

SUSTAINABLE DEVELOPMENT IN AGRICULTURE AND GREEN FARMING IN INDIA

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Abstract: Sustainable development as a concept first developed in 1987, it was during this time the scientific evidence began to mount, indicating that human actions were having negative impact on the environment on a global scale leading to outcomes such as global warming. The idea of sustainable development became a widespread concern when people concluded that the current path of human activity was unsustainable in the long term and changes in the human society were needed. If we take all the global issues together, nothing draws more attention than political and economic upheavals as well as climate change and food security. While political and economic upheavals seem to be of temporary nature, climate change and food security are going to have long term implications and call for both immediate and sustained effort by people across the globe as these are vital for our existence itself. Since the time man came to know about the benefits of organized living, he has unscrupulously used the bounties of nature and this practice continues in a great measure today also. So long as man was ignorant about modern farm practices, he had stuck to the farming that is now thought of being sustainable and beneficial in the long term. Organic farming was the original type of agriculture that had been practiced from time immemorial. It is the form of farming which relies on techniques such as crop rotation, green manure, compost and biological pest control. One of the world's most resilient agro systems dating back to prehistoric times is forest gardening comprising of organic food production system. Weed management without the use of pesticides, soil management by use of crop rotation practices and green manure comprising animal manure is a significant feature of organic farming. Sustained campaign and awareness amongst agriculturists about sustainable development these days has led farmers to manage their fields more proficiently. Interest is driven by consumer demand for locally grown, organic and sustainable products. But still a lot more is required to be done. Agriculture is the backbone of Indian economy and it is the

provider of livelihood for nearly half of the working population. At the same time the agriculture is also one of the largest contributors of greenhouse gas emissions. The emissions are primarily due to methane from rice paddies, enteric fermentation in ruminant animals and nitrous oxide from the use of manures and fertilizers. Key actions which Indian agriculture should adopt for adjustments in changes to mean temperature and precipitation are changing crop patterns, effective risk management through early warning, improved land management practices, development of resource conserving technologies, credit insurance support to farmers and nutritional strategies for managing heat stress in dairy animals. There is an urgent call for cost effective opportunities for reducing methane generation, emissions in ruminants by modification of diet and nutrient management which will help make adaptation measures sustainable. The need of the hour is devising new policies encouraging green farming as an alternative to farming coupled with use of chemical fertilizers, investment in water harvesting, promoting small farm mechanization, efficient water use technologies and using balanced fertilizers in crop production. Agriculturists indulging in these sustainable techniques can be given financial incentives for improved land management, for resource conservation including water, energy and fossil fuels. As 21st century represents the crisis of survival of human beings there is an urgent necessity to think of future simultaneously. Development is a holistic concept growth cannot alone be termed as development. Development in agriculture has to look into the aspects of social equity, environmental sustainability and people's participation. Sustainable development is not just about conserving our resources; it is about changing our culture to make conservation our way of life. Mahatma Gandhi has rightly said that: The Earth provides enough to satisfy every person's need but not every person's greed.

Keywords: climate change, crop rotation, organic farming, sustainable development

INTRODUCTION

“The Earth provides enough to satisfy every person’s need but not every person’s greed.” Mahatma Gandhi

