Principles and Practices of Organic Farming and Quality Food Production

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Introduction

Organic farming is an integrated, environmentally sound, safe and economically sustainable agriculture production system. It promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. Organic farming is a production system which avoids or largely excludes the use of synthetic inorganic fertilizers, pesticides, growth regulators and livestock feed additives. It largely depends on crop rotations, crop residues, animal manures, green manures, off-farm organic wastes, mechanical cultivation, mineral bearing rocks and aspects of biological pest control to maintain soil productivity, to supply plant nutrients and to control insects, pathogens and weed. This farming system approach is based on the perception that tomorrow's ecology is more important than today's economy. It aims to stop degradation and reestablish natural balance. The aims of organic farming are:

- To maintain long-term productivity of the soil.
- To avoid pollution problem (soil, air, water) due to use of synthetic fertilizer and pesticides.
- To minimize use of fossil energy in agriculture.
- To produce food of high nutritional quality and in sufficient quantity.
- To enhance the biological cycles within farming system involving micro organisms, soil flora and fauna, plants and animals.
- To allow agricultural produces an adequate return and satisfaction and consider the wider social and ecological impact of the farming system.

Organic Farming Systems

Organic farming systems are as follows:

Biological Farming:

It allows the use of selected chemical fertilizers (avoiding disruptive materials such as anhydrous ammonia and potassium chlorides) and adopt low input approaches to use by Biopesticides.

Nature Farming:

It includes special emphasis on soil health through composts or vermicomposts rather than other organic sources. Use of microbial preparation is also gaining importance in nature farming.

Permaculture:

It is contraction of permanent agriculture. It is concerned with designing ecological human habitats and food production systems and follows specific guidelines and principles in the design of these systems. It is not a production system, but rather a land use planning philosophy, not specific to any method of production. Thus, any site specific ecological farming system is amendable to permaculture.

Ecological Agriculture:

Ecological agriculture aims bringing to match the crop, soil and climate of a region, the ecology and farming and gaining from the economy and efficiency of inputs. Farming regions and individual farms must be treated as ecological system. The techniques are developed on the basis of holistic view of man within the biosphere and the awareness of man's dependence on scare natural resources. Intensification of farming is sought through more productive use of available resources such as soil nutrients, rain water

and local energy, together with the knowledge of labours and innovative of the people. Ecological farming is more labour intensive and several of its components such as vermicomposting, vermiwash, botanical pesticides etc. offer scope for unemployed and land less youth.

Integrated intensive farming systems:

It involves agricultural intensification, diversification and value addition. Intensification is integration of farming involving animal husbandry, fishery and agroforestry. Such farming system provide scope for organic waste recycling and value addition to every part of plant and animal biomass. The important components of this system are soil health care, vermiculture, water harvesting, integrated nutrient and pest management and post harvest technology.

Low external input supply agriculture:

It is a production system that uses synthetic fertilizers, pesticides and herbicides below rates normally recommended. Yields are maintained through greater emphasis on cultural practices, integrate nutrient and pest management and utilization of on farm resources and management. It uses locally available resources by maximizing complementary and synergistic effects of different components of the farming systems. External inputs are used in a complementary way.

Biodynamic agriculture:

Major emphasis is on biological dynamics. It is a method of organic agriculture, which consider farm as a living system and where one activity effects the other. Greater emphasis is on integration of animals to create a close nutrient cycle, effect of crop planting dates in relation to calender and awareness of spiritual forces in nature. In this system specific preparation derived from cow manure, cow urine, silica, herbal extract to treat compost piles, soils and crops.

Sustainable Agriculture

In recent years due to chemical farming a wide range of environmental threats is posing a challenge to mankind all over the world. The threat includes degradation of soil health, water quality, forest and marine resources essential to increased production of food, fodder, fibre, timber etc. Degradation of natural resources is the main issue threatening sustainable development of agriculture. The three major causes for degradation of natural resources are:

- Lack of access to land, input and other production resources by majority of rural households and communities.
- Lack of awareness among policy makers of the economic costs involved and
- Lack of environmentally sound alternative technologies acceptable to farmers.

