be the most effective method of preventing infectious disease that were once common in many countries, including polio, measles, mumps and tetanus.
- Vaccination is the administration of vaccine to stimulate the immune system of an individual to develop artificial induced active immunity against an infectious disease.
- Effective control of a particular disastrous or all the common diseases of a population can be achieved by using all relevant, appropriate methods of disease control. Such an approach of disease control is known as integrated disease management.
- Animal husbandry deals with the care of livestock like cows, buffaloes, sheep, goats, chickens, and horses etc.. Taking care of these animals involves feeding and watering them and keeping their living space clean. Breeding and birthing the animals – for example, helping deliver a baby calf is called calving, is also a big part of the job.
- There are several methods of plant breeding technique which can be used for crop and fruit improvements. Some of common methods are: (1) Acclimatization (2) Selection (3) Hybridization (4) Backcross.
- The process of introducing new plants from their growing place to new locality with different climate is termed as plant introduction. The adjustment of such plants to their new locality is called acclimatization.