Green Growth Technology for Livelihood Security & Sustainability

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ABSTRACT

Organic agri-biotechnologies are environmentally safe, economically viable and socially replicable that promotes green growth and sustainability. It is the most modern as well as the most ancient method of low cost eco-friendly and sustainable agriculture. Organic agriculture is essentially an agriculture employing a knowledge/understanding of naturally occurring processes that ensures livelihood security, quality food and nutrient security. Organic farming maintains soil health, re-enlivens soil fertility and balances useful and harmful insect-pests ratio and thus produces tasty, nutrient rich food and fodder. About 74% farmers in India are small and marginal farmers and more than 55 per cent of the net sown area of the country is rain-fed, organic practice is most relevant to them.

Keywords: Organic agri-biotechnologies; Green Technology; Climate Change; Food Security ; Nutritional Security.

1. INTRODUCTION

Decades of growth have brought tangible economic and social progress globally butthis has happened at increasingly high costs. Socially and economically, we see overallhigher inequality, persistent poverty and vulnerability. Environmentally, we see thedepletion and overexploitation of natural resources, the degradation of key ecosystemservices like water, and loss of biodiversity. These conditions are directly underminingour well-being and triggering more competition over natural resources. Poorgovernance, as well as the interests of large agri-businesses and extractive industries, risk exacerbating the scarcity of resources and disproportionately affecting the securityof millions of smallholders, farmers and the rural poor. The effects of climate change willfurther aggravate these economic and environmental inequities.

In Asia and the Pacific, around 60% of the people, and three quarters of the extremepoor, live in rural areas. Rural areas play an important part as the ‘food supplierand carbon sink’ for this fast-growing region. Thispaper high lights the development of green growth and its impact on the sustainability and livelihood security. India is mainly an agricultural country, where agriculture

contributes to about 14.6 % in gross domestic product (GDP) and support over 58 % of nation's population for livelihood (GOI, 2010). India with 2.5 % of the global land mass and more than16 % of the global population recognized the importance of human resources as the engines powering national development and gave high priority to improvement of the health and nutritional status of the population. Article 47 of the Constitution of India promises that it is the primary duty of state is to regard raising the level of nutrition and standard of living of its people and improvement in public health. Organic farms although yield on an average 10-15% less than conventional farms, the lower yields are balanced by lower input costs and higher margins. Its annual growth rate has been about 20% for the last decade (Lotter, 2003), accounting for over 31 million hectares of area and generating over 26 billion US dollars in annual trade worldwide (Escobar and Hue, 2007). Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes, the use of management practices in preference to the use of off –farm inputs, taking into account that regional conditions require locally adapted systems.

This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system (FAO, 1999).Sustainable food and agriculture policies aim to improve the efficiency of agricultural production systems while at the same time preserving the diverse ecosystem services upon which the world's food supply depends (e.g. agricultural lands, soil nutrients, forests and oceans, climate regulation, and biodiversity, etc.) These twin objectives are central to the health goals of ending hunger/under nutrition and achieving long-term food and nutrition security for all.

Thus, widespread environmental degradation, severe poverty around the globe and the burning concerns about achieving and maintaining good quality of life were the principal factors for taking interest in intergenerational equity, in relation to access to natural resources. So, the necessity of having an alternative agriculture method which can be functioned in a friendly Ecosystem while sustaining and increasing the productivity is talk of the day among not only agricultural scientists but also even common men- Organic farming is recognized as the best known alternative.

It is economically feasible to practice when the farmers are able to get premium price for their product. The cost of cultivation will be reduced by not depending upon the purchased off-farm inputs. Low productivity in the transition stage needs research activities in the national and international level. Organic farming is not only revival to the farming community, it also insures to the consumers to lead a "Healthy and Happy life". So a paradigm shift to Organic farming is the need of the day to enhance the quality of life.

