

BIOLOGY AND HUMAN WELFARE

Chapter 27

Major Concept

In this Unit you will learn:

- ▶ Vaccination and Integrated Disease Management
- ▶ Animal Husbandry
- ▶ Latest Techniques Applied to Enhance Crop and Fruit Yield
- ▶ Home Gardening
- ▶ Role of Microbes in Human Welfare



Biology tries to create and develop new fields with considerable changes for human welfare. It is derived and originated from human society. It could be proved by the improvements of plants and animals, production of medicine, food processing, agricultural developments, diagnosis of diseases, and information of social, habitual and cultural changes in the society. Therefore, it is very important to know the basics of biology and human welfare to investigate further prospects. It can be studied in three groups:

1. Human health and diseases
2. Role of Microbes in human welfare
3. Policies or the improvement of food

27.1 VACCINATION AND INTEGRATED DISEASE MANAGEMENT

Vaccination is the administration of a vaccine to develop artificial immunity against the infectious diseases. The effective and proper control of different, serious, vulnerable or common diseases of population by using various appropriate measures is called **integrated disease management** (IDM).

27.1.1 Integrated Diseases Management

There are some basic values of disease management including control, protection, resistance and prevention of vectors. Disease can be managed by controlling the pathogen and changing the environmental conditions which control the dispersal of pathogen.

Disease management refers to proactive measures taken to prevent and control diseases, while disease control involves reactive measures in response to existing diseases. These approaches are based on **primary prevention** (preventing diseases from occurring), **secondary prevention** (early detection and treatment), and **tertiary prevention** (minimizing impact and recurrence). Collectively, these preventive measures aim to prevent disease onset, reduce disease rates, and decrease the likelihood of diseases occurring.

Effective disease management can be achieved by implementing healthy habits and practices. Proper hand washing is essential to prevent the spread of diseases ensuring hands are washed thoroughly with soap and water. When cooking or handling food, maintaining hygiene is crucial by following safe food handling practices. Using tissue papers while coughing and sneezing helps

prevent the transmission of respiratory infections, it is important to avoid direct contact with wild animals to minimize the risk of zoonotic diseases. Furthermore, avoiding the sharing of personal items reduces the chances of disease transmission.

Major mechanisms of Diseases Management

1. Host resistance against the causative agents.
2. Biological control
3. Culture control
4. Chemical control

Host Resistance against the causative agents: The resistance property is found in animals and plants which restrain appearance of diseases or the ability of host to limit the pathogen activity. Such as defense through physical barriers and rapid immune system.

Biological Control: This is the control of disease through other living organisms (predators) that reduces the severity of diseases.

Culture Control: Culture control is usually engaging the environmental changes either having pets or diseases as well.

Cultural control based on intercropping, crop rotation, field sanitation and manipulation of spread dates etc. some of these techniques provide only small benefits when integrated with other techniques, they significantly improve disease management.

Chemical Control: Chemical control is very useful for plant and animal diseases, it is necessary to spray in that area where vector borne diseases are found. It uses pesticides, bactericides, insecticides and fungicides etc. to control pests and diseases. Chemical control produces some problems such as poisoning of humans and destroying of beneficial insects and crops as well as remainders.

Aims and objectives of integrated Disease Management

The integrated disease management approach aims to effectively halt disease prevalence, conduct protective trials to assess the effectiveness of preventive measures in reducing the risk or impact of diseases, and eliminate biological causative agents. Active

community participation and awareness through print and electronic media play a vital role, while educational institutions can organize workshops and seminars to disseminate information. Proactive measures encompass preventive actions taken to mitigate the occurrence or severity of diseases before they occur. Various preventive measures, including drug treatments, therapies, and vaccinations, are available, underscoring the importance of avoiding self-medication and seeking professional medical assistance.

27.1.2 Vaccination and Its Importance

Vaccine is a suspension that contains weakened or killed microorganisms that help to stimulate the immune system of organism against diseases. It is usually used through injections, but sometimes can be used through the mouth or sprayed into the nose. There are several types of vaccines including inactivated and live attenuated vaccines.

Vaccines are distinct from other substances as they possess the ability to evoke a response from the body's immune system, thereby enhancing its adaptive immunity and serving as a preventive measure against infectious diseases. These vaccines typically consist of fragmented or inactivated microorganisms, viruses, proteins, toxins, antibodies, lymphocytes, or messenger RNA (mRNA).



Fig. 27.1 Vaccination

The initial vaccine was developed by Edward Jenner, a British physician, in 1796. Jenner employed the cowpox virus as a vaccine to safeguard against smallpox, a related virus affecting humans. In 1881, Louis Pasteur, a French microbiologist, established immunization against anthrax by administering attenuated forms of the bacillus responsible for causing the disease.

The process of introducing vaccines into the body elicits protection against specific diseases and is known as **vaccination**. This procedure enables the immune system to effectively combat and counter germ infections. Vaccination serves as the paramount method for safeguarding communities and preventing the spread of preventable diseases. Individuals who have been vaccinated are incapable of transmitting infections to those around them. Certain vaccine-preventable diseases can lead to severe complications and even fatalities, underscoring the importance of vaccination in keeping individuals safe from these ailments. By significantly reducing the occurrence of illnesses, vaccination stands as the most crucial approach for safeguarding both adults and children. It is estimated to prevent approximately 3 million deaths worldwide

When individuals choose to forgo vaccination, they expose themselves to various diseases, including pneumococcal, influenza, HPV, hepatitis B, COVID, and more. Notably, adults are often the primary source of whooping cough infections, which can be particularly fatal for younger individuals. Therefore, it becomes imperative for adults to protect themselves, their families, and their community by receiving the appropriate vaccinations.

