

# Organic Agri-Biotechnology Improvises Green Growth & Sustainable Development

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**ABSTRACT:** With increasing concern about the environmental, economic and social impact of chemical –dependent conventional agriculture, have led many farmers and consumers to seek alternative practices that will lead to green growth, agriculture profitability and livelihood sustainability. Increase in cost of production, inputs management etc are adding to the farmers fatigue. Another issue of great concern is the sustainability of soil productivity as land began to be intensively tilled to produce higher yields under multiple and intensive cropping systems. Groundwater table declined sharply. Recharging of groundwater has also been reduced due to severe deforestation. Indiscriminate use of chemical pesticides to control various insect pests and diseases over the years has destroyed many naturally occurring effective biological control agents.

**KEYWORDS:** Green Revolution; Organic farming; food and nutrition security; National Programme on Organic Production (NPOP);

## I. INTRODUCTION

India is mainly an agricultural country, where agriculture contributes to about 14.6 percent in gross domestic product (GDP) and support over 58 percent of nation's population for livelihood (GOI, 2010). Promoting the organic agriculture is of paramount importance to protect biodiversity and cultural diversity of India. In most developing countries, agriculture continues to be the most important sector of the economy, accounting for the biggest proportion of employment (Båge, 2005). With increasing concern about the environmental, economic and social impact of chemical –dependent conventional agriculture, have led many farmers and consumers to seek alternative practices that will lead to green growth, agriculture profitability and livelihood sustainability (A.B., et.al.2005). The alternative organic farming is potentially a profitable enterprise, with a growing global market, already being supplied by more than 90 developing countries entrepreneurs see a market for selling food that has been grown chemical free (ADB, 2005). Local consumers in India have a fairly well-developed perception about organic produce, are interested in buying certified organic foods, and even willing to pay more for them (Alviar, C J, et. al. 1980). To gain access to this market, however, certification is a prerequisite (Aikens et. al. 1975). As such, unless effective strategies for agriculture development are successfully implemented, ending rural poverty will remain a distant goal. Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. Organic production is both old and new in the India. Organic agriculture is one of ecological agriculture models with the specific definition and strict standards, which is an important aspect of sustainable agriculture (Fischer G, et.al.2002). Although organic agriculture is certainly growing in popularity, there are conflicting opinions about its potential and the benefits it can offer, in particular whether organic methods can actually improve the livelihoods of smaller farmers. Similarly, questions remain about what impact organic methods have on labor, soil quality, local economies, and risk. Two areas of debate are most prominent: the local risk-benefit ratio of organic adoption and the marketability of smallholder organic products. Organic agriculture is a production system based on an agro-ecosystem management approach that utilizes both traditional and scientific knowledge (Adhikari, Dadhi, 2006). Biodiversity also supplies indirect services to humans which are often taken for granted. These include drinkable water, clean air, and fertile soils. The loss of populations, species, or groups of species from an ecosystem can upset its normal function and disrupt these ecological services. Recent declines in honeybee populations may result

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in a loss of pollination services for fruit crops and flowers Biodiversity provides medical models for research into solving human health problems. For example, researchers are looking at how seals, whales, and penguins use oxygen during deep-water dives for clues to treat people who suffer strokes, shock, and lung disease. India has a vast biodiversity and is a treasure house of bio-resources. India's biodiversity is the most significant in the world with 45,000 wild species of plants and over 77,000 wild species of animals have been recorded so far. India has great biodiversity mainly because of its unique bio-geographical composition (Bush M B, et.al.2004). With just 2% of the world's landmass, the country has about five percent (5%) of living resources, one third (1/3) of which are land bound. But modern agri-business are only starting to recognize the benefits of obtaining organic certification, which will give them access to external markets and higher returns for their products. There are some differences in the existing organic agriculture standards; however all of organic farming practices share common characteristics in fighting against "energy agriculture, modern industry agriculture", like using chemicals such as fertilizer, pesticides and additives etc. The organic agriculture in the nutshell concerns about human health, environment and sustainable development. Organic agriculture can help address many of the challenges facing the region. Organic agriculture emphasizes sustainable farming methods that enhance the health of ecosystems and produce safe, nutritious food. Farming methods such as slash and burn and heavy use of fertilizers and pesticides damage the long-term productivity of the land, undermine the sustainability of food production systems and will not support increasing populations as land availability decreases. Organic agriculture takes place in diverse environments that host a high level of biodiversity. However, many ecosystems are vulnerable and under pressure from increasing populations and higher levels of pollution and non-degradable waste. Organic agriculture protects and enhances biodiversity and soil and water conservation, and minimizes the impact of agriculture on downstream activities and aquatic ecosystems such as mangroves and coral reefs. Organic practices can also reduce the production of greenhouse gases from agriculture by rejecting the use of fossil-fuel and chemical inputs and encouraging carbon sequestration in soils.