2. ORGANIC VISION

It is a matter of fact that the modern agriculture is based on the use of high yielding varieties of seeds, chemical fertilizer, irrigation water, pesticides etc. to satisfy the ever growing demand for food grains not only to fulfill the problem of food security but also to earn foreign exchange at the cost of environmental quality which cannot be sustainable in future because of the adverse changes being caused to the environment and ecosystem. The term 'organic' was first used in relation to farming by Northbourne (1940) in his book ***Look to the Lad***. Over the past five years, the world has been hit by a series of economic, financial and food crises that have slowed down, and at times reversed, global efforts to reduce poverty and hunger. Today, price volatility and global weather shocks continue to severely undermine such efforts. In this context, promoting livelihood resilience and food and nutrition security has become central to the policy agendas of governments. As most good agricultural land has already been farmed and the region have exceeded the safe limit, the natural resources availability for further farming expansion is practically exhausted. Smallholder farmers need to be at the center of this agenda, and to play a leading role in the investment efforts needed to achieve it.Organic development denotes a holistic system of lifestyle which optimizes productivity in a sustainable manner. Organic technologies are environmentally safe, economically viable and socially replicable. Organic practice maintains soil health, re-enliven soil fertility and balances useful and harmful insect-pests ratio. The activated and technically upgraded organic farming is known as biodynamic farming. Bio-Farming practices in general and Biodynamic Farming system in particular are increasingly proving to be sustainable farming practice in many countries as well as in different parts of India. Biodynamic agriculture is a cost effective and techno-economically viable, export friendly, farm friendly, eco-friendly farming system. Thus is adoptable and sustainable. Table 1: summarizes incentives and constraints for farmers adopting organic agriculture in developing nations.

Table-1

Incentives	Constraints
1. Promotes ever green revolution technologies. 2. The inaccessibility or high cost of green revolution technologies. 3. Organic agriculture incorporates/ gives place to indigenous knowledge. 4. Positive influence on the environmental and sustainable development movements. 5. Premium price and market opportunities. 6. Employment & Livelihood security	1. Lack of knowledge about organic agriculture. 2. Lack of economic and political advocacy. 3. Population pressure encourages intensification as priority of government advocacy. 4. The high cost of certification by foreign organizations. 5. Low literacy levels in rural areas make record keeping, necessary in organic agriculture, a problem. 6. Lack of trade liberalization in some countries prevents development of organic exports.

Organic farming address the needs of poor and food insecure people by ensuring their access to adequate food at all times through nutrition- and gender-sensitive safety nets; strengthening their access to land, water and other productive assets; building their capacities for sustainable agricultural intensification in the face of multiple natural resource challenges and climate change; enabling them to market their produce on more favorable terms; assisting them to reduce the amount of food they lose post-harvest; strengthening their ability to find economic opportunities off the farm; and supporting them to use the locally produced food they have to improve the nutritional status of all family members. In many developing countries, the overwhelming majority of farms are small and family-run, and they produce most of the food consumed locally. Smallholders are also by far the main investors in agriculture in most of the developing world.

3. ECO-FRIENDLY TECHNOLOGY

Organic farming is a Green Technology (GT), environmental healing technology that reduces environmental damages, which contributes to both poverty reduction and sustainable agricultural development. In the long run organic farming will secure the future for sustainable farming.According to public perception, organic food is the healthy option. Sales of organic produce have rocketed over the past few years with the organics industry sending out messages of safer, healthier food created by farming practices which are better for the environment. Organic farming communitybelief that it minimizes the need for chemical inputs thereby limits damage to health and the environment. It is a more sustainable method of farming than conventional techniques. Intensive farming is said to destroy the fertility of the land, but with organic farming and sustainable crop rotations, soil health is improved. In particular, lack of sufficient amount of bio-composting and non-availability of bio-fertilizers in local market further constrain organic producers (Gill et al., 2000).Modern-day need is to achieve sustainable agriculture that obtain higher yield and increase income without affecting the environment.

4. FOOD SECURITY

Food security brings into focus the linkage between food, nutrition and health.The term “food security” was first used in the 1960s and 1970s. Food securityis a priority focus of sustainable development. World Food Summit in 1996 defined food security as a situation in which “all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”.Today with fewer than 1 billion people going hungry every day, we still have a long way to go.The projected annual growth in the populationis 1.5 that requires about 10mt extra food every year and adds an extra challenge for food security.Burgeoning populations mean more demand for food, water and land at a time when the natural resource base for agriculture is being degraded, large areas of farmland are being diverted from food crop production, and climate change threatens to further reduce agriculturally viable