Chicken pox caused by the varicella-zoster virus, manifests as itchy rashes accompanied by blisters, headache, and fever. The Varicella vaccine is specifically designed to prevent this viral infection. **Tetanus**, a bacterial disease, presents symptoms such as painful spasms and muscle stiffness. The Tdap and Td vaccines are available to provide protection against tetanus and are recommended for individuals based on their age and vaccination history.

It is important to note that all vaccines undergo rigorous testing and evaluation before they are approved for use. This ensures their safety and effectiveness in preventing the targeted diseases. While some individuals may experience mild side effects after vaccination, such as temporary fever, body aches, swelling, itching, and tenderness at the injection site, these symptoms typically subside within a few days. The overall benefits of vaccination far outweigh these temporary discomforts

27.1.3 LIST OF SOME VIRAL DISEASES

Table 27.1 List of some viral diseases

Virus	Disease	Symptoms	Vaccine
Corona virus	Common cold	Fever, headache, fatigue and pain in chest shortness of breath	Sino-pharm, Sinovac, Pfizer, Moderna and AstraZeneca
Pox viruses	Cow & Small pox	Fever, sores, rashes	Varicella
Polio virus	Poliomyelitis (polio).	Fever, lack of appetite, nausea, sore throat, malaise, constipation and abdominal pain	Inactivated polio virus (IPV) Weakened poliovirus (OPV)
Hepatitis viruses	Hepatitis	Fever, Muscle aches, loss of appetite, nausea, vomiting and fatigue	Hepatitis-B vaccine
Measles, mumps, rubella viruses	Measles, mumps, rubella	A high fever, Tiredness. A barky cough. Red or bloodshot eyes. A runny nose. A red rash, which starts at the head and then spreads downward.	Measles, mumps, rubella (MMR) vaccine
Diphtheria, Tetanus viruses	Diphtheria, Tetanus	Painful stiffening of the muscles. "Whooping cough," can cause uncontrollable, violent coughing that makes it hard to breathe, eat, or drink.	Diphtheria toxoid(DT) vaccine, Tetanus toxoid(TT) vaccine

27.1.4 The Role of Vaccines in Preventing Polio, Measles, Hepatitis and Tetanus

Vaccines play a vital role in preventing the spread and occurrence of several infectious diseases, including polio, measles, hepatitis, and tetanus. These diseases have significant health risks and can lead to severe complications, disabilities, or even death. Vaccines have been developed to provide effective protection against these illnesses by stimulating the body's immune system to recognize and combat the specific pathogens responsible for causing them. Through widespread vaccination efforts, these diseases have been significantly controlled and, in some cases, even eliminated in certain regions. The use of vaccines has proven to be a critical tool in safeguarding individuals, communities, and public health by preventing the transmission and impact of these dangerous diseases

i) Vaccination against the polio

Polio or Poliomyelitis is infectious disease that is caused by **polio virus**. The virus infects the throat and intestinal tract.

Transmission:

Person-to-person transmission is the primary mode of spreading the polio virus. The virus can be transmitted through contact with infected fecal material and saliva. Contaminated water and food sources can also contribute to the transmission of the polio virus.

Symptoms:

Polio symptoms may include fever, reduced appetite, nausea, vomiting, sore throat, constipation, and abdominal pain.

Vaccination:

There are two types of vaccine used for prevention. **IPV** inactivated polio vaccine is administered through the injection and **OPV** oral polio vaccine is given orally especially to the children under the age of five.



Fig. 27.2 Poliomyelitis



Fig. 27.3 Polio vaccine

ii) Vaccination against the Measles

Measles is caused by a virus in the **paramyxovirus** family, an infectious disease that is highly transmissible from one person to another.

Transmission:

Measles is transmitted through the air, making it an airborne disease. The virus is primarily spread through respiratory droplets and aerosol particles when an infected person coughs or sneezes.

Symptoms:

High fever, cough, red eyes, runny nose, sore throat, and a characteristic rash that begins on the head and spreads throughout the entire body

Vaccination:

The **MMR** vaccine offers protection against Measles, Mumps, and Rubella. It is a combination vaccine that contains live attenuated measles virus and is highly effective in preventing measles. The MMR vaccine has been proven to be safe, with no significant side effects reported.

iii) Vaccination against the Hepatitis

Hepatitis is an inflammation of the liver, primarily caused by hepatitis viruses, which are categorized into five main strains: types A, B, C, D, and E.

Hepatitis A can last from few weeks to various months, it is acute and short-term disease.

Hepatitis B lasts from few weeks to chronic conditions.

Hepatitis C develops from mild to chronic infection; it is blood born viral infection for long term.

Hepatitis D is not common infection. Spread through direct contact with the bodily fluids of an infected person.

Hepatitis E is water born disease; it is acute but dangerous for pregnant women.

Transmission:

Different types of hepatitis have distinct modes of transmission. Hepatitis A spreads through contaminated food and water, while hepatitis B and C are transmitted through body fluids such as blood and vaginal secretions. Hepatitis D specifically transmits through blood contact. Lastly, hepatitis E is primarily transmitted through contaminated food and water sources.

Symptoms:

These are some common symptoms of Hepatitis; Flu like symptoms, loss of appetite, abdominal pain, fatigue and jaundice like symptoms such as yellow eyes, skin, urine and stool.

Vaccination:

Vaccination against hepatitis is essential in preventing the diseases. The hepatitis A vaccine is formulated using an inactivated form of the virus, while the hepatitis B vaccine is produced using recombinant DNA technology. These vaccines are readily accessible and effective in providing protection against their respective hepatitis strains. It's important to note that currently, there is no available vaccine for hepatitis C

iv) Vaccination against the Tetanus

Tetanus, commonly known as "lockjaw," is indeed a bacterial infection caused by the bacterium *Clostridium tetani*. However, the toxin produced by the bacterium affects the nervous system, leading to muscle stiffness and spasms rather than direct muscle contraction. The incubation period for tetanus is usually between 3 and 21 days, with an average of 10 days.

