FACULTY OF AGRICULTURE SCIENCES AND ALLIED INDUSTRIES

SUSTAINABLE AGRICULTURE

The word ―sustain, from the Latin *sustinere* (*sus*-, from below and *tenere*. to hold), to keep in existence or maintain, implies long-term support or permanence. As it pertains to agriculture, sustainable describes farming systems that are ―capable of maintaining their productivity and usefulness to society indefinitely. Such system... must be resource-conserving, socially supportive, commercially competitive and environmentally sound.

The *concept of sustainable agriculture* set out by the Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR) states ―sustainable agriculture is the successful management of resources for agriculture to satisfy the changing human needs, while maintaining or enhancing the quality of environment and conserving natural resources.

Problems and its impact on agriculture

Agriculture has changed dramatically, especially since the end of World War II. Food and fiber productivity soared due to new technologies, mechanization, increased chemical use, specialization and government policies that favoured maximizing production. Although, these changes have had many positive effects and reduced many risks in farming, there have also been significant costs. Prominent among these are topsoil depletion, ground water contamination, decline of family farms, continued neglect of the living and working conditions for farm labourers, increasing costs of production and the disintegration of economic and social conditions in rural communities. Problems of agriculture can be listed as under:

1. Decline in agricultural growth rate
2. Decline in factor productivity
3. Static or decline in food production
4. Increasing malnutrition
5. Shrinkage in net cultivated area
6. Increasing environmental pollution
7. Depleting groundwater table
8. Increasing cost of production
9. Low farm income
10. Increasing unemployment

As a result, agricultural productivity has been witnessing stagnation in recent years. Besides, issues such as competing demand for water in the context of changing demographics and its various end uses further aggravates the degree of risks in the agriculture sector. These have considerable implications for food and livelihood security and as agriculture production being risk prone, may lead to migration from rural to urban and sub urban areas. Indian agriculture now faces the challenge of ensuring food security amidst constraints such as stagnating net sown area, deterioration of land quality, reduction in per capita land availability etc. The challenges are:

(i) Need for more food: Around 310 M t of food grains in 2050

(ii) Stagnating net sown area: 140 ± 2 M ha since 1970

(iii) Land share under fallow: 38 per cent increase since 1951

(iv) Per capita land availability: From 0.91 ha in 1951 to 0.32 ha in 2001 and to 0.19 ha is projected by 2050

(v) Per capita net sown area: 0.33 ha in 1951 to 0.14 ha in 2001

Fostering rapid, sustainable and broad-based growth in agriculture is therefore, a key priority keeping in mind the overall socio-economic development trajectory of the country, especially in the light of existing vulnerabilities that relate to a shrinking land resource base, additional stresses arising from the non-agricultural sector and issues emerging due to changing climate. This necessitates a strategic approach with a renewed vision and redefined focus.

A growing movement has emerged during the past three decades to question the role of the agricultural establishment in promoting practices that contribute to these social problems. Today, this movement for sustainable agriculture is garnering increasing support and acceptance within mainstream agriculture. Not only does sustainable agriculture address many environmental and social concerns, but it offers innovative and economically viable opportunities for growers, labourers, consumers, policymakers and many others in the entire food system.

Indicators of agricultural sustainability

These help us to identify, quantify and evaluate the effect of agriculture. We will be able to see the consequences of our policies on progress towards sustainability. Our future programmes and initiatives, as well as those of others, will be more easily and better targeted.

This set of indicators provides a means of measuring the economic social and environmental impacts of agriculture and to help assess the effectiveness of policies and the sustainability of the sector.

In order to be able to make a balanced assessment of agriculture‘s progress towards sustainability, social, environmental and economic factors must be examined. Tins calls for indicators that are cross-linked as well as representative of the issues most relevant to agriculture. The trends revealed by individual indicators need careful interpretation before conclusions can be drawn on the progress towards sustainability of the sector as a whole.

Indicators are able to show positive progress towards sustainability. For example, use of environmentally friendly fanning system has been rising. By combining indicators with agricultural productivity and energy use, we can see that energy efficiency has been rising. But other indicators show adverse movement. The numbers of certain species of farmland birds, for example, are in decline. Some of the indicators included in this set are not yet fully developed as they are based on existing data. In time, however, they should provide a better reflection of the trends towards a more sustainable agriculture sector.

Indicators are a composite set of attributes or measures that embody a particular aspect of agriculture. Indicators are quantified information, which help to explain how things are changing over time. Sustainability indicators look at economic, social and environmental information in an integrated manner. Many professionals agree that at least three criteria should guide the development of sustainability indicators:

Indicators of key natural resources in rainfed cropping system

S. No.	Indicators key	Management aspects
1.	Nutrient balance	Organic matter—rate of change Nitrogen cycling—especially when using grain legumes in rotation with cereals. Monitoring status of phosphorus, sulphur and potassium Micronutrients.
2.	Erosion	Vegetation cover—includes trees as well as stubble. Soil surface cover—stubble retained (30% sufficient to prevent wind and water erosion). Stream bank. Sheet and gully erosion.
3.	Productivity, yield and quality	Water use efficiency—*i.e.*, actual versus potential (in some areas the potential is much less than the actual) (biomass/grain yield/net return), recharge (dryland salinity and nutrient leaching). Pasture composition—legume and perennial.

		Matched animal versus pasture production—appropriate enterprise selection/capability. Maintenance of genetic base/improvement
4.	Soil structure	Infiltration. Permeability/water storage. Stability. Water logging. Compaction.
5.	pH	Change, Toxicity deficiency, Indicator plants
6.	Energy efficiency	Energy input vis-à-vis energy output of the whole agricultural system.
7.	Biological factors	Soil macro/micro flora and fauna, animal health, plant health (root growth and others) pests (animals and plants).
8.	Farm management skills	Understanding a good indicator would be the understanding of the farmers of their own technical system.
9.	Precipitation	Performance of rainfall in a year as % of normal and its coefficient of variation. Distribution of area based on rainfall amount (dry: 0-750mm, medium: 750-1150 and 1150-2000mm, assured: > 2000mm). Categorization of the amount of rainfall (excess: =20% or more, normal: =10% to -10%, deficient: 20% to -59%, scanty: -60% or less). Number of districts having mean annual rainfall of 750-1250 mm and moisture availability period for at least 150 days. Area affected due to drought (slight, moderate or calamitous).