land. Food insecurity, mostly seasonal, was confined to poorer segments in remote areas; hunger had been reduced and energy needs met by food grains. But pulses critical to meet protein needs in populations subsisting on vegetarian diets, were expensive and consumption had come down. Vegetables intake which is essential to provide the needed micronutrients continued to be low. Low dietary intake is the major factor responsible for under nutrition but nutrient loss associated with infections comes a close second. Potable water supply and sanitation are critical for prevention of infections. Health care for early detection and effective management of infections can reduce under nutrition due to infections. India has been self-sufficient in food production since seventies and low household hunger rates. The government took an action for the redemption of the food insecurity among the "poorest of the poor" in a very active and effective manner. The Indian National Food Security Act, 2013 (also Right to Food Act), aims to provide subsidized food grains to approximately two thirds of India's 1.2 billion people. Under the provisions of the bill, beneficiaries are to be able to purchase 5 kilograms per eligible person per month of cereals at very low prices.Pregnant women, lactating mothers, and certain categories of children are eligible for daily free meals. The bill has been highly controversial. It was introduced into India's parliament in December 2012, promulgated as a presidential ordinance on July 5, 2013, and enacted into law in August 2013. Through this India would if not all so may be able to fulfill few targets of "Millennium Development Goals".

5. NUTRITIONAL SECURITY

India has been in the forefront in developing national food and nutrition databases, undertaking research studies and surveys documenting the ongoing agriculture, food, nutrition and health transitions.Human health is directly affected by environmental degradation and climate change, undermining the right to health. Promoting universal access to health care and healthy environments (including water and sanitation, clean air, etc.) can significantly minimize these impacts. The promotion of health benefits of greenhouse gas mitigation policies in sectors such as energy, transport, food and agriculture, water and housing will reduce the adverse effects of climate change on health. Food policies should also consider nutrition and health as an outcome, including communicable and non-communicable diseases. Smallholder farmers can significantly contribute to economic growth, as well as to reducing poverty and ensuring food and nutrition security. Food and nutrition security means equitable access for all people to high quality food rich in micronutrients and containing the minimum amount of additives and chemical residues (e.g. pesticides, fertilizers, hormones, antibiotics, etc.) needed to ensure optimal production without compromising human health. Inadequate food and poor health are two direct factors contributing to under nutrition.

Major achievements have been reached that most of the people in the world receive sufficient food to meet their energy requirements. However, energy is not sufficient to ensure good nutrition. Adequate micronutrients must also be available.Among the most important micronutrients are: iron, vitamin A, and Iodine. Indisputably, Iron deficiency is a major public health nutrition problem. According to the estimation of WHO, about 5 billion people suffer currently from iron deficiency- about 80% of the world's population.Commitment to tracking agriculture programmes for relevant nutrition indicators and evaluating the impact of the programmes on nutrition outcomes is central to understanding which approaches reduce the under nutrition burden. India must also scale up its investments in integrated data systems (including health, nutrition, economic, and livelihoods) at regular intervals for diagnostics, problem solving and tracking progress.Ignoring the agriculture-nutrition pathways in India will have enormous economic and social cost.Table-2 summaries the nutraceutical value of crops grown in conventional vs bio-dynamically (influence of cosmic forces). Biodynamic (BD) crops products contain more vitamin C, iron, magnesium and phosphorus than conventional crops products, contains significantly less nitrates. To be sustainable there should be successful management of resources i.e. it must produce adequate high quality food, be environment friendly, protect the soil, and be profitable and socially viable. Biodynamic crops products contain more vitamin C, iron, magnesium and phosphorus than conventional crops products, contains significantly less nitrates, BD grown crops shows better protein quality, higher content of nutritionally significant minerals, lower amount of heavy metals.