Transmission:

C. tetani is found in the soil and dust, and it enters into the body through the injured skin.

Symptoms:

Tetanus is characterized by several symptoms, including muscle stiffness and contractions, which can lead to lockjaw, causing difficulty in fully opening the mouth. Prolonged muscle contractions called tetany result in sustained muscle spasms and rigidity. Additional symptoms may include breathing difficulties, feeding problems, and gastrointestinal issues like constipation.

Vaccination:

Different types of vaccines are used to protect from diphtheria and tetanus. The vaccine is called **DT vaccine**. (Diphtheria & tetanus). TDP vaccine is used for Tetanus, diphtheria and Pertussis (whooping cough).

27.1.5 Schedule of the Vaccination of Polio, Measles, Hepatitis and Tetanus

Table 27.2 Schedule of the Vaccination

Disease	Vaccine	Age group
Polio	OPV vaccine, IPV vaccine	Birth to 5 years
Measles	MMR vaccine (Measles, Mumps and rubella)	Up to one year
Hepatitis-A Hepatitis-B	Hepatitis A vaccine is inactivated Hepatitis B vaccine is recombinant DNA	At any age
Tetanus & Diphtheria	DT vaccine (Tetanus & Diphtheria) TDP vaccine (Tetanus, diphtheria and Pertussis or whooping cough).	Childhood

27.2 ANIMAL HUSBANDRY

Animal husbandry, is a branch of agriculture, encompasses the management and care of livestock such as buffaloes, cows, cattle, sheep, goats, horses, and poultry for various purposes including milk, eggs, meat, fiber, and other food products. This involves providing proper care for the animals, including their living space, cleanliness, timely and appropriate feeding, access to water, breeding, reproductive processes such as calving i.e., giving birth to a calf in cattle, provision of shelter during inclement weather, shade for protection from sunlight, and attentive care during the birthing process and subsequent nourishment of the offspring. Additionally, ensuring the availability of veterinary medicine and professionals for

the health and well-being of the animals is crucial, along with fulfilling all necessary requirements and necessities.

Animals play a vital role in providing a diverse range of highly nutritious food products, emphasizing the need for proper care and attention. Meat and dairy products from animals like cows, buffaloes, and goats are commercially significant, as they are rich sources of protein and in high demand. Additionally, animals such as hens and ducks contribute to the protein supply through the production of eggs. Animal husbandry encompasses various sectors including poultry, dairy farming, apiculture (beekeeping), and aquaculture. Adequate preparation and maintenance of healthy and visually appealing animals are crucial for successful sales and marketing in this field

Major types of Animal husbandry

These are some major types of animal husbandry

Dairy farming:

Dairy farming focuses on the production of milk, which serves as a significant source for various dairy products like cheese, yogurt, cream, and butter. The successful management of dairy animals, including cows, buffaloes, sheep, and goats, is crucial for ensuring their physical and mental well-being, as it directly impacts human welfare. To maintain commercial value, these dairy animals require constant attention and regular inspections.

Poultry Farming:

Poultry farming involves the breeding and rising of birds for commercial purposes. Birds such as hens, ducks, and turkeys are raised both for meat and egg production, serving both commercial and household needs. Ensuring the well-being and health of these birds is of utmost importance, requiring careful care and regular inspections to maintain a disease-free and healthy environment.

Apiculture (Bee farming):

Apiculture, also known as bee farming, involves the management of bee colonies within manmade hives. Honey bees are domesticated for their commercial value in providing honey, wax, and playing a crucial role in pollination. The designated location for keeping bees is referred to as an apiary.

27.2.1 Role of live stocks in National Economy

Livestock plays a crucial role in Pakistan's economy, contributing approximately 11.9 percent to the GDP and employing about 37.4 percent of the labor force according to economic survey 2021-22. It provides essential products like milk, meat, eggs, wool, and various by-products, which ensure food security, nutrition, and income for numerous rural and urban households. Livestock also serves as a valuable source of draught power for agriculture and transportation, as well as organic fertilizer for crop production. Despite facing challenges such as low productivity and inadequate infrastructure, the livestock sector has exhibited impressive growth, driven by factors like high yields, favorable prices, government support, and improved access to resources. Pakistan has emerged as a leading global producer of milk and meat. However, there is a need to address issues like low productivity, feed quality, healthcare services, marketing infrastructure, and environmental degradation. Embracing modern technologies, enhancing animal welfare standards, promoting value addition and processing capabilities, and facilitating exports are vital for enhancing the sector's competitiveness and sustainability.

