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Sustainable Agriculture

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Abstract

Sustainable agriculture is an important component in the scheme of integrated management of environment in urban and rural areas. One may argue that most of the agricultural activities are confined to the rural areas, so how do the urban areas come in its purview. In addition, both the areas are subsumed in, and form a continuum in the natural environment. These aspects have to be kept in mind for devising strategies for effective management of environment. This research paper analyses the evolution of different models of agriculture, highlighting the fact that its sustainability hinges on the balance between socio-economic realities and a healthy environment. It looks at sustainable agriculture from socio-economic and cultural perspectives.

Keywords: Biological, diversity, conservation, sustainability, economically and ecologically

1. Agriculture: Traditional to Modern Farming Systems

In this section, a brief overview of the evolution of traditional to modern farming systems beginning with the post World War II period.

1.1 Agriculture after World War II

Since the end of World War II, agriculture has undergone dramatic changes. Food and fibre productivity soared due to the use of new technologies, mechanization, introduction of new and better seeds/varieties, increased use of chemical fertilizers and pesticides, availability of specialists' advice and supportive government policies that favoured maximizing production. These changes allowed fewer farmers with reduced labour demands to produce the majority of the food and fibre in the developed countries of North America like the United States, in some of the European states and to some extent in some parts of the Third World. Although these changes have had many positive effects and reduced many risks in farming, the costs have also been significantly high. Prominent among these are depletion of topsoil, contamination of groundwater, decline in the size of family farms, neglect of the living and working conditions for farm labourers, high costs of production, and the disintegration of economic and social fabric of the rural communities. The changing agricultural approach that appeared to hold the promise of fulfilling the increasing needs of the society took the form of the familiar Green Revolution. We now describe it briefly.

1.2 Green Revolution Agriculture

The Green Revolution in agriculture was an attempt to solve world hunger problems by boosting food production through an increase in

the yield of grain crops. In the 1960s and 1970s, scientists working in agricultural research institutes, mostly funded by public money, began to carry out research into ways in which the yield of the grain crops, in particular, wheat, maize and rice could be improved. The new crops, known as hybrids, were developed by selectively crossbreeding different plant varieties.

There were two distinctive categories of these new crops:

• Maize hybrids, developed from varieties grown in the USA and Zimbabwe, spread across large parts of Central America and to a lesser extent East Africa.

• Fertilizer-responsive varieties of crops were introduced in East Asia (rice); and in North Mexico, India and Pakistan (wheat).

However, these hybrid crops necessitated extensive chemical inputs like artificial fertilizers, pesticides and herbicides and the use of machines such as tractors, combine harvesters, pumps for irrigation and food processing technologies.

1.3 The Effects of the Green Revolution

In many areas the Green Revolution resulted in two-or-three-fold increase in food production. In some areas, it enabled farmers to plant two or even three crops a year. In some countries national food production increased remarkably as a result of Green Revolution. For example, India, once a net importer of wheat, is now a major exporter. In other countries, the Green Revolution has not resulted in such an unprecedented increase in agricultural production. For example, it is generally accepted that most African countries benefitted little from the Green Revolution.

Besides this, a variety of new issues have opened up with the onset of Green Revolution. On the one hand, promoters of Green Revolution point to the fact that in the most benefitted areas such as the South and the South East Asia, the proportion of the population that is undernourished declined rapidly between 1970 and 1990, while in regions like Sub-Saharan Africa it has risen. On the other hand, many critics argue that the Agri-practices of Green Revolution have had serious consequences for the poor. According to them:

• Green Revolution crops lend themselves to mechanized farming which is the most efficient on large farms. This has led to many small farms and holdings being subsumed into larger farms, displacing tenant farmers and sharecroppers and resulting in increased landlessness.

• The increased production of new crops has sometimes taken place at the expense of crops traditionally grown and consumed by the poor. For example, traditionally, pulses have been a source of protein for poor people in India and Pakistan, yet in areas covered under Green Revolution, pulses have been replaced by wheat, which is more expensive to be as much nutritious.