Table-2

SN	Particulars	Biodynamic Products	Conventional Products
1	Vitamin C (mg)	89.2	67.9
2	Iron (Fe)	3.7	3.0
3	Magnesium (Mg)	80.0	68.6
4	Phosphorus (P)	124.0	111.8
5	Carotene	14.0	0.3

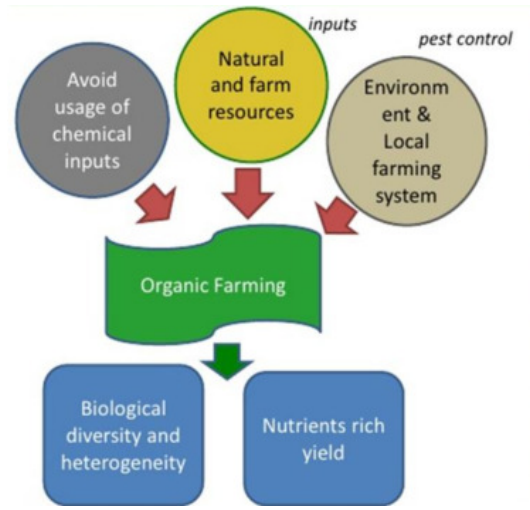
6. SUSTAINABILITY

The basic dimension of sustainable development is environmental, social and economic.Organic farming supports natural resources & their sustainability. The quality-controlled bio-products are better targeted to global markets and will certainly boost the India's share in the global trade, which is less than 1%. Diversifying agriculture practices could further improve the agribusiness sector. Animal manure is the natural soil conditioner & amendment agents. Livestock play multifaceted roles strengthening indigenous agricultural practices, organic farming and generating income and livelihoods for large masses of rural India. However, with the advent of modern mechanized

technology in agriculture, livestock population in our country is rapidly declining by 10-30%. FAO strongly advocates that improved pasture and range land management practices are essential not only for supporting livestock production but also for restoring carbon pool, nutrient cycling and soil quality. In terms of sustainability, the negative effects of changing temperatures and precipitation onagricultural production, food security, and under nutrition in developing countries has been described asthe largest single negative impact of climate change on global health (McMichael A, et al., 2004). The biodynamic agriculture and organic farming are similar in that both are ecologically oriented and do not use chemical fertilizers, pesticides and weedicides. The main difference between the two is that in biodynamic agriculture eight different preparations (BD500-507) are used, with the cosmic forces, mainly the influence of the moon and the planets through the biodynamic planting calendar, which makes it an activated organic farming system. Biodynamic farming practices rejuvenate and re-enliven the earth so that it could continue supporting a healthy plant and animal life. It is sustainable and promotes natural resources i.e. produce adequate high quality food, environment friendly, protect the soil, and socially viable.

7. BIO-FARMING FOR SUSTAINABLE DEVELOPMENT

1. Farm Friendly Technology: Sir Albert Howard is considered as the father of sustainable agriculture wrote in the book-An Agricultural Testament, "I regarded these (Indian) peasants as my professors. I learnt from them how to grow healthy crops without the slightest help from artificial manures or insecticides."



The success of organic farming depends on soil fertility and regular monitoring of soils and crop growth. It is advisable to shift gradually from normal cropping practices to organic farming where the soil productivity is poor and procurement of organic manure is difficult. Above all the poor farmers do not have to depend on the high cost of external inputs. In comparison of the conventional farm the biodynamical farm soils has better physical, chemical and biological properties such as the soil texture, depth and porosity, water holding capacity, organic matter content. The organic matter content, soil respiration, mineralizable nitrogen, and the ratio of mineralizable nitrogen to organic carbon are reported to be higher on the biodynamic farms i.e. higher microbial activity and thicker topsoil on biodynamic farms. Earth worms which are also called as farmer's farm factory are reported to be more than 25 times in number and 8 times in weight on the biodynamic farms as compared to the

conventional farm. These characteristics make the biodynamic technology more a farm-friendly technology. It can be explained through this diagram-1.

2. Export -Friendly Agriculture: The biodynamic farm products are certified organic or biodynamic products-Demeter certification. These bio-grown products are free from all the chemicals. The produce has better nutritive values, taste and due to the natural growth they have good storage capacity. Even perishable vegetables and other produce lost longer on biodynamic farms. The demand of biodynamic produce is increasingly growing in the national and international market. In most of the developed countries only certified food and agro-products are now getting entry and recognition. The cost of the bio-dynamically grown produce fetches premium price up to 25%to 35% higher than the market price of a similar conventional product. As now the economic stability is one of the most significant characteristics of sustainable farming system the biodynamic farm promises a better alternative because of its greater enterprise diversity and less year-to-year variability in gross revenue. In general at a biodynamic farm net returns are about 40% higher than their conventional counterparts.