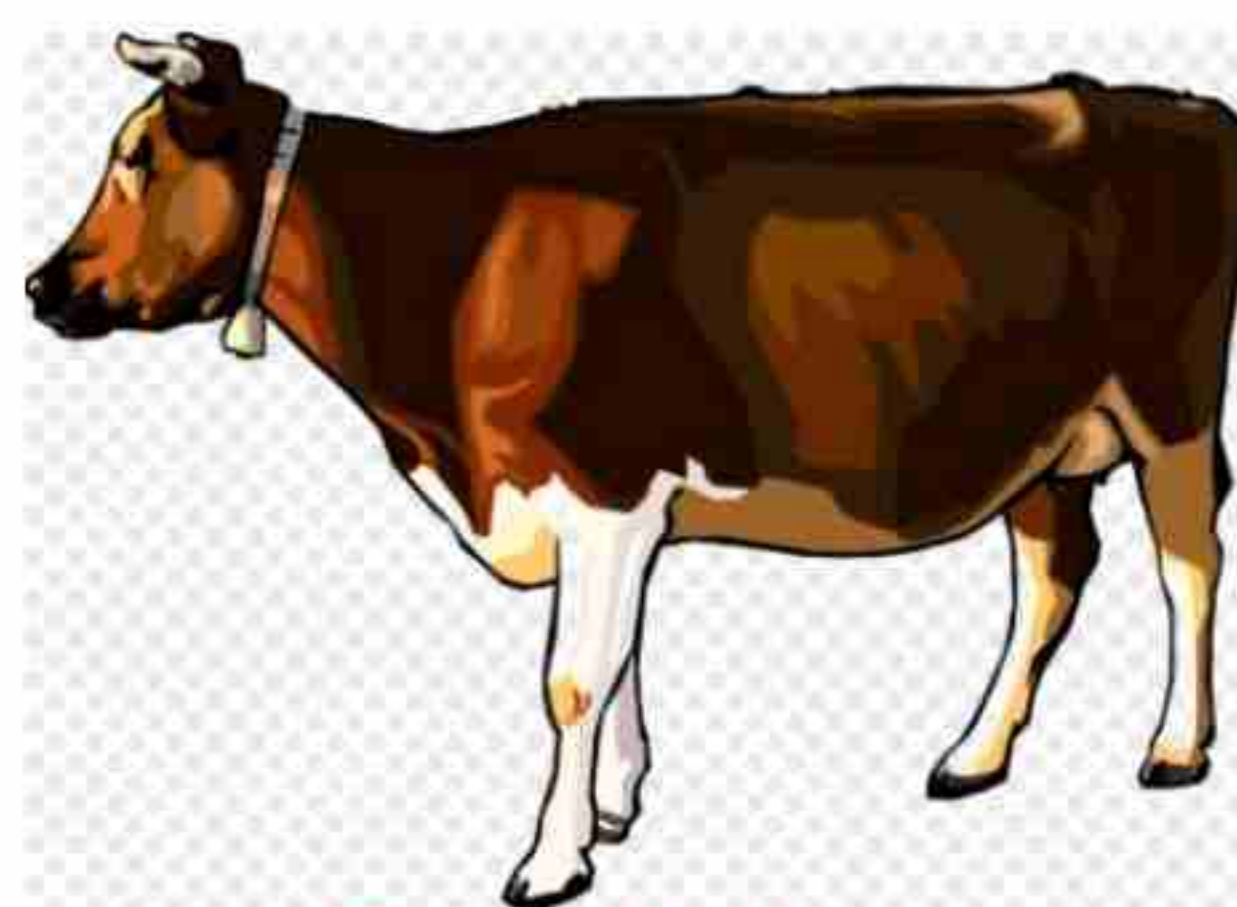
27.2.2 List of Outstanding Milk Producer Breed of Cows in Pakistan

Cow is the second leader of outstanding milk producer breeds in Pakistan; there are five main Cows such as Brown Swiss, Simmental, Normande, Jersey and Holstein. Whereas **Brown Swiss** and **Simmental** are the best milk producing breeds.

Table: 27.3 Outstanding milk producing breeds of Cow per lactation cycle

Cow		Per lactation cycle
1.	Brown Swiss	10,000- 12,000 L
2.	Simmental	About 9,000 L
3.	Normande	6,000 - 7,000 L
4.	Jersey	5,000-6000 L
5.	Holstein	4,000- 5000L

Note: (The lactation cycle is the period between one calving and the next one. It consists of three phases the early, mid and late lactation and dry period)



