

CONCEPT OF SUSTAINABLE AGRICULTURE

Agriculture is the process of producing food, feed, fibre and other desired products by cultivation of certain plants and raising of domesticated animals. Agriculture has changed dramatically, especially since the end of World War II. Food and fibre productivity has increased by using new technologies, mechanization, increased use of fertilizers and pesticides and expansion of irrigation facilities. These changes allowed farmers with reduced labour demands to produce the majority of the food and fibre. Although these changes have had the positive effect of these practices have also caused some serious environmental and social problems such as erosion of top soil depletion and pollution of groundwater contamination, unemployment of farm labourers due to their replacement by increasing use of farm machinery in agriculture operations. A growing movement has emerged during the past two decades to question the role of the agricultural establishment in promoting practices that contribute to these social problems.

In view of the growing negative consequences of modern agriculture there is growing demand to promote "sustainable agriculture". Sustainable agriculture incorporates address many environmentally safe agricultural practices and offers innovative and economically viable opportunities for farmers, labourers, consumers etc., policymakers and many others in the entire food system.

HUMAN NEEDS AND OVER USE OF ENVIRONMENT

Urban populations are growing rapidly throughout the world and many cities in developing countries have become centres of poverty. Almost half of the world's people live in densely populated urban areas. Rural people migrate to urban areas in search of jobs, food, housing, a better life style, entertainment etc. Others move to cities because of poverty, lack of land to grow food and declining agricultural jobs etc. The proportion of global population living in urban areas is increasing and urban population is increasing rapidly in developing countries and poverty is becoming one of the major problem in urban areas as more poor people migrate to cities from villages. Biggest human need is, need for survival.

21.2 NEED FOR ENHANCING QUALITY OF ENVIRONMENT

The huge population puts a tremendous pressure on resources. The high rate of consumption of resources and high waste output. Large areas of forests and agricultural land are disturbed and degraded to provide urban dwellers with houses, food, water, energy for transport, minerals and other resources. As cities expand, they destroy rural crop land, fertile soil, forests, wet land and wild life habitats. At the same time, they provide little of the food they use. From the point of view of environment, the cities are like giant vacuum cleaners, sucking up all the resources and giving out pollution, wastes and heat.

21.3 SUSTAINABLE AGRICULTURE

Sustainable agriculture is that form of agriculture which attempts to produce sufficient food to meet the needs of present day population without exhausting soil fertility and irreversibly damaging the environment. Sustainable farming systems are those that are least toxic and least energy intensive and yet maintain productivity and profitability i.e. low input agriculture or organic farming.

Thus, sustainable agriculture is one that,

- supports profitable production;
- protects environmental quality;
- uses natural resources efficiently;
- provides consumers with affordable, high-quality products;
- decreases dependency on non-renewable resources;
- enhances the quality of life for farmers and rural communities;

- and will last for generations to come.

21.4 METHODS OF SUSTAINABLE AGRICULTURE

Sustainable production practices involve a variety of approaches. At the planning level one must take into account the local geography (topography), soil condition and nature, local climate, pests, local inputs and the farmer's goals. The grower (farmer) must then select appropriate practices. Several methods adopted in sustainable agriculture are:

- cultivation practices to increase biological and economic stability .
- selection of improved varieties to suit the need.
- soil management by proper method of tillage.

Many farmers in India and other developing countries follow the traditional practice of mixed cropping or diverse cropping and crop rotation.

(a) Mixed cropping or diverse cropping It is an old practice in our country . Two or more crops are grown all at the same time in a field. If by chance one crop fails, the others crops cover the risk of total crop failure. Usually a long duration crop is grown with a short duration one so that both get sufficient nutrition at the time of maturity . Then water and nutrient requirement are also different.

Generally a leguminous crop is grown along with the main crop. Legumes helps to increase soil fertility by fixing atmospheric nitrogen. This saving the cost of chemical fertilizers.