3. Eco-Friendly; Biodynamic agriculture technology not uses any short of chemical application and the focus is on balance natural growth and recycling of natural resources. The preparations are produced from the plant parts and most of the applications are based on ecological principles. Organic farming helps to adopt a climate justice approach. Although, commercial organic agriculture with its rigorous quality assurance system is a new market controlled, consumer-centric agriculture system world over, but it has grown almost 25-30% per year during last 10 years. In spite of recession fears the growth of organic is going unaffected. The movement started with developed world is gradually picking up in developing countries. But demand is still concentrated in developed and most affluent countries. Local demand for organic food is growing. India is poised for faster growth with growing domestic market. Success of organic movement in India depends upon the growth of its own domestic markets

4. Sustainable: Organic agriculture is a good farming system and development concept for achieving sustainability in agriculture. National Planning Commission of India in 2000 recognized organic farming as a thrust area. Sustainable agriculture integrates three main goals– environmental health; economic profitability; and social and economic equity. Among the available technologies such as organic agriculture, biotechnology etc., the challenge is to decide suitable, affordable, and competitive technology.The cycling of nutrients and quality farm produce in adequate amount with the entire environmental safety and profit make it sustainable. India has traditionally been a country of organic agriculture, but the growth of modern scientific, input intensive agriculture has pushed it to wall. But with the increasing awareness about the safety and quality of foods, long term

sustainability of the system and accumulating evidences of being equally productive, the organic farming has emerged as an alternative system of farming which not only address the quality and sustainability concerns, but also ensures a debt free, profitable livelihood option.

5. Adoptable: The biodynamic agriculture is an activated system of organic farming. Most of the preparations are quite easy to prepare and based on the local resources. The preparations, understanding and application are easy and adoptable. In this farming system approach a piece of land is used optimally and to its fullest potential to produce a range of nutritious and healthy food as well as other required commodities in a manner which can healthily feed a small family, and maintain soil health and productivity by agricultural practices based on principles of nature. Pests (both insects and diseases) are also controlled and managed by the selection of crop mixes and using biological control measures.

6. Climate change: Organicagri-biotech combats climate change. Climate change will increase the risk of hunger and under nutrition over the next few decades and will challenge the realization of the human rights for health and adequate food. With a change in patterns of extreme events such as heat waves, droughts, floods, and other disasters, vulnerable communities will suffer serious setbacks in terms of food and nutrition security. With large land area and climate diversity, India has a considerable potential to contribute to Csequestration. The soil organic carbon (SOC) in cultivated soils is less than 5 mg g^{-1} compared to 15.20 mg g^{-1} in uncultivated soils. This available potential of 10.15mg g^{-1} soil–C sink could balance net emission from fossil fuel combustion.

8. CONCLUSION

Synthetic and petro-product based input dependent Green Revolution alarm bells have been ringing for a decade or more and now environment is threatened.OF systems can deliver agronomic and environmental benefits both through structural changes and tactical management of farming systems. The benefits of OFare relevant both to developed nations (environmental protection, biodiversity enhancement, reduced energy use and CO2 emission) and to developing countries like India (sustainable resource use, increased crop yields without over-reliance on costly external inputs, environment and biodiversity protection, etc.). The soils are dying, the agriculture is becoming increasingly destabilized and farmer's suicides are mounting throughout the length & width of the country. Ensuring health, foodand nutrition security is essential for poverty eradication and climate-resilient sustainable development.Biodynamic is an innovative & activated organic farming system that has significant role to play in the areas of sustainable agriculture with emphasis on ecological conservation and renewable resources. The degenerative effects of intensive farming practices on soil fertility and ecological balance are surfacing which needs immediate attention for sustaining the productivity rate.

Increasingly, the movement away from organic methods of farming has resulted in the loss of food, nutritional, livelihood and ecological security and at times, life itself. Many recent reports in the media have written an epitaph for Indian soils, food & nutritional security. When used correctly green growth and environment-friendly technology has promoted sustainable agricultural growth and reduced widening rural-urban income disparities. To address these challenges, robust and carefully targeted investment is needed, along with comprehensive policy frameworks at global, regional and national levels.

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