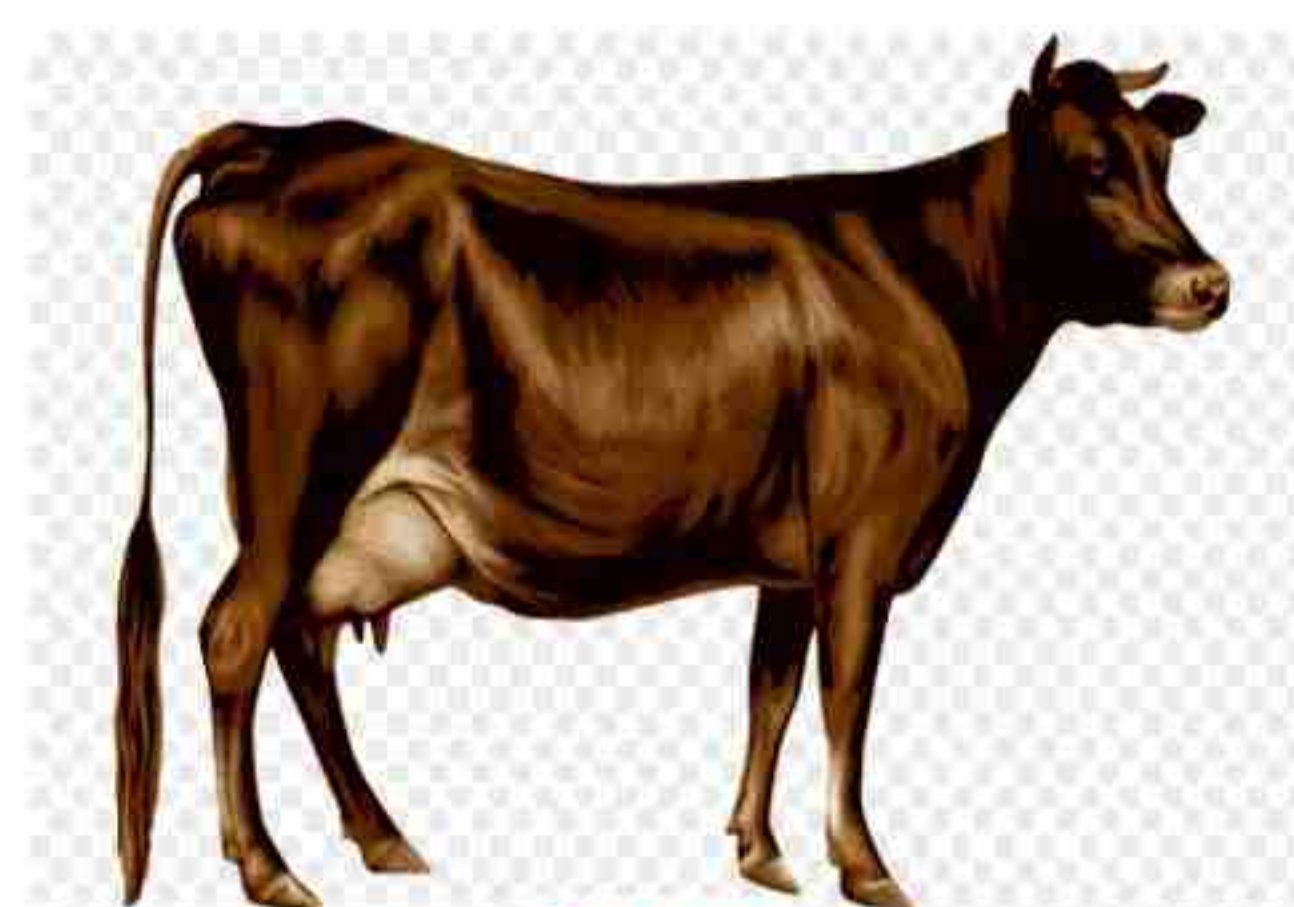
Brown Swiss



Simmental



Normande



Jersey



Holstein

Fig. 27.2 Types of Cows

27.2.3 Outstanding Milk Producing Breeds of Buffalo

Buffalo is the chief milk producing breeds in Pakistan. There are different varieties of buffalo such as Nili-Ravi, Kundi, Jaffrabadi, Godavari and Bhadawari. **Nili-Ravi** is the top milk producing animal of this group, Pakistan has two best breeds of buffaloes such as Nili-Ravi and Kundi.

Table: 27.4 Outstanding milk producing breeds of Buffalo per lactation cycle

	Buffalo	Per lactation cycle
1.	Nili- Ravi	1500-2500 L
2.	Kundi	1700-2000 L
3.	Jaffrabadi	1000-1200 L
4.	Godavari	1200-1500 L
5.	Bhadawari	800-1000 L

Note: (The lactation cycle is the period between one calving and the next one. It consists of three phases the early, mid and late lactation)