## II. LITERATURE SURVEY

The origin of organic farming goes back in its recent history to 1940s (Allchin, B., Allchin, F. R. 1997). During this period, the path breaking literature on the subject published by J.I. Rodale in the United States, Lady Balfour in England and Sir Albert Howard in India contributed to the cause of organic farming. Lambkin (1994) summarized various studies conducted on economics of organic farming in different crops in South and West of England and parts of Scotland and Wales. They concluded that the organic farming systems were more diverse in terms of enterprise. Padel and Uli (1994), reviewed several studies on costs and returns of organic farming in various crops in Germany. Their study revealed that the organic farming under German conditions was equally profitable with conventional farming. Lal, R. (2010), reviewed the various field experiments conducted on organic farming in India. Many sample farms recorded yields that were the same or slightly below conventional farms. Overall, the study concluded that 72 per cent of farmers strongly convinced that 'organic farming is as profitable as conventional'. Anderson (2006), examined different research studies conducted on organic farming in USA. They concluded that the lower yields on organic farms contrasted with conventional farms were balanced by lower production costs. Wynen (1994), carried out a review study on organic farming in Australia. He concluded that the wheat yields were almost similar between organic and conventional farms.

The study also indicated that the variability of wheat yields on organic farms was lower than on conventional farms. Shirsagar (2008), studied the impact of organic farming on economics of sugarcane cultivation in Maharashtra. The study was based on primary data collected from two districts covering 142 farmers, 72 growing Organic Sugarcane (OS) and 70 growing Inorganic Sugarcane (IS). The results concluded that OS. A new study by the World Economic Forum (WEF) and the Boston Consulting Group (BCG) identifies 16 emerging-market firms that they say are turning eco-consciousness into a source of competitive advantage UNCTAD (2002). These highly profitable companies are using greenery to reduce costs, motivate workers and forge relationships. The most salient quality of these companies is that they turn limitations (of resources, labor and infrastructure) into opportunities. Organic and biodynamic farming systems have soils of higher biological, physical, and in many cases chemical quality than that of conventional counterparts. When productivity in terms of inputs applied and outputs obtained and social costs of conventional farming are accounted organic alternative has also been found to be economically competitive (Reganold, 2000).. Bhattacharyya, et al (2005), estimated size of global organic market to be U.S. \$ 26 billion. The Foundation of Ecology and Agriculture (SOEL) in 2004 reported global organic area to be 24 million hectare. Of each nation's total

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agricultural land 0.03% in India, 0.06% in China, 0.65% in Sri Lanka and 0.08% in Pakistan was under organic management. In 2005 SOEL reported 10% increase in area under organic farming. National Planning Commission of India in 2000 recognized organic farming as a thrust area. National Programme for Organic Production was launched subsequently with National Steering Committee's approval on national standards, accreditation criteria for accrediting inspection and certification agencies, accreditation procedures, and inspection and certification procedures (Bhattacharyya, 2005). In Nepal preliminary drafts of organic certification policies and procedures have been developed and organic market has prospered especially through private sector. Consolidating organic standards, certification/ regulatory mechanisms, technology packages, and market network can support organic farming and therefore sustainable agriculture. According to the latest FiBL-IFOAM (2010), survey on certified organic agriculture worldwide data on organic agriculture are available from 160 countries. Livelihood status is poor and also faces various socio-economic and environmental constraints for sustainable development due to the stagnating and / or declining resource use productivity, increasing degradation of natural resources, particularly soil, water and nutrients, and declining land-man ratio (Wai, Ong Kung. 2006). To improve the livelihoods status in these regions the concept of sustainable livelihoods is increasingly gaining ground important in research and development initiatives for poverty alleviation, rural agriculture development and rural resources management (Ashley, 2000). Broad sustainable livelihood principles underpin application of the sustainable livelihood approach and most of them draw on some form of livelihoods analysis to assess how development activities fit with the livelihoods of the poor (Carney et. al. 1999). Some criticize organic farming movement as a return to the exhausting workload, and doubt that organic farming cannot feed the world population. With regards to the latter argument, (Badgley et. al. 2009) studied past reports on yields of both organic and conventional farming, and found that the average yield of organic farming is 92.2% of conventional farming in “developed countries”, and 180.2% in the “global south”, Thus, concluding that the organic farming can feed the world. A co-operative model for the development of organic farming can enable poor individual farmers to become established; whereas this would be quite impossible on their own.