• Many farmers have become dependent on the chemical industries that supply the agro-inputs such as fertilizers, pesticides, and herbicides for growing the Green Revolution crops. In India alone, during the mid-1990s, fertilizer consumption was 200 times higher than it was at the beginning of the 1960s.

• Traditionally, farmers have taken care not to over-utilize their resources such as land, soil and water. However, the excessive use of artificial fertilizers and pesticides has harmed the water quality in many areas, and has contributed to land degradation.

• The heavy use of fertilizers and pesticides has had adverse effects on the health of the farmers as well as the consumers.

The debates about the benefits of the Green Revolution still continue. The increase in pests and diseases, coupled with declining soil and water quality, cast serious doubts on whether the high crop yields can be sustained in the times to come!

1.4 Problems Related to the Green Revolution

The following problems related to the Green Revolution vis-à-vis the conventional agriculture practices, have also been observed.

• The various regions of the world under the Green Revolution have not exhibited uniform and increased crop production trends. In some there has been unprecedented increase whereas in others famine-like conditions prevailed.

• The new more productive methods have been found to have detrimental effects on the environment, for example:

− Soil erosion (Figure 1) for every ton of grain produced, approximately 20 tons of top soil is utilized;

− The lowering of the water table, as more crops

are planted than the land can sustain and new seed varieties often need large amounts of water;

− The Stalinization and alkalization of soils through excessive irrigation and removal of trees;

− Residues of pesticides and herbicides are found in other living beings, in water supplies and various food items.

• Farm subsidies in industrialized nations affect the terms of trade in the Third World countries.

• Third World debt leads to the use of land for large scale cash crop production, pushing subsistence farmers onto marginal lands, thus contributing to further degradation of soil.

Figure 1. Different forms of soil erosion

(Source:http://eusoils.jrc.it/ESDB_Archive/pesera/pesera_cd/images/img_h2.gif**)**

2. Sustainable Agriculture

A growing movement has emerged during the past two decades (1980s and 1990s) to question the role of the agricultural establishment, especially with reference to Green Revolution in promoting practices that contribute to a variety of socio-economic and other problems. This movement for sustainable agriculture is gradually garnering increasing support and acceptance within mainstream agriculture throughout the world. Not only does sustainable agriculture seen to address many environmental and social concerns, but it offers innovative and economically viable opportunities for growers, labourers, consumers, policy makers and many others in the entire food production system.

2.1 Concept of Sustainable Agriculture

The concept of sustainable agriculture is still evolving. However, it is important to identify the basic ideas, practices and policies that constitute our concept of sustainable agriculture. This will help in clarifying the research agenda and priorities and suggesting practical steps that may be appropriate for moving towards sustainable agriculture.

Main Elements

The main elements of sustainable agriculture are as follows (also see Figure 2):

• Appropriate land use for crop production as against monoculture,

• Working in harmony with natural systems,

• Harnessing the powers of nature for example, in pest control,

• Soil protection using mulch and minimal tillage methods,

• Organic matter build up through the use of manure and compost,

• Animals are important for making manure and, therefore, for maintaining soil fertility,

• Plant nutrient maintenance through crop rotation,

• Judicious use of artificial fertilizers or chemical pesticides,

• Local markets and decentralized systems of distribution, and

• Biological diversity maintenance and conservation.

Figure 2. Some elements of sustainable agriculture. a) Mulching with crop residues is highly effective; b) Natural pest control is very promising; and c) Manure is a valuable resource for sustainable agriculture

Sources: a) http://www.ipmthailand.org/images/Components/Organic_farm_egg_plant_mulching_3.JPG. b) http://pested.unl.edu/pic18.gif. c) http://www.ipmthailand.org/images/Components/Organic_farm_straw_manure_rice_husk_ash_1.JPG

2.2 Goals

Sustainable agriculture integrates three main goals:

a) Environmental health,

b) Economic profitability, and

c) Social and economic equity.