Production scenario is beset with ecological, technological and demographic problems. In contrast, demand scenario features a high growth rate in food requirements. Such situation would lead to dwindling global food reserves and an escalation in the cost of food grains and other agricultural commodities. In this context, the need for redoubling efforts in enhancing agricultural production and in promoting agrarian prosperity is obvious. In India during 1970s, a growing environmental agriculture movement evolved in response to increasing soil erosion, pesticide use and ground water contamination. As a result, the economic condition of farmers started progressive decline due to low levels of farm productivity. In 1980s the term sustainable agriculture has emerged to describe an alternative system of agriculture based on resources conservation and quality of rural life, sustainable agriculture is really a long term goal.

World Scenario of Sustainable Agriculture

Agricultural progress is linked with the demand of the increasing population as well as food production which seems to be alarming. planners and scientist world over in the past five decades it has drawn attention of the governments. Soil degradation, environmental pollution, loss of biodiversity, global warming and other factors threaten the human life in different countries. Thus, there is an urgent need to keep up the pace of the present development and ensure sustainable agricultural system for future generations. Agricultural sustainability should have ecological, economic, social and cultural dimensions. The essence of sustainability is the maintenance of natural resource productivity (Hart and Sands, 1992). The sustainable agriculture is to develop farming systems that are productive and profitable, conserve the natural resource base, protect the environment and enhance health and safety over the long term. This can be achieved depend on creative and innovative production practice and resource conservation that provide farmers with economically viable and environmentally sound alternatives in developing their farming systems.

Sustainable agriculture is a spectrum of farming systems ranging from organic systems that attempt to eliminate the use of synthetic chemical inputs (fertilizers and pesticides). The scientific information of vital concern to all countries if we are to address both economic and environmental issues in agriculture on a global basis. In order to meet the requirement of the growing population in respect of food and fibre and feed for the livestock, sustainable agricultural systems need to be developed. Sustainable land use system is the farm systems that interact with biophysical and socio-economic environment in such a way that they are viable in short run and ecologically sustainable in the long run. Sustainable development focuses on a relationship of cooperation and coexistence of human with nature as compared to the prevailing exploitation of nature by human (Batie, 1989).

Sustainable Agriculture in United States of America:

Urbanization of the best agricultural land in East and West coast and other pockets of dense population pressure, is loosing land and creating pollutant that affect crop yield. Higher levels of ozone and acid rain are detected in some area. Heavy dependence of fossil fuel and inefficiency of energy use in agriculture, and use of chemical fertilizers and pesticides and leaching of those in public water supply system has become a national problem. In many region nutrient and soil run-off into surface water and salinization, has become a problem. In Western Great plains, declining water table in Western Great Plains is a problem. Modern agriculture has encouraged high capital investment by U.S. farmers and cash flow and debt servicing. Many farm rented land are reluctant to make permanent improvement on land they do not own. They are not free to try new practices or experiment on this land. More research falls in the area of pest management, cropping system and with the least in farmer integration, economic and policy analysis and livestock (Janke & Blew, 1992).

Central America:

In central America, there are considerable areas of forest. Under low populated area they do little to reduce soil degradation. However, these forest areas serve as a source of fuelwood for high populated areas. The greatest loss in forests occurred in Guatemala, Honduras, Nicaragua, and Costa Rica. Also, the areas in pasture increased more than areas in crops. In Central America, some land use systems may be defended as sustainable (Kass et al., 1992). In low populated area, the damage to the resource base was minimal. In the forest area, shade grown coffee and cocoa can be maintained for many years with no degeneration of the resource base. At low population densities, shifting cultivation is a sustainable land use system. In some better land of central Guatemala or pacific coast of Central America the annual crop production has not resulted any obvious degeneration of soil resource. There are many area where continue maize cultivation is continuing for more than 2000 years. The Central America has much to offer in consideration of sustainability. In low land of Maya, civilization has degenerated its resource base, while the highland Maya has superior resource base, and less problematic climate that achieved a sustainability.