Sustainable development as a concept first developed in 1960s, it was during this time the scientific evidence began to mount, indicating that human actions were having negative impact on the environment on a global scale leading to outcomes such as global warming. The idea of sustainable development became a widespread concern when people concluded that the current path of human activity was unsustainable in the long term and changes in the human society were needed. If we take all the global issues together, nothing draws more attention than political and economic upheavals as well as climate change and food security. While political and economic upheavals seem to be of temporary nature, climate change and food security are going to have long term implications and call for both immediate and sustained effort by people across the globe as these are vital for our existence itself. Since the time man came to know about the benefits of organized living, he has unscrupulously used the bounties of nature and this practice continues in a great measure today also.¹ Natural resources have continually come under stress and degradation due to unplanned efforts directed to boost agricultural production. In our effort to fulfill the food grain requirements for increasing population we are tending towards unprincipled use of scarce and precious resources, which are indispensable for our social and economic development. Soil is impoverished, water and air are polluted and there is an increase in intensity of genetic erosion in plants and animals. Even the climate is getting irreversibly altered due to global warming and green house effect. The fundamental challenges in the 21st century are to find ways for sustainable development that are environmentally sound, equitable and allow respect for individual and social rights.² The concept of sustainability lies in maintaining harmony between buoyancy-dynamism in agricultural growth for meeting basic human needs along with emphasis on protection and conservation of natural resources. If the viability of natural resources is impaired because of neglect or misuse, agricultural sustainability environmental quality and the linkage between them in the quest for human survival will be at stake.³ Sustainable agriculture is the successful management of resources to satisfy the changing human needs, while maintaining or enhancing the quality of

environment, and conserving natural resources.⁴ The fundamental aim of the sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations.

Development of ideas about agricultural sustainability

So long as man was ignorant about modern farm practices, he had stuck to the farming that is now thought of being sustainable and beneficial in the long term. Organic farming was the original type of agriculture that had been practiced from time immemorial. It is the form of farming which relies on techniques such as crop rotation, green manure, compost and biological pest control. One of the world’s most resilient agro systems dating back to prehistoric times is forest gardening comprising of organic food production system.⁵ Weed management without the use of pesticides, soil management by use of crop rotation practices and green manure comprising animal manure is a significant feature of organic farming. However, still there are divergent views about how best these techniques of organic farming are utilized and best results are yielded. Some say agriculture will have to expand into new lands- but this would mean further losses of biodiversity. Others say that food production growth must come through redoubled efforts to repeat the approaches of the Green Revolution. Others still say that agricultural sustainability offers options for farmers to intensify their land use and increase food production for the growing population. Solving the persistent hunger problem is not simply a matter of developing new agricultural technologies and practices. Most poor producers cannot afford expensive technologies. They will have to find new types of solutions based on locally available and/or cheap technologies combined with making the best of natural, social and human resources. Although farmers throughout history have used a wide range of technologies and practices we would today call sustainable, it is only in recent decades that the concepts associated with sustainability have come into more common use.⁶

⁴ D Worster, *The Wealth of Nature: Environmental History and the Ecological Imagination*, Oxford University Press, New York.

⁵ R.K Nayak, *International Environmental Law- Consumer Environmentalism versus Environmental Consumerism*, 8 (Discussion paper No.7, Edith Cowman Uni. Perth, W.A. Australia, 1995).

⁶ *The Week Magazine*, November 2013

¹ J Pretty, *The Living Land*, Earthscan, London

² *The Chronicle*, December 2013

³ *The Times of India*, 2nd December 2013

Concerns began to develop in the year 1960s, and were particularly and were particularly driven by Rachel Carson's book *Silent Spring*⁷. Like other popular and scientific studies at the time, it focused on the environmental harm caused by agriculture. In the 1970s, the Club of Rome identified the economic problems that societies would face when environmental resources were overused, depleted or harmed and pointed towards the need for different types of policies to generate economic growth. In the 1980s, the World Commission on Environment and Development, chaired by Gro Harlem Brundtland, published *Our Common Future*, the first serious attempt to link poverty alleviation to natural resource management and the state of the environment. Sustainable Development was defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". The concept implied both limits to growth and the idea of different patterns of growth.⁸ In 1992, the UN Conference on Environment and Development was held in Rio de Janeiro. The main agreement was Agenda 21, a 41 chapter document setting out priorities and practices in all economic and social sectors, and how these should relate to the environment. Chapter 14 addressed Sustainable Agriculture and Rural Development (SARD). The principles of sustainable forms of agriculture that encouraged minimizing harm to the environment and human health were agreed. However, progress has not been good, as Agenda 21 was not a binding treaty on national governments, and all are free to choose whether they adopt or ignore such principles.⁹

The "Rio Summit" was followed by several important actions that came to affect agriculture: (a) The signing of the Convention on Biodiversity in 1995 (b) The establishment of the UN Global IPN (Integrated Pest Management) Facility in 1995, which provides international guidance and technical assistance for integrated pest management. (c) The signing of the Stockholm Convention on Persistent Organic Pollutants in 2001, so addressing some problematic pesticides. (d) The ten years after Rio World Summit on Sustainable Development held in Johannesburg.