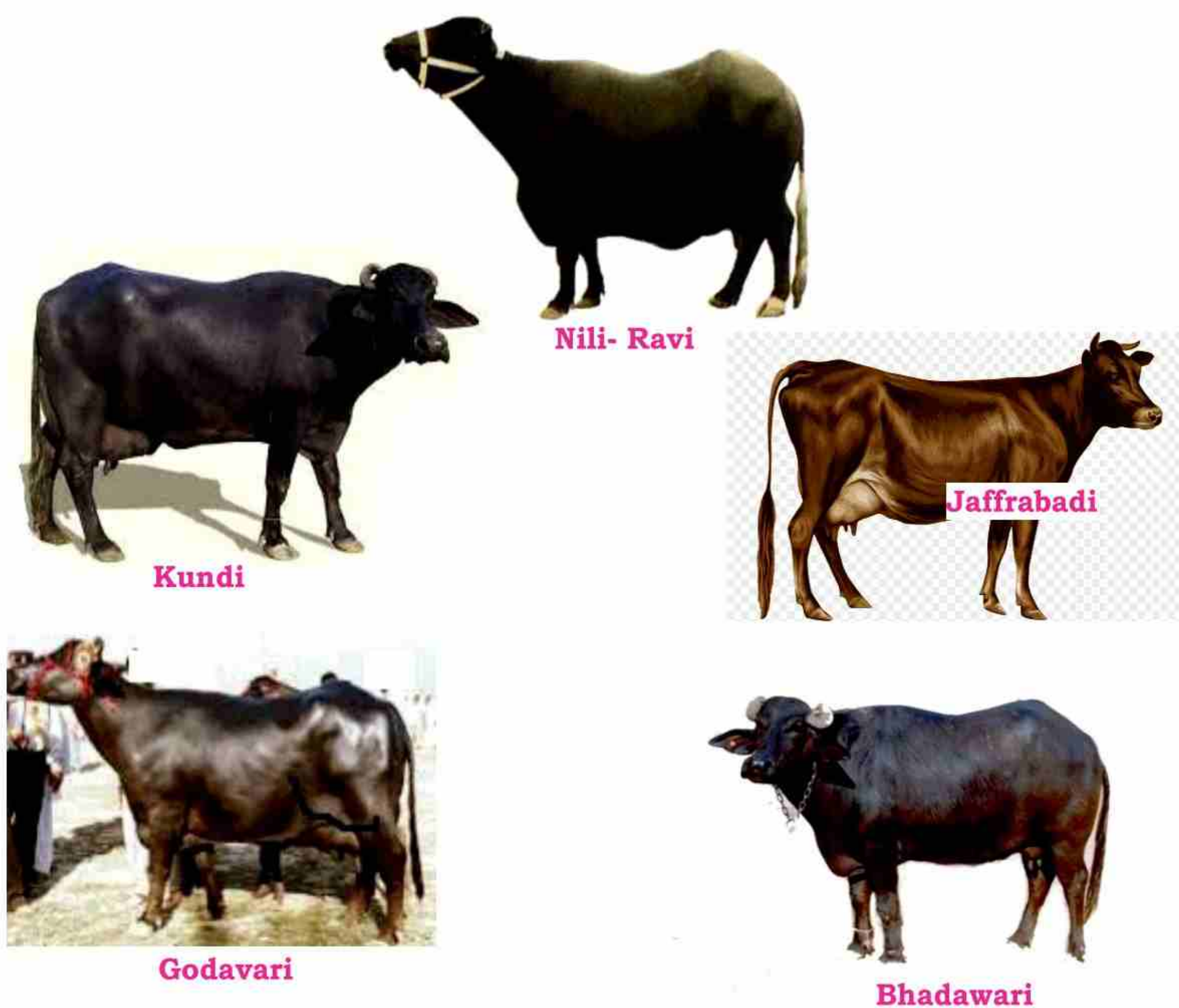


Fig. 27.3 Types of Buffalos

27.3.1 Latest Techniques Applied to Enhance Crop and Fruit Yield

Plant breeding is to change the characters of plants qualities into wanted or advancement in characters. **Mendel is known to be the father of Plant breeding.** Plant breeding also enhances the biodiversity which shows genetically and ecologically variations.

Methods adopted for plant improvements

There are different methods which are adopted for plant improvement such as Acclimatization, selection, hybridization and back crossing.

Acclimatization:

Acclimatization is a natural process through which plants adjust to changes in their environment, including variations in temperature, humidity, salinity, behavior, and physiology. It involves the plant's ability to adapt and regulate its biological functions to thrive under different conditions.

Plant introduction, on the other hand, refers to the intentional transfer of plants from their original habitat to a new location. The purpose of plant introduction is to establish new crop varieties or species in that particular area. This process plays a crucial role in agricultural development by expanding crop diversity and enhancing productivity.

As examples of successful plant introductions, Kinohimitsu or kino originated from Singapore, papaya from South Mexico and Central America, potatoes from Peru and northwestern Bolivia, and sweet potatoes from Central or South America have all been introduced and cultivated in the subcontinent

Selection:

Selection is a fundamental process in plant breeding and serves as the basis for crop improvement. It involves choosing or segregating the best quality plants from a population of crop plants. The purpose of selection is to identify and propagate plants that exhibit desirable traits under specific conditions.

Hybridization:

Hybridization is a key technique in plant breeding that involves the crossing or fusion of two genetically dissimilar parents through artificial pollination. This process results in the production of offspring or hybrids that are characterized by heterozygosity. Hybrids display characteristics such as vigor, size, growth rate, and yield. The outcome of hybridization is the development of hybrid varieties in crops such as onions, tomatoes, oilseeds, pulses, and fruits. Heterosis or hybrid vigor refers to the superiority of hybrids over their parents in one or more traits. This superiority is reflected in higher yield rates and increased resistance to diseases and pests.

Backcrossing:

Backcrossing is a technique used to introduce specific traits from a hybrid back into its parent or a genetically similar individual. It is commonly applied in horticulture, animal breeding, and the development of knockout or unconscious individuals. Backcrossed hybrids are often denoted by the acronym "**BC**." For instance, when an F₁ hybrid is crossed with one of its parents or a genetically similar individual, it is referred to as "**BC**₁." Subsequent crossings lead to the production of "**BC**₂' " generation and so on.

27.4.1 Home Gardening

Home gardening is a multifaceted system that combines farming and gardening practices within and around the home. It involves the cultivation of various plants, including flowers, attractive plants, vegetables, and fruits. Home gardening serves several purposes, such as meeting food requirements, beautifying the house, and providing a space for children to play and for hosting social gatherings. It offers numerous benefits on economic, social, physical, and environmental levels.



Fig. 27.6 Home gardening

One of the key aspects of home gardening is the promotion of organic plantation. This method has gained significant importance nowadays as it avoids the use of pesticides and artificial fertilizers, focusing instead on natural and sustainable practices.

Importance of Home Gardening:

Enhancement of Nutritional Value: Home gardens contribute to the improvement of the nutritional value of food by providing fresh and organic fruits, vegetables, and other produce.

Mental and Physical Health Benefits: Engaging in gardening activities boosts mood and reduces stress. Tasks such as preparing the garden area, digging, plant selection, and watering contribute to keeping the body active and provide aerobic exercise. Simply spending time in the garden, particularly walking, has positive effects on physical well-being.

Positive Environmental Effects: Home gardening creates a natural environment around houses, balconies, and galleries, often utilizing containers and pots for plant growth. The plants absorb carbon dioxide (CO₂) and release oxygen, contributing to a vigorous and fresh environment.

Erosion Reduction: The presence of plants in the soil helps in reducing erosion.

Source of Fresh and Organic Food: Home gardening ensures the availability of fresh, clean, and organic food. The produce grown in such gardens is rich in vitamins, as it grows in soil free from pesticides but enriched with natural fertilizers.

Control of Family Budget: Growing fruits and vegetables at home reduces expenses and allows families to have better control over their budgets. These homegrown products are of high quality, delicious, and available year-round, requiring families to only purchase items such as cooking oil from the market.

Year-round Food Availability: Home gardening enables a continuous supply of food throughout the year, avoiding the need for consuming produce from cold storage, which may not be as healthy.

Entertainment and Activities: The garden space around the house provides opportunities for exercise, yoga, parties, and play. Children benefit from the garden as a playground, and the presence of green plants has positive effects on health and eyesight. Beautiful decorative plants add to the overall aesthetic appeal of the home.

