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Sustainable Agriculture: A System of Farming

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Abstract: Nutrient depletion in the farm land areas has brought terrible devastation in some cropping areas of a country. There is no vegetation whatever, despite adequate rainfall and chemical fertilizers are now re-vegetating such areas. They have rapidly overtaken organic matter as a chief source of nutrients and expert opinion believes that such external nutrients source are the only way to sustain the food requirement of the population. If sustainability is to be maintained as the first priority, then other important components such as efficiency of input use, economic return and environmental protection can all be used appropriately as part of the sustainability phenomenon.

Key words: Sustainable agriculture, fertilizers, crops, farming, input, output

Introduction

Sustainable agriculture is a management system, which is economically viable. If is not profitable then is not sustainable. It is socially supportive, if it enhances the quality of life of the farmers, farm families and farm communities (Abdel-Memon *et al.*, 1997). Sustainable agriculture involves the successful management of resources for agriculture to satisfy changing human needs, while maintaining the quality of the environment and conserving natural resources (Wani *et al.*, 1994). One of the most important requirements for sustainable agriculture is maintaining of soil fertility. This is not possible unless nutrient removal by crops is replenished.

Sustainable farmers use sustainable growing methods to grow their crops organically, using natural techniques to help with pests and natural fertilizers. They rotate crops, so that the soil does not lose its nutrients. Basically, to farm using sustainable methods, one has to care about his land. In this system, those inputs, which are available as natural resource on the farm and those purchased externally in the most efficient manner, possible to obtain productivity and profitability from a farming operation, while minimizing the adverse effects on environment. A large basal application of nutrients as necessary and followed by a fast growing legume crop and then an appropriate rotation with nutrient replacement will sustain production indefinitely. Soil nutrients and water are essential to plant growth, but in many areas of the developing world soils are deficient in key nutrients. Sustainable agriculture depends on maintaining a balance between consuming and conserving soil nutrients (MacRae *et al.*, 1990).

Sustainable farming is becoming more and more necessary, as the soil becomes less and less able to sustain plants naturally and more farmers use chemical fertilizers, which in stead of helping, actually destroys the soil it is used in and more pesticides are being used, which un balances the food chain by killing of whole species of `pests', which causes whoever eats them to die and so on throughout the entire food chain. Sometimes pests become immune to certain pesticides because of over usage. There is also the issue of seeds. Many farmers buy and use seeds, which were created in a laboratory. These seeds are `one-timers', they may grow good this year, but the seeds that come from them will not grow plants, which means that next year the farmers will have to buy all new seeds. This is a very sneaky way of doing business, which forces the farmers to come back year after for new seeds. This dependency on chemical fertilizers, pesticides, and on lab grown one-time seeds is stealing away farmer's freedom.

Sustainable agriculture and the sound use of fertilizers to support it, is one of the important development challenges facing countries around the world (Peoples *et al.*, 1994). Agriculture is also closely linked to environmental quality in a variety of ways and the challenge of our generation is how to feed a growing plant, while maintaining the integrity of our ecological life support system (IAEA, 1998). Sustainable agriculture is a basic philosophy and system of farming for profitable agriculture. It involves design, system and management procedures that work smoothly with natural processes to conserve all available resources, promote agro-ecosystem resilience, and self and meaningful regulation and minimize waste and environmental impact, while maintaining or improving farm productivity. Sustainable agriculture system are designed to use existing soil nutrients and water cycle, and naturally occurring energy flows for food production, such systems aim to produce food that is both nutritious and without products that harm human health. In practice, such systems have tended to avoid the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives, and of relying upon crop rotation, crop residues, animal manure, legumes green manure, off-farm organic wastes, mechanical cultivation and mineral bearing-rocks to maintain soil fertility and productivity and on natural biological and cultural control for insects, weeds and other pests (MacRae *et al.*, 1990).

Within this definition, a great number of approaches and philosophies is possible, and the particular strategies for conversion will depend as much on the economic, and institutional supports. Sustainable agriculture is receiving increasing attention all over the world, because of increasing concern about the degradation of the agricultural resource base, low commodity prices that have sent many produces looking for low-input alternatives to cut costs, consumer concern for food quality and perception that the quality of rural life is deteriorating. In the perspectives a lot of progresses have been made to boost up the sustainable agriculture by high efficiency i.e., conventional systems have altered to reduce consumption of costly resources such as banding fertilizers, monitoring pests, and timing of operations, substitution of costly inputs such as resource-dependent and environmentally impacting products and practices are replaced by those that are more environmentally benign e.g., synthetic nitrogen fertilizers by organic sources, pesticides by biological control agents, and moldboard plough by chisels or discs.