The concept of agricultural sustainability has grown from an initial focus on environmental aspects to

include first economic and then broader social and political dimensions:¹⁰

Ecological

The core concerns are to reduce negative environmental and health externalities, to enhance and use local ecosystem resources and preserve biodiversity. More recent concerns include broader recognition for positive environmental externalities from agriculture (including carbon capture in soils and flood protection).

Economic

Economic perspectives seek to assign value to ecological assets, and also to include a longer time frame in economic analysis. They also highlight subsidies that promote the depletion of resources or unfair competition with other production systems.

Social and Political

There are many concerns about the equity of technological change. At the local level, agricultural sustainability is associated with farmer participation, group action and promotion of local institutions, culture and farming communities. At the higher level, the concern is for enabling policies that target poverty reduction.

What is agriculture sustainability?

Sustained campaign and awareness amongst agriculturists about sustainable development these days has led farmers to manage their fields more proficiently. Interest is driven by consumer demand for locally grown, organic and sustainable products. But still a lot more is required to be done. Agriculture is the backbone of Indian economy and it is the provider of livelihood for nearly half of the working population. At the same time the agriculture is also one of the largest contributors of greenhouse gas emissions. The emissions are primarily due to methane from rice paddies, enteric fermentation in ruminant animals and nitrous oxide from the use of manures and fertilizers.¹¹ Key actions which Indian agriculture should adopt for adjustments in changes to mean temperature and precipitation are changing crop patterns, effective risk management through early warning, improved land management practices, development of resource conserving technologies, credit insurance support to farmers and nutritional strategies for managing heat stress in dairy animals. Many different terms have come to be used to imply greater sustainability in some agricultural systems over prevailing ones (both pre-industrial and

⁷ R T Carson, Contingent valuation: A user's guide, Environmental Science and Technology, p. 1413-1418

⁸ World Commission on Environment and Development, *Our Common Future*, Oxford University Press, Oxford

⁹ J. Pretty, *Regenerating Agriculture*, Earthscan, London

¹⁰ M M Cernea, *Putting People First*, 2nd edition, Oxford University Press, Oxford

¹¹ Editorial, *Times of India*, 20th November 2013.

industrialized).¹² These include sustainable, eco agriculture, organic, ecological, low input, biodynamic, environmentally sensitive, community based, wise use, farm fresh and extensive. There is continuing and intense debate about whether agricultural systems using some of these terms qualify as sustainable. The key principles are to¹³: (a) Integrate natural processes such as nutrient cycling, nitrogen fixation, soil regeneration and natural enemies of pests into food production processes. (b) Minimize the use of non renewable inputs that damage the environment or harm the health of farmers and consumers. (c) Make productive use of the knowledge and skills of the farmers, so improving their self reliance and substituting human capital for costly inputs. (d) Make productive use of people's capacities to work together to solve common agricultural and natural resource problems, such as for pest, watershed, irrigation, forest and credit management.

The technologies are often integrated into packages. These include: (a) *Integrated pest management*, which uses ecosystem resilience and diversity for pest, disease and weed control, and seeks only to use pesticides when no other options are available. (b) *Integrated nutrient management*, which seeks both to balance the need to fix nitrogen within farm systems with the need to import inorganic and organic source of nutrients, and to reduce nutrient losses through erosion control. (c) *Conservation tillage*, which reduces the amount of tillage, sometime to zero, so that soil can be conserved and available moisture used more efficiently. (d) *Agro forestry*, which incorporates multifunctional trees into agricultural systems, and collective management of nearby forest resources also known as joint forest management. (e) *Aquaculture*, which incorporates fish, shrimps and other aquatic resources into farm systems, such as into irrigated rice fields and fish ponds, and so leads to increases in protein production. (f) *Water harvesting*, in dry land areas, which can mean formerly abandoned and degraded lands can be cultivated and additional crops grown on small patches of irrigated land owing to better rainwater retention. (g) *Livestock integration*, into farming systems, such as dairy cattle and poultry, including using zero grazing.