In flatter areas, food production moved fast. Making crop production on such sites sustainable certainly would be a valuable contribution. Unfortunately, the return obtained from cereal crops would not make such sites sustainable. Therefore, introduction of higher value crops can develop sustainable production system.

Agroforesty has been proposed as means of making annual crop and pasture system sustainable (Sanchez, 1987). Introduction of leguminous trees into crop and pasture systems could bring benefit like coffee and cocoa plantations. Export of nutrients and processed materials from crops and pasture systems are higher than in beverage crops (Sanchez, 1976).

In recent years, with increase in population densities, land use was increased with high profitability. This resulted modification of the original sustainable system with environmental degradation (FAO, 1975, Leonard, 1985). Lowland monoculture of crops was mostly used for export and extensive cattle grazing (Hawking, 1985). Shade was removed from Coffee to obtain greater productivity, with less protection of the soil resources (Budowski et al, 1984), to maintain productivity and to exploit the forest resources. More than the existing forest has been destroyed since 1950 (Leonard, 1985).

European countries:

All countries in Eastern Europe except Poland have large size state farm or collective farm. Poland has large cooperative or state farm account for only slightly less than 20% of agricultural land, and remaining 80% of farm land is managed by small and medium sized private farmers, their area vary from 1 to 50 hectares. In almost all these countries there is shortage of farm products is found. There is continuous intensification of agricultural production and excessive concentration of livestock production (meat production). These big farms result in great loses of fertilizer cause severe pollution of the natural environment. There is serious pollution of soils, ground and surface water, which conflict with principle of sustainable agriculture.

In West European countries, there is differences in climate, history and agricultural tradition. In northern Europe, the major products are milk production, pastures, wheat, barely and sugar beets, while in Alpine valleys, milk and cheese production, woodlands and pasture dominate. In

mediterranean Europe, vine yard, citrus and olive yards, vegetables, cereals especially on the slope are major product. In low land valleys the cash crops like corn, wheat, soybean and sugarbeet are grown. In limited area, cattle, poultry and pigs are raised.

Sustainable farming pose serious questions in these countries with respect to energy, technology use, chemical fertilizer, and pesticides which are being increasingly overused in most part of these areas. Heavy dependence on external input, and soil erosion, pesticide resistance, ground water pollution, lake, river and lagoon eutrophication, and food contamination are the main claims for changes towards sustainability.

In European projects, there is limited success in Integrated Pest Management (IPM) among farmers (Vereijken, 1989. El Titi and Lands, 1990). This was due to improper design of ecological parameters and the performance (Edwards, 1990). For sustainable agriculture, the options are to handle a farming system in order to minimize pest and use of costly inputs like chemicals and energy and optimise crop rotation and organic matter content in top soil (Vereijken, 1990). Sustainability must be developed as an integrated strategy emphasizing maximum quality of production instead of maximum quantity, which result environmental compatible quality and higher biodiversity (Paoletti, 1992).

Canada:

In canada, only 11% of the total land area is suitable for agriculture, of which only 5%. area is capable of crop production. The limitation of crop production are mainly climate and topography. Canada's agriculture depends heavily on export market especially for oilseeds, grains, meats, live animals, dairy products and potatoes. Canada has no national plan, however is intensifying its use of the land. Nevertheless, the urbanization of the best lands is continuing and the degradation of agricultural land is widespread due to salinization, acidification, loss of organic matter, compaction, wind and water erosion. However, the policy response is growing, though there is no strategic plan with respect to the allocation of resource and for their sustained management.

Australia:

Australia is world's driest continent. About one Third of Australia is desert. and receives less than 20 cm of annual rainfall. Further, 20% area receives 38 cm rainfall. However, Australia's northern, eastern and south-eastern areas, the climate varies from tropical to temperate. The mediterranean areas usually are well watered with regular rainfall and become the main agricultural regions.

Over 200 years, Australian economy has grown based on primary productions of wool and timber followed by wheat, sugar, meat and other livestock products. Recently the minerals such as iron ore, coal, copper have become primary export earners. Because of the ratio of population to resources, about. 80% of primary production is exported, with agricultural produce contributing 42% and mineral resources 58% of export revenue.

