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AI3019

**SUSTAINABLE AGRICULTURE AND
FOOD SECURITY**

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UNIT – II

SUSTAINABLE AGRICULTURE

2.1 SUSTAINABLE AGRICULTURE

Sustainable agriculture refers to the ability of a farm to produce food indefinitely, without causing severe or irreversible damage to ecosystem health.

Elements of sustainability

There are many ways to improve the sustainability of a given farming system, and these vary from region to region. However, there are some common sets of practices among farmers trying to take a more sustainable approach, in part through greater use of on-farm or local resources each contributing in some way to long-term profitability, environmental stewardship and rural quality of life.

- a) **Soil conservation-** Many soil conservation methods, including contour cultivates contour bunding, graded bunding, vegetative barriers, strip cropping cover cropping, reduced tillage etc help prevent loss of soil due to wind and water erosion.
- b) **Crop diversity-** Growing a greater variety of crops on a farm can help reduce risks from extremes in weather, market conditions or croppests. Increased diversity crops and other plants, such as trees and shrubs, also can contribute to soil conservation, wildlife habitat and increased populations of beneficial insects
- c) **Nutrient management-** Proper management of nitrogen and other plant nutrients can improve the soil and protect environment. Increased use of farm nutrient sources such as manure and leguminous cover crops, also reduces purchased fertilizer costs.
- d) **Integrated pest management (IPM)-** IPM is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in way that minimizes economic, health and environmental risks.
- e) **Cover crops-** Growing plant such as sun hemp, horse gram, pillipesara in the off season after harvesting a grain or vegetable crop can provide several benefits, including weed suppression, erosion control, and improved soil nutrients and soil quality .
- f) **Rotational grazing-** New management- intensive grazing systems take animals out barn into the pasture to provide high-quality forage and reduced feed cost .

Importance of sustainable agriculture:

A regionally integrated system of plant and animal production practices are designed to produce long-term results such as:

1. Production of sufficient human food, feed, fibre, and fuel to meet the needs of a sharply rising population.
2. Protection of the environment and expansion of the natural resources supply.
3. Sustainment of the economic viability of agriculture systems.

Sustainable agriculture practices

Through decades of science and practice, the following farming practices have proven effective in achieving sustainability, especially when used in combination:

- 1. Rotating crops and embracing diversity.** Planting a variety of crops can have many benefits, including healthier soil and improved pest control. Crop diversity practices include intercropping (growing a mix of crops in the same area) and complex multiyear crop rotations.
- 2. Planting cover crops and perennials.** Cover crops such as clover, rye, or hairy vetch are planted during off-season times when soils might otherwise be left bare, while perennial crops keep soil covered and maintain living roots in the ground year-round. These crops protect and build soil health by preventing erosion, replenishing soil nutrients, and keeping weeds in check, reducing the need for fertilizers and herbicides.
- 3. Reducing or eliminating tillage.** Traditional plowing (tillage) prepares fields for planting and prevents weed problems but can cause soil loss. No-till or reduced-till methods, which involve inserting seeds directly into undisturbed soil, can reduce erosion and improve soil health.

4. **Applying integrated pest management (IPM).** A range of methods, including mechanical and biological controls, can be applied systematically to keep pest populations under control while minimizing use of chemical pesticides.
5. **Integrating livestock and crops.** Industrial agriculture tends to keep plant and animal production separate, with animals living far from the areas where their feed is produced, and crops growing far away from abundant manure fertilizers. A growing body of evidence shows that a smart integration of crop and animal production can make farms more efficient and profitable.
6. **Adopting agroforestry practices.** By mixing trees or shrubs into their operations, farmers can provide shade and shelter that protect plants, animals, and water resources, while also potentially offering additional income from fruit or nut crops.

7.Managing whole systems and landscapes. Sustainable farms treat uncultivated or less intensively cultivated areas as integral to the farm. For example, natural vegetation alongside streams, or strips of prairie plants within or around crop fields, can help control erosion, reduce nutrient runoff, and support bees and other pollinators and biodiversity in general.

Major factors affecting the ecological balance and sustainability of agricultural resources are:

a) Land/soil related problems

- i. Soil degradation
- ii. Deforestation
- iii. Accelerated soil erosion
- iv. Siltation of reserves
- v. Wind erosion

b) Irrigation related problems

- i. Rise in groundwater table & water logging
- ii. Soil salinization & alkalization
- iii. Over- exploitation of groundwater

c) Indiscriminate use of agro-chemicals

- i. Fertilizer pollution
- ii. Pesticide pollution

d) Environmental pollution

- i. Greenhouse effect
- ii. Depletion emissions
- iii. Methane emission
- iv. Eutrophication

2.2 Agroecosystem

The concept of agroecosystems offers a valuable approach to address this challenge. Agroecosystems are ecosystems found on agricultural land that are influenced by human activities. They can be viewed as cohesive units of agricultural activity, encompassing crops, livestock, soil, water, and other biotic and abiotic components, along with their interactions within and across scales. It's important to note that agroecosystems are not isolated; they are interconnected with surrounding ecosystems and socio-economic systems through flows of matter, energy, and information. The study of agroecosystems, known as agroecology, combines ecological concepts and principles to promote more harmonious and synergistic interactions between humans and the environment within agricultural systems. Agroecology serves as both an applied science and a practice, arising from the desire for just and sustainable approaches to agriculture, nutrition, and food security amidst environmental change and degradation.

Components of Agroecosystems

Agroecosystems are composed of various biotic and abiotic components that interact with each other in complex ways. In this section, we will focus on four major components of agroecosystems: crops, livestock, soil and water.

A. Crops