The idea of agricultural sustainability, therefore, does not mean ruling out any technologies or practices on

ideological grounds. If a technology works to improve productivity for farmers, and does not harm the environment, then it is likely to be beneficial on sustainability grounds. Agricultural systems emphasizing these principles are also multifunctional within landscapes and economies. They jointly produce food and other goods for farm families and markets, but also contribute to a range of valued public goods, such as clean water, wildlife, carbon sequestration in soils, flood protection, groundwater recharge and landscape amenity value.¹⁴ As a more sustainable agriculture seeks to make the best use of nature's goods and services, so technologies and practices must be locally adapted and fitted to place. These are most likely to emerge from new configurations of social capital, comprising relations of trust embodied in new social organizations, and new horizontal and vertical partnerships between institutions, and human capital comprising leadership, ingenuity, management skills and capacity to innovate. Agricultural systems with high levels of social and human assets are more able to innovate in the face of uncertainty.

A common, though erroneous, assumption has been that agricultural sustainability approaches imply a net reduction in input use, and so are essentially extensive (they require more land to produce the same amount of food). All recent empirical evidence shows that successful agricultural sustainability initiatives and projects arise from changes in the factors of agricultural production (e.g. from use of fertilizers to nitrogen fixing legumes; from pesticides to emphasis on natural enemies). However, these have also required reconfigurations on human capital (knowledge, management skills, labour) and social capital (capacity to work together).¹⁵

A better concept than extensive, therefore, is to suggest that sustainability implies intensification of resources- making better use of existing resources (e.g. land, water, biodiversity) and technologies. For many, the term intensification has come to imply something bad- leading, for example, in industrialized countries to agricultural systems that impose significant environmental costs. Intensification using natural, social and human capital assets, combined with the use of best available technologies and inputs (best genotypes and best ecological management) that minimize or eliminate

¹² R.K.Pachuri, "Earth's Dearth- Invest More in Natural Capital", The Times of India (New Delhi) p.10 3rd August, 2002

¹³ N Uphoff, Understanding social capital: learning from the analysis and experience of participation, Earthscan, London

¹⁴ M A Altieri, Agroecology: The Science of Sustainable Agriculture. Westview Press, Boulder, CO

¹⁵ The Chronicle, August 2013

harm to the environment can be termed “sustainable intensification”.¹⁶

The Environmental Challenges Ahead

Increased food supply is necessary though only partial condition for eliminating hunger and food poverty. What is important is who produces the food, has access to the technology and knowledge to produce it, and has the purchasing power to acquire it. The conventional wisdom is that, in order to increase food supply, efforts should be redoubled to modernize agriculture. But the success of industrialized agriculture in recent decades has masked significant negative externalities, with environmental and health problems increasing day by day.

There is surprisingly very few data on the environmental and health costs imposed by agriculture on other sectors and interests. Agriculture can negatively affect the environment through overuse of natural resources as inputs or through their use as a sink for pollution. Such effects are called negative externalities because they are usually non market effects and therefore their costs are not part of market prices. Negative externalities are one of the classic causes of market failure whereby the polluter does not pay the full costs of their actions, and therefore these costs are called external costs.¹⁷