27.4.2 Some Seasonal Vegetable and Fruit Plants Suitable for Home Gardening

Table No. 27.5 List of summer vegetables and fruits

Vegetables of Summer	Fruits of Summer
Green beans	Mango
French beans	Apricots
Squash	Plums
Carrot	Leeches
Cauliflower	Grapes
Garlic & Onion	Guava
Okra	Papaya
Brinjal	Peaches
Cabbage	Water melon
Green & red chilies	Grewia

Table No. 27.6 List of winter vegetables and fruits

Vegetables of Winter	Fruits of Winter
Asparagus	Oranges
Peas	Banana
Garlic	Grape fruit
Spinach	Date
Potato	Pummel
Tomato	Kiwifruit
Winter lettuce	Passion fruit
Broad beans	Pear
Onion	Tangeries
Spring cabbage	Pomegranate

27.5 ROLE OF MICROBES IN HUMAN WELFARE

Microbes, including bacteria, viruses, and parasites, are microscopic organisms that cannot be seen with the naked eye. They are found in various environments such as water, soil, and air. Microbes have both beneficial and harmful effects on human welfare. While some microbes can cause diseases, they also play crucial roles in the production of antibiotics, vaccines, enzymes, vitamins, and the fermentation of dairy products such as cheese and curd.

27.5.1. List of some Beneficial Viruses

Cowpox virus: Provides immunity against smallpox.

Oncolytic viruses: Kills cancer cells and aids immunity.

Bacteriophages (phages): Specifically infect and kill bacteria.

Endogenous retroviruses: Contributed to placenta evolution

Gamma herpes virus (MHV-68): Shows resistance to infection

27.5.2 Role of microbes in household food processing:

Microbes play a vital role in everyday food processing in households, including the production of yogurt, bread, and cheese.

Bread: Bread dough contains yeast, specifically ***Saccharomyces cerevisiae***, which undergoes fermentation. During fermentation, yeast produces carbon dioxide (CO₂) and ethyl alcohol. The CO₂ gas creates air pockets in the dough, giving it a puffy and soft texture once baked.

Yogurt: The conversion of milk into yogurt involves the use of specific microbes, such as ***Lactobacillus*** species. These microbes ferment the lactose present in milk, converting it into lactic acid. This fermentation process gives yogurt its tangy flavor and thick texture.

Cheese: Various types of cheese available in the market are produced using specific microbes. For example, Swiss cheese utilizes the bacteria ***Propionibacterium shermanii***, while Roquefort cheese is ripened using the fungi ***Penicillium roqueforti***. These microbes contribute to the unique flavors, textures, and ripening processes involved in cheese production.

Role of microbes in industrial production:

Microbes also play a significant role in industrial production, particularly in the food industry. They are utilized in the production of various products, including chemicals, hormones, antibodies, beverages, fruit juices, and enzymes.

Fermented beverages: *Saccharomyces cerevisiae*, the same yeast used in bread production, is commonly employed in the production of fermented beverages. These microbes convert sugars into alcohol during the fermentation process, resulting in the production of alcoholic beverages like beer and wine.

Role of microbes in sewage treatment:

Sewage treatment involves the removal of pollutants from wastewater. Microbes, particularly *Bacillus* species, play a significant role not only in sewage treatment but also in the breakdown of proteins and oils. The treatment of wastewater is crucial to mitigate its negative impact on the environment. The process typically consists of three steps: primary, secondary, and tertiary treatments.

Primary Treatment: Primary treatment focuses on the removal of floating solids and organic materials from the sewage. It involves allowing the sewage to pass slowly through a basin, where heavy solid materials settle down. This stage is often carried out in a primary sedimentation tank.

Secondary Treatment: In the secondary treatment phase, solid materials are further removed by employing microbes to digest and break down residual organic matter. The microorganisms naturally present in the sewage feed on the solid organic materials, facilitating their growth and multiplication. This step reduces the organic content of the sewage through aerobic or anaerobic processes.

Sludge Digestion: Sludge digestion is a biological process in which organic solids present in the wastewater are decomposed into stable substances. This process helps in reducing the volume of sludge and converting it into more manageable and environmentally friendly forms.

Tertiary Treatment: Tertiary treatment serves as the final stage of sewage treatment, aimed at improving the quality of the treated water before it is reused or discharged. This stage involves various advanced processes such as filtration, disinfection, and nutrient removal to further enhance the water quality.

Effluent: Effluent refers to the treated wastewater that is released or reused after undergoing the necessary treatment processes. Microbes play a crucial role in the breakdown and removal of organic materials during sewage treatment, contributing to the effective and environmentally responsible management of wastewater.