A variety of philosophies, policies and practices have contributed to these goals. People in many different capacities from farmers to consumers have shared this vision and contributed to it. Despite the diversity of people and their perspectives, the following themes commonly weave through the basic concepts and definitions of sustainable agriculture.

Sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, stewardship of both natural and human resources is of prime importance. Stewardship of human resources includes consideration of social responsibilities such as working and living conditions of labourers, the needs of rural communities, and consumer health and safety both in the present and in the future. Stewardship of land and natural resources involves maintaining or enhancing this vital resource base for the long term usage.

A systems perspective is essential to achieve sustainability. The system is envisioned in its broadest sense, from the individual farm to the local ecosystem, and to communities affected by this farming system both locally and globally. An emphasis on the system allows a larger and more thorough view of the consequences of farming practices on both human communities and the environment. A systems approach helps us to explore the interconnections between farming and other aspects of our environment.

A systems approach also implies interdisciplinary efforts in research and education. This requires not only the input of researchers from various disciplines but also farmers, farm workers, consumers, policy makers and all the stakeholders.

Remember: Making the transition to sustainable agriculture is a process. For farmers, the transition to sustainable agriculture normally requires a series of small, realistic steps. Family economics and personal goals influence how fast or how far participants can go in the transition. It is important to realize that each small decision can make a difference and contribute to advancing the entire system further on the "sustainable agriculture continuum". The key to moving forward is the will to take the next step.

Finally, it is important to point out that reaching towards the goal of sustainable agriculture is the responsibility of all participants and stakeholders in the system, including farmers, labourers, policy makers, researchers, retailers, and consumers. Each group has its own part to play, its own unique contribution to make to strengthen the sustainable agriculture community.

2.3 Promotion Strategies

The strategies for realizing the goals of sustainable agriculture and to establish an effective system need to incorporate the following four areas of concerns:

i) Appropriate use of natural resources in

farming,

ii) Sustainable plant production practices,

iii) Sustainable animal production practices, and

iv) The socio-economic and political contexts.

These strategies represent a range of potential ideas for individuals committed to translating the vision of sustainable agriculture within their own circumstances.

2.4 Appropriate Use of Natural Resources in Farming

Water, energy, soil are the chief natural resources used in agriculture and affected by the farming practices. The air quality is also affected by these activities. Let us learn about the issues involved in using these resources so as to minimize their environmental impact.

Water: A Principal Resource

When the production of food and fibre degrades the natural resource base, the ability of future generations to produce and flourish decreases. The decline of ancient civilizations in Mesopotamia, the Mediterranean region, Pre-Columbian Southwest U.S. and Central America is believed to have been strongly influenced by natural resource degradation from non-sustainable farming and forestry practices. Water is the principal resource that has helped agriculture and society to prosper, and it has been a major limiting factor when mismanaged.

Water supply and use: In drought hit areas, drought-resistant farming systems need to be introduced. For this purpose, the following steps are helpful:

1) Improving water conservation and storage measures,

2) Providing incentives for selection of drought-tolerant crop species,

3) Using reduced-volume irrigation systems, such as drip irrigation and sprinkler irrigation, (Figure 3)

4) Managing crops to reduce water loss, or

5) Not planting at all.

Figure 3. a) Drip; and b) sprinkler irrigation respectively

[Sources: a) http://www.florence.ars.usda.gov/research/water/dripirrb.jpg b) http://static.howstuffworks.com/gif/irrigation-moveable- sprinkler.jpg]

Water quality: The most important issues related to water quality involve salinization and contamination of ground and surface waters due to excessive use of water for irrigation, pesticides, nitrates and selenium. Salinity has become a problem wherever water of even relatively low salt content is used on shallow soils in arid regions and/or where the water table is near the root zone of crops. Tile drainage can remove the water and salts, but the disposal of the salts and other contaminants may negatively affect the environment depending upon where they are deposited.