Some problems have been solved internally by site and time specific design and management approaches, instead of the application of external inputs, e.g., the farm is made more ecologically diverse and therefore, more resource self-reliant. With the improvement in yield productivity in sustainable agriculture, approximately 5000 farmers have converted to sustainable practices in Canada, at least 40000 in the US, several thousand more in Europe and many more in other countries of the world. These farmers are testimony to the agronomic and economic feasibility of sustainable farming systems and a number of investigators have studied their success (MacRae *et al.*, 1990).

Now, the depressed economic situation is making more and more farmers to look alternative farming practices as a way to cut input costs and maintain or recover financial health. Although, yield may be lower in sustainable agriculture systems, nearly all investigators and surveys report that total costs were substantially lower and net incomes were at least as high or exceed those of conventional farmers, particularly for organic farmers for whom premium prices may be available. Another common change is that farmers become more aware of the `organismal' nature of the farm, which functions well when all its components are present and essential biological processes are supported through the careful management of events in time and space (Hanley, 1980; Koepf *et al*., 1976). The conversion process usually takes from 3 to 6 years. A farmer should perform such types of work on a small part of the farm. Farm structure and soil fertility often determine the speed and area of transition (USDA, 1980). Because sustainable agriculture is designed to maximize the use of the farm's internal resources to minimize the purchase of off-farm inputs, a farm inventory, covering available physical, biological and human resources is a critical first step in the conversion process. Availability of water is also an essential element of a farm inventory. The selection of optimal crop rotations is central to successful sustainable farming and is key determining factor for soil management, weed, pest and disease control, animal feeding and ultimately, finances. Legumes are essential in any rotation and should comprise 3-50 % of the cropland. They can be used as forage (clovers, vetch, trefoil and alfalfa), as seed to be sold (clovers and alfalfa), as animal feed (faba beans), or as human food (peas and beans). Green manure can be used in rotations for erosion and weed control and to improve soil physical properties.

The best crops to start a conversion appear to be pasture, a hay crop, or annual legume. The legumes play important role in biological nitrogen-fixation (BNF), which is a free source of nitrogen. Danso (1994) reported that, various estimates indicate that BNF contribute more N for plant growth than the total amount of nitrogenous fertilizers applied to crops each year. In fact BNF offers an economically attractive and ecologically sound means of reducing external inputs particularly in the developing countries. Most converting farmers after their tillage practices to reduce soil degradation and losses by erosion, improve weed control, produce more timely organic matter decomposition and especially improve soil fertility. The approaches used depend on the farmer's knowledge, access to equipment and the farm's particular economic and environmental conditions. Managing the top 8 cm of soil is vital because most of the biological activity, microorganisms and organic matter is found in this soil layer. In some cases, compacted soil must be loose and by using deep chisel tillage or a sub-soiler. Alternatively, a deep-rooted green manure crop, such as alfalfa or sweet clover, may be helpful in breaking up hardpans (Peters, 1987).

Recent research confirm what experienced farmers have been saying for some time: conversion from conventional to sustainable production practices is possible in a reasonably short period of time. Financial risks can be minimized if the converting farmer plans ahead, identifies markers for products converts the farm in stages, and gradually cuts expenditures on off-farm inputs. Developing cropping systems that balance the financial and biological needs of the farm will also reduce the chances of farm failure. For those wishing to convert organic production, markets for organic produce are not yet firmly established in many commodities and communities and relatively little market research has been conducted. Taking a longer term view, new, problems will likely be created as more and more conversions take place, such as availability of manure and skilled labor.

These information gaps should not discourage farmers from making the transition, except for those already in severe financial difficulty. Although, some have failed in their attempts to convert, many have done so successfully, without great hardship, and have few doubts about the wisdom of their decision. They have found the benefits of converting to go far beyond the purely economic. Their skills and their appreciation of their environment have been enhanced; the healthy of their soil, animals, and families has improved; and many have a peace of mind that was absent when producing conventionally. Many are actively involved in efforts to make conversion easier and freely pass on their knowledge to other farmers and to scientists who are interested in studying the conversion process. For all these reasons, this is likely to see many more conversion in the years ahead and an increased in sustainable farming system by the scientific community.

The maintenance, restoration and enhancement of soil fertility are widely acknowledged as key factors in the development of national food security and sustainable agricultural growth. Traditionally, soil fertility conservation and plant nutrition practices include farmyard manure application, green manuring and incorporation in soil of crop residues to sustain crop production. But, demographic pressure demanded more produce per unit of area and time to feed the growing population by using the low sustainable input factors to get high output results in crop productivity.

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