In pasture improvement technology, pasture legume contributed potential benefit. The ley farming system, crop rotation with legume based pasture spread rapidly in wheat-sheep zone of southern Australia. On the other hand, the pastoral zone of northern region relied on the native vegetation as the sole source of fooder for grazing cattle under an extensive system of land use. The sheep and beef zone in the plateaus and South-eastern and Western Australia have improved pastures and produce wool, lambs or high quality beef and veal. The other major land use zones are the dairy zone, sugar plantations and the irrigated farms for crop and pastures.

In past few decades, Australian farmers have achieved growth in agriculture sector by a combination of resource use and yield improving technologies. The decline in environmental quality and land degradation due to non-sustainable farming practices have become issues of national importance. The causes of land degradation in Australia is described by Burch et al (1987) as follends:

- Intensification of land use.
- Soil acidification by ley pasture
- Water pollution
- Chemical pollution.
- Tillage practice

The research strategies for sustainable land use are soil conservation and enhancement of its productivity. Sustainable technologies includes substitution of expensive and damaging inputs are being developed to be incorporated in the cultivation and crop management practices of farmers.

Despite the increased awareness and concern for land degradation the adoption of these technologies by farmers have been slow.

Significant developments have been made in understanding unique features of the environment and appropriate technology to prevent further land degradation. Community participation in caring for the land and contemporary agriculture will bring sustainable future for the farmers.

Middle East and North Africa:

Dryland areas of Middle East and North Africa are a major source of food and fibre for people. The yield of crops is very low as compared to the developed countries. This is mainly due to use of traditional production practices, low adoption of improved technology, no implementation of soil and water conservation practices, inadequate use of fertilizer, soil erosion and erratic and low rainfall.

Strategies to increase food production and sustainable agriculture in this region includes investment in land and capital resource levels of the farmers. At national and regional levels, there is concern for long term productive capacity of soils, the sustainability of crops and livestock production. (Francis et al., 1986). Recently, the research is being focussed on resilient species, minimum effective input rate, minimum production in poor years and diverse cropping patterns (Bay-Peterson, 1986, UNDP 1989). For sustained crop production, improve agronomic practices are focused on soil and water conservation, increase biomass production and cropping system for better soil cover and organic matter levels. Forage and livestock systems were given high priority. The small farmers in the region are resource poor and find difficult and risky to adopt a package of practices, even its potential benefits are demonstrated at a research level. Technological recommendations must allow these farmers, flexibility in choosing production practices that best fit their particular environment (Jaradat, 1992).

Eastern Africa:

In east Africa, the geographical area include, Kenya, Uganda, Tanzania, Rwanda and Burundi. The tropical climate of East Africa is prone to serious problem of soil erosion particularly gully erosion. There is prohibition of cultivation in steep hills and river bank. In these countries the farmers built

terracing in community basis to control gully erosion. In all East African countries, the soil and water conservation policies and laws exist but these are generally poor implemented.

In these countries animal manures particularly goat manure has significant positive residual effect on crop yield. The research. is conducted on crop/Livestock/soil interaction in East African countries for beneficial economic impacts to the farmers. High soil acidity should be reduced through appropriate soil management using green manure and animal manure. Liming is not practical for small scale, poor resource farmers. In arid and semi-arid regions, draught resistant varieties, growing food and cash crops and proper integration of crops, trees and livestock should be practiced for increasing productivity, of both crops and livestock (Moses Onim, 1992). In Eastern Africa, the urgent environmental degradation issue is the increased movement of people into arid and semi-arid areas.

Western Africa:

Western Africa comprises Burkina Faso, Chad, Gambia, Mali, Niger and Senegal. In these regions most of land use systems in a continuous degradation of the natural resource base. For reducing degradation trend, motivation and awareness of the people are required for sustainable land use. Both researchers, extension workers and farmers should have multidisciplinary and team work for water and soil fertility maintenance in WAS region (Badji and Seve, 1992). The scopes of sustainable land use in this region are:

- Improve use of soil and water resources, soil and water management, improving soil fertility, small scale irrigation.
- Improved cropping practices: Intercropping, relay cropping, crop rotation, agroforestry, home gardening
- Genetic improvement, crop breeding, animal breeding
- Mixed farming of crops and animal system and aquaculture. Systems to reduce yield losses: Integrated pest management, Post harvest technologies, animal health.