Temporary solutions include the use of salt-tolerant crops, low-volume irrigation, and various management techniques to minimize the effects of salts on crops. In the long term, some farmlands may need to be removed from production circle or converted to other uses. Other uses include conversion of row crop land to production of drought tolerant forages, the restoration of wildlife habitats or the use of agro-forestry to minimize the impacts of salinity and high water tables. Pesticide and nitrate contamination of water can be reduced using many of the practices discussed in the sections

on plant and animal production practices.

Wildlife: Another way in which agriculture affects water resources is through the destruction of riparian habitats within watersheds. The conversion of wild habitat to agricultural land reduces fish and wildlife through erosion and sedimentation, the effects of pesticides, removal of riparian plants, and the diversion of water. The plant diversity in and around both riparian and agricultural areas should be maintained in order to support a diversity of wildlife. This diversity will enhance natural ecosystems and could aid in agricultural pest management.

Energy: Non-Renewable versus Renewable Sources

Modern agriculture is heavily dependent on non-renewable energy sources, especially petroleum. The continued use of these energy sources cannot be sustained indefinitely, yet to abruptly abandon our reliance on them would be economically catastrophic. However, a sudden cut-off in energy supply would be equally disruptive. In sustainable agricultural systems, there is reduced reliance on non-renewable energy sources and there is a substitution of renewable sources or labour to the extent that is economically feasible.

Soil Erosion

Soil erosion is a serious threat to our ability to produce adequate food. Numerous practices have been developed to keep the soil in place. These include reducing or eliminating tillage, managing irrigation to reduce runoff, and keeping the soil covered with plants or mulch. More details about the enhancement of soil quality are given in the next section.

Air Quality

Many agricultural activities affect air quality. These include smoke from burning of agricultural wastes; dust from tillage, traffic, harvest practices, pesticide drift from spraying, and nitrous oxide emissions from the use of nitrogen fertilizers. Options to improve air quality include incorporating crop residue into the soil, using appropriate levels of tillage, and planting wind breaks, cover crops or strips of native perennial grasses to reduce dust.

2.5 Sustainable Plant Production Practices

Sustainable production practices involve a variety of approaches. These strategies must take into account the topography, soil characteristics, climate, pests, local availability of inputs and the individual grower's goals. Despite the site-specific and individual nature of sustainable agriculture, several general principles can be applied to help growers select appropriate management practices.

Selection of species and varieties that are well suited to the site and to the conditions on the farm;

• Diversification of crops including livestock rearing and cultural practices to enhance the biological and economic stability of the farm;

• Management of the soil to enhance and protect its quality;

• Judicious use of inputs; and

• Consideration of farmers' goals and lifestyle choices.

Selection of Site, Species and Variety

Preventive strategies if adopted early can reduce inputs and help establish a sustainable production system. When possible, pest-resistant crops should be selected which are tolerant of existing soil or site conditions. When site selection is an option, factors such as soil type and depth, previous crop history, and location (e.g., climate, topography) should be taken into account before planting.

Diversity

Diversified farms are usually more resilient economically and ecologically. While monoculture farming has advantages in terms of efficiency and ease of management, the loss of the crop in any one year could put a farm out of business and/or seriously disrupt the stability of a community dependent on that crop. By growing a variety of crops, farmers spread economic risk and are less susceptible to the radical price fluctuations associated with changes in supply and demand.

Properly managed diversity can also buffer a farm in a biological sense. For example, in annual cropping systems, crop rotation can be used to suppress proliferation of weeds, pathogens and insect pests. Also, cover crops can have stabilizing effects on the agro-ecosystem by holding soil and nutrients in place, conserving soil moisture with mowed or standing dead mulches, and by increasing the water infiltration rate and soil water holding capacity. Cover crops in orchards and vineyards can buffer the system against pest infestations

by increasing beneficial arthropod populations and can therefore reduce the need for chemical inputs. Using a variety of cover crops is also important in order to protect against the failure of a particular cover crop species to grow and to attract and sustain a wide range of beneficial arthropods.

