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Aiming towards Sustainable Agricultural Health

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Introduction

With the dawn of new millennium, challenges in the agri- culture sector are quite different from those met in the previous decades. The Indian population has crossed one billion mark. Population has been increasing at the fate of 2.1 per cent per annum. This accounts for the enormous pressure to produce more food from less land. It is high time to transform the Indian agricultural scenario to meet the food demand for the growing population and simultaneously conserve the environment. This calls for special effort to manage natural resources of agriculture and the need for 'Sustainable Agriculture'

In the context of sustainable agriculture, the age-old technique of slash and burn can be re-considered. This (method, in vogue in Tropical Asia, was characterized raising a crop for one or two years and afterwards it would remain fallow for a few years. At the end of this period, the field would become covered with the same vegetation once again. So long as the population density remained well below the carrying capacity of the area concerned, this technique functioned as a viable, sustainable form of forming. But when the delicate balance between the two factors is upset, this system collapses. Hence, it is neither practical nor possible to adopt the traditional farming methods in their original forms. So we will have to look into new farming techniques that can meet the requirements of sustainability and development.

Organic farming systems have attracted increasing attention over the last two decades because they are perceived to offer some solutions to the problems currently besetting the agricultural sector. Indiscriminate use of chemicals in agriculture has lead to the concern over the safety of food and sustainable production. Sustainability of soil fertility and a steady increase in crop productivity are the priority areas to overcome food scarcity. Organic farming aims to create integrated humane, environmentally and economically sustainable agricultural production system which maximize reliance on farm derived renewable resources and the management of ecological and biological processes and Interaction, so as to provide acceptable levels of crop, livestock and human nutrition,

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protection from pests and diseases and appropriate return to the human and other resources employed.

Organic farming protects the long-term fertility of soils by maintaining organic matter levels, fostering soil biological activity and careful mechanical Intervention. Moreover insoluble nutrient are made available to the plants by the action of soil microorganisms. It also provides for the nitrogen self-sufficiency by biological nitrogen fixation via the use of legumes and effective recycling of crop residues and livestock wastes. Control of weeds, diseases and pests relies primarily on crop rotations, natural predators, resistant varieties and minimal thermal biological and chemical intervention.

The success of organic farming system depends on the efficient agronomic management to stimulate the productivity of soil resources. Farmyard manure (FYM) is the most commonly used organic manure in India. Cow dung, a main source of FYM, contains 0.5 per cent nitrogen. 0.2 per cent phosphorus and 0.5 per cent potassium. Another important source of organic manure is the bio- degraded coir pith. The green manure crop as well as green-leaf manure adds to the nitrogen status of the soil. Leguminous green manure crops supply 120-175 kg of nitrogen per hectare. Vermi-compost is yet another rich organic manure prepared using earthworms plant nutrients. It is a rich source of nitrogen, phosphorus, potassium, calcium, magnesium, vitamins and growth hormones that enhance plant growth and soil microbial population. In addition it improves soil structure and water holding capacity.

Biofertilisers are eco-friendly, low cost inputs playing a significant role in improving the quality of agricultural produce and sustaining the productivity over a longer period of time. They are living cells of different types of microorganisms that can mobilize nutritionally important elements from the non-usable form through biological process. Among biofertilisers for increasing nitrogen supply, nitrogen fixing bacteria (*Rhizobium*, *Azotobactor* and *Azospirilum*), blue green algae and azolla are important. Except *Rhizobium* all are free-living, while it is symbiotic bacteria. Legume-*Rhizobium* symbiosis is the most promising as it supplies 80-90 per cent of the total nitrogen requirement of the legumes Biological nitrogen fixation contributes to 69 per cent of the global nitrogen fixation

One of the important features of organic agriculture is the exclusion of synthetic plant protection chemicals for pest and disease control. The use of plant-based insecticides has been very popular among the traditional farmers of India. Unlike chemical pesticides, they are relatively harmless to

higher forms of life while being lethal to insect pests: The leaves, roots, bark, fruit and seeds of plants are utilized for the extraction of insecticidal principles. *Acorus calamus, Adhatoda vasion, Azadirachta indico, Thevetia nerifolia, Pongamia glabra, Lantano camaro, Chrysanthemum indica* etc. have been extensively used in insecticidal preparations to ward off major crop pests.The botanical pesticides are highly bio degradable and have no toxic residues.

Biocontrol of pests employing natural parasites and predators and beneficial fungi, bacteria and viruses is effective and is devoid of problems related to environmental pollution. The technology is eco-friendly and do not lead to development of resistance in pests. The most widely used organisms to control insect posts are the bacteria, *Bacillus thuringiensis*, fungi, *Trichoderma* spp. and virus, Nuclear polyhederosis virus (NPV).

The concept of sustainable agriculture also includes integrated fertility management, pest management, water management and farming systems. The integrated approach of fertility and pest management emphasis the cultural, mechanical, biological and genetic control to achieve optimum output at reduced doses of chemicals. Water is a scarce resource for Indian agriculture and efforts are to be directed to harness water resources and their effective utilization. Farming systems consolidates all farming enterprises such as crop production, forestry, livestock, aquaculture, bee keeping etc. It generates more employ- ment opportunities besides fetching additional income.

An important area to be exploited towards sustainable agriculture is biotechnology and genetic engineering. Genetic engineering has made possible substantial improvement in the yield of many crop plants and also creation of new strains of high yielding plants through cloning and gene transfer. The most ambitious application of this technology is in the field of nitrogen fixation. Legumes fix nitrogen through *Rhizobium leguminosarum*. Genetic engineering has turned a new leaf by converting cereals into nitrogen fixing plants by the transfer of *nif* genes from *Rhizobium* of legumes. Another practical application of this area is the development of pest and disease resistant varieties. Development of plant species resistant to drought, flooding, high and low temperature regimes by genetic manipulation enable them to overcome these abiotic stresses that adversely affect the crop growth and development.

The concept of sustainable agriculture needs to be practical rather than theoretical. The farmers have to be made convinced of the facts that points to it and make them adopt latest technologies. Extension activities such

as group meetings, trainings, field demonstrations, field visits and success stories motivate and encourage them to change their old farming practices and help to build a progressive attitude that aims to sustainable agriculture.