Southeast Asia:

The south east Asian countries are Thailand, Philippines, Indonesia, Malaysia, Vietnam and Combodia. These countries are densely populated with highly resilient agriculture production system. Prolonged intensification in agriculture and extractive systems have drastically declined productivity. Increases in human population increased future pressure on the productive capacity of landuse system.

A research base is targeting critical constrains to the sustainability of current land use system which will be major component of future national well being. Major agricultural research concentrated on development by technology for increasing productivity. However, research Institutions also need to focus work on formulation and evaluation of sustainable land use system (Hart and Sand, 1991).

In Southeast Asian countries, the agricultural policy is dominated by rice production. All these countries are self-sufficient in rice production or are exporting surpluses. Government price supports are low resulting inexpensive rice supplies for urban populations. In all countries the working population is agriculture base, the domestic terms of trade favour the development of industrial sector of the economy, indirectly taxing agriculture. Farm size is small (0.5-3.0 ha). Today market economy is penetrated to remote areas in all countries.

Different research Institutes like Rice Research Institute, Farming system research Institute, khon kaen university are active to elevate rainfed rice soil organic matter. Thailand has 3.5 m ha rainfed rice are with low soil fertility. A number of research Institutions in the region. are engaged to develop sustainable small land holder food production systems.

A major sustainability issue is forest plantation with reduction of biological diversity and reduction in species fauna and soil nutrient imbalances. In most countries the resources base is fast degrading. The research priorities should be concentrated on coastal low lands and uplands. The low level of research on sustainability problems of the coastal low lands is of great concern. The fishery resources of the region is dependent on the rich and intact coral reefs and mangrove areas. The present trend indicates a general decline in fishery mainly due to destruction of mangrove and coral habitats and blast fishing and improper fishing methods.

The upland ecosystem of Southeast Asia presents the most difficult and alarming challenge to sustainability, The crisis of the upland is interconnected with national political, economic and ecological stability.

The resource degradation in uplands is drastic. Though number of Institutions are involved, the satisfactory solutions are not easily forthcoming. The crisis of the uplands in farming and forestry in Southeast Asia need further institutional innovations, addressing the system research and development issue on an international and interdisciplinary basis.

Japan:

In Japan, the rice based agriculture predominant for nearly two thousand years under a monsoon climate and temperature. The sustainability is quite new to Japanese agriculture (Miyazaki and Kada, 1992). Rice is grown under submerged condition and nature and production of rice has processed by itself ecologically and biologically sustainable system which has enabled farmers to produce rice in paddy field year after year for long time. However, since 1960s, such a sustainable system has been gradually changing when Japan has entered into a industrial economic development stage. The rice production system has changed to high input to high output stage from low input to low output stage. With such change, Japanese agriculture has increased its intensity of land use per unit of land area, which caused problem of deterioration of soil fertility, soil and ground water pollution and other conservation problems. Recently, Japanese people are concerned about these issues in contest of global warming, environmental problems and desertification.

In order to increase the food self-sufficiency and domestic production and to utilize paddy field more efficiently, the agricultural policy goal of Japan is change the cropping pattern of paddy fields under these changing circumstances. The Ministry of Agriculture has implemented long term project to remodel the land use system which should be ecologically adaptive. One of the core plans is to recognise the use of paddy field as wheat, barely, soybean fields on a regional basis. As an sustainable agriculture policy, a ‘Manure Bank’ system is established in each locality for the purpose of utilizing organic manure (Substituted for Chemical fertilizer) for maintaining soil fertility of a region. Such efforts have a basic idea to create a system of regional based manure cycles, with cooperation between livestock farmers and grain farmers within each region or locality. The research project have also been started to look into the sustainability of

alternative land use systems by researchers of Government Research Institutes and Universities.