Optimum diversity may be obtained by integrating both crops and livestock in the same farming operation. This was the common practice for centuries until the mid19th century, when technology, government policies and economics compelled farms to become more specialized.

Mixed crop and livestock operations have several advantages:

• First, growing row crops only on more level land and pasture or forages on steeper slopes reduce soil erosion.

• Second, pasture and 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 by consuming crop residues 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 trade and price fluctuations and in conjunction with cropping operations, make more efficient use of farm labour.

Soil Management

A common philosophy among sustainable agriculture practitioners is that a 'healthy' soil is a key component of sustainability, that is, a healthy soil will produce healthy crop plants that have high vigour and are less susceptible to pests. While many crops have pests that attack even the healthiest of plants, proper soil, water and nutrient management can help control some pest problems along with those caused by crop stress or nutrient imbalance. Furthermore, crop management systems that impair soil quality often result in greater inputs of water, nutrients, pesticides, and/or energy for tillage to maintain yields.

In sustainable farming systems, the soil is viewed as a fragile and living medium that must be protected and nurtured to ensure its long-term productivity and stability. Methods to protect and enhance the productivity of the soil include:

• Using cover crops,

• Addition of compost and/or manures,

• Reducing tillage,

• Avoiding traffic on wet soils, and

• Maintaining soil cover with plants and/or mulches.

Conditions in the soils, which are warm, irrigated, and tilled, do not favour the buildup of organic matter. Regular additions of organic matter or the use of cover crops can increase soil aggregate stability, soil tilth, and diversity of soil microbial life.

Efficient use of inputs Many inputs and practices used by conventional farmers are also used in sustainable agriculture. Sustainable farmers, however, maximize reliance on natural, renewable, and on-farm inputs. Equally important are the environmental, social, and economic impacts of a particular strategy. Converting to sustainable practices does not mean simple input substitution. Frequently, it substitutes enhanced management and scientific knowledge for conventional inputs, especially chemical inputs that harm the environment on farms and in rural communities. The goal is to develop efficient, biological systems, which do not need high levels of material inputs.

Growers frequently ask if synthetic chemicals are appropriate in a sustainable farming system. Sustainable approaches are those that are the least toxic and least energy intensive, and yet maintain productivity and profitability. Preventive strategies and other alternatives should be employed before using chemical inputs from any source. However, there may be situations where the use of synthetic chemicals would be more sustainable than a strictly non-chemical approach or an approach using toxic organic chemicals. For example, one grape grower switched from tillage to a few applications of a broad-spectrum contact herbicide in the vine row. This approach used less energy and compacted the soil less than numerous passes with a cultivator or mower.

Consideration of the Farmer's Goals and Lifestyle Choices

Management decisions should reflect not only environmental and broad social considerations, but also individual goals and lifestyle choices of

the farmers and farming communities. For example, adoption of some technologies or practices that promise profitability may also require such intensive management that one's lifestyle actually deteriorates. Management decisions that promote sustainability should nourish the environment, the community and the individual.

2.6 Sustainable Animal Production Practices

In the early part of the last century, most farms integrated both crop and livestock operations. Indeed, the two were highly complementary both biologically and economically. The picture has changed quite drastically since then. Crop and animal producers now are still dependent on one another to some degree, but the integration now most commonly takes place at a higher level — between farmers, through intermediaries, rather than within the farm itself. This is the result of a trend towards separation and specialization of crop and animal production systems. Despite this trend, there are still many farmers, particularly in the developing countries in South Asia, who integrate crop and animal systems either on dairy farms, or with range cattle, sheep or hog operations.

Even with the growing specialization of livestock and crop producers, many of the principles outlined in the crop production section apply to both the groups. The actual management practices will, of course, be quite different.

Management Planning

Including livestock in the farming system increases the complexity of biological and economic relationships. The mobility of the stock, daily feeding, health concerns, breeding operations, seasonal feed and forage sources, and complex marketing are sources of this complexity. Therefore, a successful ranch plan should include enterprise calendars of operations, stock flows, forage flows, labour needs, herd production records and land use plans to give the manager control and a means of monitoring progress towards goals.

