MICROBES AS BIOCONTROL AGENTS

(1) Biocontrol involves utilizing biological means to manage plant diseases and pests.

(2) In modern society, the prevalent approach to addressing these issues has been through the use of chemicals such as insecticides and pesticides. However, these chemicals pose significant risks to both human health and the environment, contaminating soil, groundwater, fruits, vegetables, and crops. Traditional farming practices also contribute to soil pollution through the application of weedicides, which indiscriminately eliminate both beneficial and harmful organisms. Adopting a holistic approach involves understanding the intricate interactions within the ecosystem, including the various organisms that make up the field fauna and flora.

(3) Biological control of pests and diseases in agriculture entails relying on natural predation rather than chemical interventions. Organic farmers prioritize biodiversity, recognizing its role in promoting overall health. They aim to establish ecosystems where pests are not eradicated but rather kept in check through a dynamic balance of organisms. This approach fosters a sustainable environment where diverse insect populations maintain manageable levels within the ecosystem.

The organic farmer believes that completely eliminating creatures commonly labeled as pests is not only feasible but also undesirable. This is because without these pests, the beneficial predatory and parasitic insects, which rely on them as a source of food or as hosts, would struggle to survive.

(4) Consequently, employing biocontrol methods decreases our reliance on harmful chemicals and pesticides. A crucial aspect of biological farming involves gaining knowledge about the diverse organisms present in the field, including both predators and pests. Understanding their life cycles, feeding patterns, and preferred habitats enables the development of effective biocontrol strategies.

Examples of Biocontrol

(i) The ladybird, characterized by its red and black markings, serves as an effective predator for controlling aphids.

(ii) Dragonflies play a beneficial role in eliminating mosquito populations.

(iii) Bacillus thuringiensis (Bt) is a microbial biocontrol agent utilized to manage butterfly caterpillars. Packaged in sachets as dried spores, it is mixed with water and sprayed onto susceptible plants such as brassicas and fruit trees. Ingested by insect larvae, the toxin is released in their gut, resulting in their demise. This bacterial disease selectively targets caterpillars while sparing other insects. Genetically engineered transgenic plants, incorporating B. thuringiensis toxin genes, exhibit resistance to insect pests, as seen in Bt cotton.

(iv) The fungus Trichoderma is being developed as a biological control agent for treating plant diseases. Commonly found in root ecosystems, Trichoderma species effectively combat various plant pathogens.

(v) Baculoviruses, belonging to the genus Nucleopolyhedrovirus (NPV), are pathogens that target insects and other arthropods. These viruses, predominantly used as biocontrol agents, possess species-specific insecticidal properties with a narrow spectrum. Importantly, they do not harm plants, mammals, birds, fish, or non-target insects.

(vi) Biopesticides are organisms applied to combat pests, including both weeds and insect pests. They are classified into two main types: bioherbicides and bioinsecticides.

Integrated Pest Management (IPM)

also known as sustainable pest management, is implemented when there is a need to preserve beneficial insects or when treating ecologically delicate areas. IPM involves integrating various strategies to control pests across one or multiple crops, aiming for the most effective, economical, safe,

ecologically sustainable, and socially acceptable methods. In agriculture, IPM utilizes a combination of physical, chemical, and biological techniques to minimize the harmful impact of crop pests while maintaining ecological balance.

The primary objective of IPM is to establish and sustain conditions where insects are prevented from causing significant crop damage. Various tools and components are employed in IPM for different crops. These include the use of pest-resistant or tolerant crop varieties, natural predators and pathogens, parasitic organisms, cultural practices like summer ploughing and late planting, quarantine measures, judicious application of pesticides, as well as attractants and repellents.