China:

China is dependent on its agricultural economy. The diversity of climate and complexity of topography result diversity of China's farming system and system of agricultural production. Different types by cropping system and system exist under different conditions of climate, soil and socio-economic formation.

China has seven percent of the cultivated land in the world. With increase in population, food production and resultant environment, the sustainable development of China's agriculture appears to be very important and urgent. Since, 1980s, the study on ecological agriculture at selected places as par local socio-economic situations and natural resource was carried out. Such efforts achieved marked economic environment and social benefits. The state department and the farming community have taken seriously the study and adoption of technologies related with ecological agriculture. Some of the ecological farming technologies like ecological engineering techniques, comprehensive development in agriculture have been popularised among the peasants. With these adopted technique, it was possible to achieve an organic link between the related component to agricultural production through interrelationships among the crops, domestic animals and soil. The waste of one component will become input feed of for another component, thus increasing the productivity of the agroecosystem and enriching the diversity of the systems. By utilization of space and time on same piece of land to form multilayer of production to raise land productivity and maintain soil fertility. This technique is more practical in China which has less tillable land and higher population density. As for example, in paddy field, paddy and fish breeding and fish production, multilayer of orchards, intercultivation of mushroom in paddy field, duck and fish breeding in irrigated woodland, multiple cultivation in rubber plantation, various forms of intercropping etc. are emphasized by the farmers.

China's ecological agriculture has similarity with organic agriculture of the countries. The studies Chinese ecofarming will make contributions to the sustainable development of agriculture (Zhengfang and Youxia, 1992).

India:

The food grain production by Indian Agriculture in last five decades have been impressive. With increase in growth rate of population, the food grain production also was increased. The main emphasis in agricultural production has been in irrigated sector and that too mainly in rice and wheat crops. These two crops are benefitted most from Government price support and procurement policies as compared to coarse cereals, pulse, oilseed. These are cultivated mostly in marginal land in rainfed condition.

Seventy percent of the cultivated area receive medium to low rainfall (1150 mm or below), and in most cases, rainfall is inadequate and uncertain with respect to crop-water requirements. Till 1951, India had irrigation potential by 22.6 m ha in first five year plan and additional 0.5 m ha was targeted in eighth plan period. The expansion of irrigation sources not only enhanced the food grain production but also stability of production.

Nutrient management is the key to the higher crop production. There was rise in fertilizes use to make up deficiency of nutrient elements. The situation of nutrient disorder calls for an integrated nutrient management by use of on farm generated organic manure with inorganic fertilizer.

With the advent of green revolution and practice of chemical farming and growing newly developed high yielding varieties under intensive agriculture, brought problems of pests. Pest attack caused tremendous losses of crops. As a result, chemical pesticide consumption has shown steady increase. From the mid fifties, application has increased both in quantities and in coverage of plant protection from 2.4 million ha in 1956 to 80 million ha in 1984. The pesticide application influenced in upsetting the ecological balance and polluting the environment, soil and water.

Good quality of seed is basic requirement for augmenting crop production and productivity. The extent of area under HYV is an important indicators of the spread of modern technology for higher crop production. Development of appropriate crop varieties is going to be main component of sustainable agriculture.

The research strategy for sustainable agriculture should be an exercise in the development of a farming system which meet the production objective through efficient utilization of inputs without impairing the quality of environments. Some of the sustainable agriculture strategies should be integrated use of inputs and farm residues, maximum productive efficiency

of inputs and with interacting environments considering in a long term perspective. The need is to integrate the components and evaluate the synthesized systems against the existing system of production. Long term monitoring the improved systems with regards to the parameters by sustainability will be required. On station research could be initiated but the off-farm testing of the developed technology will be required. The following course research work should be adopted in future for sustainable agriculture in India (Singh et al., 1992).

1. Synthesis of the sub-systems of sustainable agriculture through on station research, and location. specific need.
2. Development of research methods for evaluating the farming systems with regard to its biological, environmental and social efficiency.
3. Development of methodology of monitoring the improved systems over long period of time.

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