Animal Selection

The animal enterprise must be appropriate for the farm or ranch resources. Farm capabilities and constraints such as feed and forage sources, landscape, climate and skill of the manager must be considered in selecting which animals to produce. For example, ruminant animals can be raised on a variety of feed sources including range and pasture, cultivated forage, cover crops, shrubs, weeds, and crop residues. There is a wide range of breeds available in each of the major ruminant species, i.e., cattle, sheep and goats. Hardier breeds that, in general, have lower growth and milk production potential are better adapted to less favourable environments with sparse or highly seasonal forage growth.

Animal Nutrition

Feed costs are the largest single variable cost in any livestock operation. While most of the feed may come from other enterprises on the ranch, some purchased feed is usually imported from off the farm. Feed costs can be kept to a minimum by monitoring animal condition and performance and understanding the seasonal variations in feed and forage quality on the farm. Determining the optimal use of farm-generated by-products is an important challenge of diversified farming.

Reproduction

Use of quality germplasm to improve herd performance is another key to sustainability. In combination with good genetic stock, adapting the reproduction season to fit the climate and sources of feed and forage reduce health problems and feed costs.

Herd Health

Animal health greatly influences reproductive success and weight gains, two crucial aspects of successful livestock production. Un healthy stock not only waste feed but also require additional labour. A herd health programme is critical to sustainable livestock production.

Grazing Management

Most of the adverse environmental impacts associated with grazing can be prevented or mitigated with proper grazing management:

• First, the number of stock per unit area (stocking rate) must be correct for the landscape and the forage sources. There will need to be compromises between the convenience of tilling large, unfenced fields and the fencing needs of livestock operations. Use of modern, temporary fencing may provide one practical solution of this dilemma.

• Second, the long-term carrying capacity and the stocking rate must take into account short and long-term droughts. Properly managed

grazing significantly reduces fire hazards by reducing fuel build-up in grasslands and bush lands.

• Finally, the manager must have sufficient control to reduce overuse in some areas while other areas go unused. Prolonged concentration of stock that results in permanent loss of vegetative cover on uplands or in riparian zones should be avoided. However, small-scale loss of vegetative cover around water or feed troughs may be tolerated if surrounding vegetative cover is adequate.

Confined Livestock

Production Animal health and waste management are key issues in confined livestock operations. The moral and ethical debate taking place today regarding animal welfare is particularly intense for confined livestock production systems. The issues raised in this debate need to be addressed.

Confined livestock production is increasingly a source of surface and ground water pollutants, particularly where there are large numbers of animals per unit area. Expensive waste management facilities are now a necessary cost of confine d production systems. Waste is a problem of almost all operations and must be managed with respect to both the environment and the quality of life in nearby communities. Livestock production systems that disperse stocks in pastures, their wastes are not concentrated and do not overwhelm natural nutrient cycling processes have become a subject of renewed interest.

2.7 The Socio -Economic and Political Contexts

In addition to develop strategies for preserving natural resources with the changing production practices, sustainable agriculture requires a commitment to change public policies, economic policies and institutions, and social values. Strategies for change must take into account the complex, reciprocal and ever-changing relationship between agricultural production and the broader society. The "food production system" extends far beyond the farm and involves the interaction of individuals and institutions with contrasting and often competing goals including the farmers, researchers, input suppliers, farm workers, unions, farm advisors, processors, retailers, consumers, and policy makers. Relationships among these actors shift over time as new technologies spawn economic, social and political changes. A wide diversity of strategies and approaches are necessary to create a more sustainable food production system. These will range from specific and concentrated efforts to alter specific policies or practices, to the longer-term tasks of reforming key institutions, rethinking economic priorities, and challenging widely -held social values. Areas of concern where change is the most needed are discussed below.