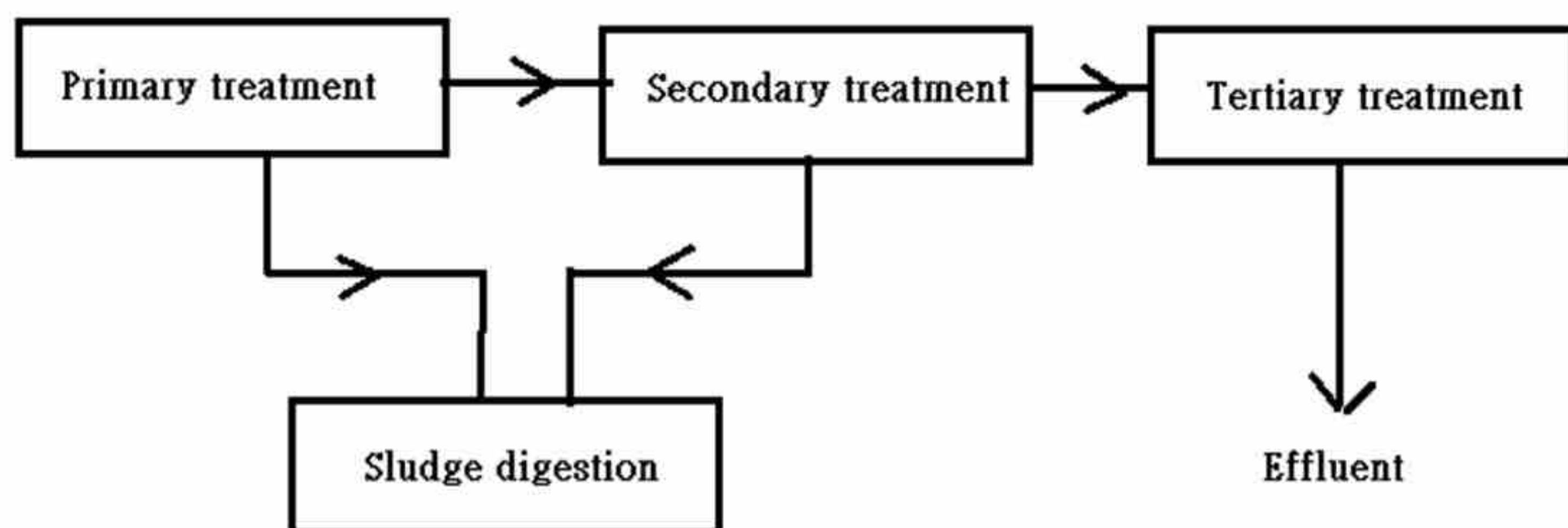


Fig. 27.7 Sewage treatment plant

Role of microbes in energy generation:

Microbes play a crucial role not only in sewage treatment but also in energy generation. They have the ability to generate various forms of fuel, such as hydrogen, methane, lipids, and ethanol, which can be utilized as sources of energy. When these fuels are burned, they produce energy.

Microorganisms also contribute to energy generation through their role in the decomposition of organic or inorganic matter in ecosystems. During this process, they produce electrons that can be harnessed for energy production.

Specific bacteria, such as *Escherichia coli* and *Bacillus subtilis*, have the capability to thrive on carbon resources present in the environment through processes like photosynthesis and enzymatic hydrolysis. These bacteria have been utilized to produce strains of ethanol or liquid biofuels, which can serve as renewable energy sources.

The ability of microbes to generate energy-rich compounds and participate in the breakdown of organic matter contributes to the development of sustainable energy solutions. By harnessing the energy-generating capabilities of microorganisms, we can explore and utilize alternative sources of fuel that have a reduced environmental impact compared to traditional fossil fuels.



SUMMARY

- The effective and proper control of different, serious, vulnerable or common diseases of population by using various appropriate measures is called integrated disease management.
- Effective disease management can be achieved by implementing healthy habits and practices.
- The control of disease through other living organisms (predators) that reduces the severity of diseases.
- The initial vaccine was developed by Edward Jenner, a British physician, in 1796. Jenner employed the cowpox virus as a vaccine to safeguard against smallpox, a related virus affecting humans.
- The process of introducing vaccines into the body elicits protection against specific diseases and is known as vaccination.
- The Varicella vaccine is specifically designed to prevent this viral infection.
- Polio symptoms may include fever, reduced appetite, nausea, vomiting, sore throat, constipation, and abdominal pain.
- Animals play a vital role in providing a diverse range of highly nutritious food products, emphasizing the need for proper care and attention.



EXERCISE

1. Encircle the correct answer:

- i) DT vaccine is used for
 - (a) Hepatitis
 - (b) Measles
 - (c) Common cold
 - (d) Diphtheria toxoid
- ii) *Clostridium tetani* which caused tetanus is a
 - (a) Virus
 - (b) Bacteria
 - (c) Parasite
 - (d) Fungi
- iii) MMR vaccine is effective for
 - (a) Measles
 - (b) Polio
 - (c) Measles, Mumps & rubella
 - (d) Hepatitis
- iv) The top milk producing animal of Pakistan is
 - (a) Bhadawari
 - (b) Jaffrabadi
 - (c) Nili- Ravi
 - (d) Godavari

- v) The yeast that gives puff appearance to dough is called
 - (a) *Saccharomyces*
 - (b) *Lactobacillus*
 - (c) *Penicillium*
 - (d) *Escherichia coli*
- vi) The removal of floating solids and organic materials from the sewage is
 - (a) Primary treatment
 - (b) Secondary treatment
 - (c) Tertiary treatment
 - (d) none of these
- vii) The process of hybrid crossing with its parents is called
 - (a) Selection
 - (b) Hybridization
 - (c) Back cross
 - (d) Acclimatization
- viii) French beans and Cauliflowers are vegetables of
 - (a) Winter
 - (b) Summer
 - (c) Spring
 - (d) all seasons
- ix) The Science that deals with the modification of DNA and enhances the characteristic of an organism is called
 - (a) Genetic Engineering
 - (b) Biotechnology
 - (c) Biology
 - (d) None of these
- x) Sludge digestion is a biological process in which organic solids are decomposed into stable substances
 - (a) Stable substances
 - (b) non stable substances
 - (c) Effluent
 - (d) None of these

2. Write short answer of the following

- i) Why vaccination is important for infectious disease?
- ii) List the outstanding milk producing breeds of cow.
- iii) What do you mean by integrated diseases and its management?
- iv) What is the role of livestock?
- v) Differentiate between following
 - (a) Selection and Backcross
 - (b) Vegetables of summer and vegetables of winter
 - (c) Selection and Hybridization

3. Give detail answer of the following questions

- i) Explain in detail different steps of sewage treatment.
- ii) Explain vaccination and its importance.
- iii) Describes the role of microbes in food processing and sewage treatments.

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