Externalities in the agricultural sector have at least four features: (i) their costs are often neglected; (ii) they often occur with a time lag; (iii) they often damage groups whose interests are not well represented in political or decision making process; and (iv) the identity of the source of the externality is not always known. For example, farmers generally have few incentives to prevent pesticides escaping to water bodies, to the atmosphere and to nearby nature as they transfer the full cost of cleaning up the environmental consequences to society at large. In the same way, pesticide manufacturers do not pay the full cost of all their products, as they do not suffer from any adverse side effects that may occur. There are always growing concerns that such systems may not reduce food poverty. Poor farmers, at least whilst they remain poor, need low-cost and readily available technologies and practices to increase local food production. At the same time, land and water degradation is increasingly posing a threat to food

security and the livelihoods of rural people who occupy degradation-prone lands.¹⁸

CONCLUSION

There is an urgent call for cost effective opportunities for reducing methane generation, emissions in ruminants by modification of diet and nutrient management which will help make adaptation measures sustainable. A more sustainable agriculture which improves the asset base can lead to rural livelihood improvements. People can be better off, have more food, be better organized, have access to external services and power structures, and have more choices in their lives. But like all major changes, such transitions can also provoke secondary problems. New winners and losers will emerge with the widespread adoption of sustainable agriculture. Producers of current agro chemicals products are likely to suffer market losses from a more limited role for their products. The increase in assets that could come from sustainable livelihoods based on sustainable agriculture may simply increase the incentives for more powerful interests to take over. Not all political interests will be content to see poor farmers and families organize into more powerful social networks and alliances.

Many countries also have national policies that now advocate export-led agricultural development. Access to international markets is clearly important for poorer countries, and successful competition for market share can be a very significant source of foreign exchange. However, this approach has some drawbacks¹⁹: (a) Poor countries are in competition with each other for market share, and so there is likely to be a downward pressure on prices, which reduces returns over time unless productivity continues to increase. (b) Markets for agri-food products are fickle, and can be rapidly undermined by alternative products or threats (e.g. avian bird flu and the collapse of the Thai poultry sector). (c) Distant markets are less sensitive to the potential negative externalities of agricultural production and are rarely pro poor (with the exception of fair trade products). (d) Smallholders have many difficulties in accessing international markets and market information.

There is indeed very little clear evidence that export-led poverty alleviation has worked. Even Vietnam, which has earned considerable foreign exchange from agricultural development, has to do so at very low prices and little value added. More importantly, an

¹⁶ G R Conway, *The Doubly Green Revolution*, Penguin, London

¹⁷ J W Baumol, W E Oates, *The Theory of Environmental Policy*, Cambridge University Press, Cambridge p 203

¹⁸ J Pretty, *The Pesticide Detox, Towards a More Sustainable Agriculture*, Earthscan, London

¹⁹ Jules Pretty, Andrew S. Ball, *Environment and Society*, SAGE Publication London

export-led approach can seem to ignore the in-country opportunities for agricultural development focused on local and regional markets. Agricultural policies with both sustainability and poverty-reduction aims should adopt a multi-track approach that emphasizes five components: small farmer development linked to local markets, agri-business development- both small businesses and export led, agro processing and value added activities- to ensure that returns are maximized in country, urban agriculture- as many urban people rely on small scale urban food production that rarely appears in national statistics and livestock development- to meet local increases in demand for meat (predicted to increase as economies become richer).²⁰ A differentiated approach for agricultural policies will become increasingly necessary if agricultural systems themselves are to become more productive and sustainable whilst reducing negative impacts on the environment.

The need of the hour is devising new policies encouraging green farming as an alternative to farming coupled with use of chemical fertilizers, investment in water harvesting, promoting small farm mechanization, efficient water use technologies and using a balanced fertilizer in crop production. Agriculturists indulging in these sustainable techniques can be given financial incentives for improved land management, for resource conservation including water, energy and fossil fuels. As 21st century represents the crisis of survival of human beings there is an urgent necessity to think of future simultaneously. Development is a holistic concept growth cannot alone be termed as development. Development in agriculture has to look into the aspects of social equity, environmental sustainability and people's participation. Sustainable development is not just about conserving our resources; it is about changing our culture to make conservation our way of life.

²⁰ Sawalia Bihari Verma, Environmental Law: Pollution and Management, University Book House, Jaipur