Food and Agricultural Policy

In most of the Third World countries, existing federal, state and local government policies often impede the goals of sustainable agriculture. New policies are needed to simultaneously promote environmental health, economic profitability, and social and economic equity. For example:

• Commodity and price support programmes could be restructured to allow farmers to realize the full benefits of the productivity gains made possible through alternative practices.

• Tax and credit policies could be modified to encourage a diverse and decentralized system of family farms rather than corporate concentration and absentee ownership. Government and land grant university research policies could be modified to emphasize the development of sustainable alternatives.

• Marketing orders and cosmetic standards could be amended to encourage reduced pesticide use.

• Coalitions must be created to address these policy concerns at the local, regional, and national levels.

Land Use

Conversion of agricultural land for urban uses is of particular concern in both developed and developing countries, as rapid growth and escalating land values threaten farming on prime soils. Such farmland conversion trends often discourage farmers from adopting sustainable practices in a long-term perspective on the valued land. At the same time, the close proximity of newly developed residential areas to farms is increasing the public demand for environmentally safe farming practices.

Comprehensive new policies to protect prime soils and regulate development, in developed and developing countries should be introduced. By helping farmers to adopt practices that reduce the use of chemicals and conserve scarce

resources, sustainable agriculture research and education can play a key role in building public support for agricultural land preservation. Educating land use planners and decision makers about sustainable agriculture is an important priority.

Labour

In some of the developed and most of the developing countries, like India and Pakistan, the conditions of the farmers and agricultural labour are generally far below accepted social standards and likewise lesser legal protection in other forms of employment. Policies and programmes are needed to address this problem, working towards socially just and safe employment that provides adequate wages, amiable working conditions, health benefits, and increased opportunities for economic stability. The needs of migrant labour for year-around employment and adequate housing are a particularly crucial problem needing immediate attention. To be more sustainable over the long-term, labour must be acknowledged and supported by government policies, and carefully considered when assessing the impacts of new technologies and practices.

Rural Community Development

Rural communities in all South Asian countries are currently characterized by economic and environmental deterioration. Many are among the poorest locations in the nations. The reasons for the decline are complex, but changes in farm structure have played a significant role. Sustainable agriculture presents an opportunity to rethink the importance of family farms and rural communities. Economic development policies are needed that encourage more diversified agricultural production on family farms as a foundation for healthy economies in rural communities. In combination with other strategies, sustainable agricultural practices and policies can help foster community institutions that meet employment, educational, health, cultural and spiritual needs.

Consumers and the Food Production Systems

Consumers can play a critical role in creating a sustainable food systems. Through their purchases, they send strong messages to producers, retailers and others in the system about what they think are important. Food cost and nutritional quality have always influenced consumer choices. The challenge now is to find strategies that broaden consumer perspectives, so that environmental quality, resource use, and social equity issues are also considered in shopping decisions. At the same time, new policies and institutions must be created to enable producers using sustainable practices to market their goods to a wider public. Coalitions organized around improving the food systems are one specific method of creating a dialogue among consumers, retailers, producers and others. These coalitions or other public forums can be important vehicles for clarifying issues, suggesting new policies, increasing mutual trust, and encouraging a long-term view of food production, distribution and consumption.

3. Conclusion

Agriculture has undergone dramatic changes since the end of World War II. These changes, confined largely to the developed countries, had many positive effects and reduced risks in farming, but their social and economic costs were very high. The Green Revolution ushered in the 1960s and 70s changed the national food production status for the better in South and South-east Asia. But it did not register similar success in the Sub-Saharan Africa region. The debate about the pros and cons of Green Revolution still continues. The sustainable agriculture approach encompassing concern towards environment and resource conservation has garnered immense support and acceptance in the recent years. Environmental health, economic profitability, social and economic equity are the main goals of sustainable agriculture. A systems perspective is essential towards achieving the outlined goals. The strategies for realizing the goals of sustainable agriculture and in establishing sustainable agriculture system should include concerns such as judicious natural resource use, sustainable plant and animal production practices, and the consideration of the socio-economic and political dimensions.

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