The various plans followed in diverse or mixed cropping practices are-

- polyvarietal cultivation where several genetic varieties of the same crop are planted.
- intercropping where two or more different crops are grown at the same time on a plot like carbohydrate rich cereal that uses soil nitrogen and nitrogen fixing legume that puts back the nitrogen in the soil.
- polyculture, in which different plants maturing at various times are planted together . This practice has many advantages because fertilizer and water requirement of plants are different so there is less need of these inputs. Pests are controlled naturally because their natural predators find multiple habitats to survive. It has been found that this practice produces much higher yield per hectare compared to monoculture.

Large scale mechanization lead to the spread of monoculture i.e. only one crop variety is sown in the entire area when only one cultivator is planted in a large area. This system uses lot of fertilizer , pesticide, water . This practice may be productive for sometime but causes environmental and economic problems.

(b) Crop rotation It is practice of growing different crops in regular succession in the same field. This practice controls insects and diseases, increases soil fertility and decreases soil erosion. Generally soil cannot sustain continuous cropping with high yielding single crop because certain nutrients required by the crop get exhausted totally while others remain unutilized leading to serious nutrients imbalance in soil and encouraging certain diseases and pests. Sowing a leguminous crops (eg. green gram) as a rotational crop is very useful because legumes enhance nitrogen level in the soil due to their ability to fix atmospheric nitrogen, reduces the need for chemical nitrogen fertilizer . Thereby cutting the cost and saving the soil from the harmful effects of using high yielding varieties alongwith the application of large amount of fertilizer , pesticides and water . It is possible to grow two or sometimes three different crops in succession on the same land within a year is known as multiple cropping. This practice can go on for sometime but the land cannot maintain high yield in the long run.

Crop rotation takes into account the following factors:

(i) Leguminous crop should be grown after non-leguminous crop.

(ii) Crops require less water (irrigation) should be grown after one – that requires more water .

(iii) Crops requiring less manure should be sown after one that requires more manure.

Important crop patterns of crop rotation 1. Green gram – Wheat – Moong 2. Ground nut – Wheat – Moong 3. Arhar – Sugarcane – Wheat – Moong 4. Paddy – Wheat – Moong

Optimum diversity may be obtained by integrating both crops and livestock in the same farming operation. Mixed crop alongwith livestock operations have several advantages.

First, growing crops only on more level land and pastures or forages on steeper slopes will reduce soil erosion.

Second, pasture and leguminous forage crops in rotation enhance soil quality and reduce erosion; livestock manure, in turn, contributes to soil fertility .

Third, livestock can buffer the negative impacts of low rainfall periods by consuming crop residue that in “plant only” systems would have been considered crop failures.

Finally , feeding and marketing are flexible in animal production systems. This can help cushion farmers against price fluctuations and, make more efficient use of farm labour .

Soil Management: healthy soil is a key component of sustainable agriculture. That is healthy soil along with water and nutrients produces healthy crop plants that are less susceptible to pests and diseases. Accordingly , soil must be protected and nurtured to ensure long term productivity and stability . Methods of protection include using cover crops, compost, reducing tillage, conserving soil moisture by dead mulches, this increases water hold capacity of the soil.

Varietal improvement with limited land at our disposal, we have to increase production of food grains, fodder , sugar , oil, fibers, fruits and vegetables. One of the most important method to do that is to improve the existing varieties of plants by the application of genetics and plant breeding and related sciences. Significant improvement in crop production has been achieved by using the conventional methods of selection and plant breeding.

Some of the objectives of varietal improvement are:

- (i) development of high yielding varieties of crop plants.
- (ii) food crops developed for better and higher nutritional quality like protein quality in pulses, baking quality in wheat, preserving quality in fruits and vegetables, oil quality in oil seed producing plants.
- (iii) development of crop varieties resistance to diseases and pests.
- (iv) improving varieties for resistance against heat, cold, frost, draught and water logging.