In a case study in Natal, Fischer (2005), found that the cost of establishing a framework for organic agriculture, and implementing capacity-building activities for smallholders, were way beyond the capacity of individual smallholders. Establishing a co-operative for the organic farmers may be difficult as most of them don't have a clear understanding of the benefits of co-operatives. Rehber et al. (1999), found that lack of education and infrastructure in the rural areas was a major barrier for the progress of the organic farming focused co-operative movement. This is why state support is very important, especially during the establishment and launching period of organic farming movement. The IFAD evaluation found that organic adoption initially tends to increase labor costs and concurs with other studies (Damiani 2003; Pretty et al. 2005; UNCTAD 2002), that note the switch to organics from a traditional or rustic form of cultivation has positive consequences in terms of yields and profitability, thereby providing better incomes.

### III. PROBLEM AND ISSUES

With humankind and the planet facing the converging threats of climate change, natural resource depletion and ecosystem collapse, ensuring that global agricultural systems can feed our burgeoning population, are sustainable and can both endure and help mitigate these threats could not be more vital (UNCTAD, 2002). The common wisdom among governments, international development institutions, big business and “expert” advisers, is that organic agriculture—which has underpinned the growth of human civilization for thousands of years – is a ‘side issue’ and that we must employ the methods of industry and technology if we are to feed a world of 9 billion people projected of 2050 (FAO, 2008). Industrial agriculture has a high carbon footprint and is often not well suited to delivering the balanced diet and food security needs of local communities. It also depletes soil carbon, further exacerbating both its climate and food security impacts (Aggarwal P K 2003). Industrial agriculture is not only unsuitable because of its negative impacts on food security, climate, soil, water, wildlife, animal welfare, and human health. Diminishing oil supplies and rapidly increasing demand, will push artificial fertilizers far beyond the economic reach of the majority of farmers and the costs of internationally transporting food will become increasingly prohibitive. Among the poor, small and marginal class a very high proportion are subsistence farmers living on low-value traditional crops.

While development in the agriculture sector has traditionally put emphasis on increasing productivity using external inputs, it has become increasingly clear that conventional ‘Green Revolution’ farming has by-passed the poor in marginal areas. There is also increasing evidence that high-external-input agriculture is unsustainable, resulting in

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stagnant or declining yields, increasing ecological degradation, and worsening rural socio-economic conditions. Increasingly, organic agriculture (OA) is emerging as an alternative strategy to improve food stability in marginal areas. During the past few decades, the Green Revolution has brought about significant changes in the world's food production systems. It is recognized that while the Green Revolution has benefited better-off farmers in irrigated areas, it has by-passed the poor in marginal areas. Low-external input sustainable agriculture (LEISA) has long been viewed as an alternative for areas where the Green Revolution technologies are not feasible Bhattacharyya, et al (2005). More recently, one particular alternative that has gained interest is organic agriculture, due to its commercial viability. Most farmers in marginal areas practice traditional agriculture methods using very little or no agrochemicals. By adopting organic agriculture (OA), which requires less financial inputs while placing more reliance on natural and human resources, farmers could move towards more sustainable agricultural practices (Scialabba, 2000). Improving the agricultural production system in marginal areas in a sustainable manner and providing market access for the poor hold the key to the mass reduction of poverty. Nutritional food and livelihood security is the prime consideration of small and marginal farmers of India. Organic agriculture is emerging as a promising option to help solve this problem among small and marginal farmers of India inhabiting rain fed areas, arid zones and hilly and mountain areas. Already Indian farmers have taken the organic movement further by expanding the area up to 500,000 hectares by the end of 2006. Present study was thus designed to investigate productivity and economic returns from organic farming of over 26 food and cash crops across India. The study investigated the 'cost of cultivation' and 'cost of production' of organic crops vis-à-vis inorganic production in different agro-ecological zones in India and to quantify the impact of organic production techniques on the crop productivity and farm incomes. Therefore, the proposed study is important to assess the impact of impact of organic farming & agri-biotechnologies on the green growth and socio-economic empowerment and sustainable development. The study findings may be useful for policy imperatives and smooth functioning, promoting and progressing of organic farming as an eco-friendly and common climate sequestration techniques. More benefits of organic farming may be obtained through proper understanding and functioning of modern agri-biotechnology techniques practices to sustain the productivity and livelihood security. The proposed study will help in achieving ecological security, environmental and economic balance and hold the country in pride position amongst developed nations of the world. Organic farming will ensure sustainable management of land, water, forest and biodiversity. Integrated development of these natural resources will bring desirable peace, prosperity, happiness, livelihood security and sustainable development.

**1. Statement:** The alternative organic farming is potentially a profitable enterprise, with a growing global market, already being supplied by more than 90 developing countries Entrepreneurs see a market for selling food that has been grown chemical free. Local consumers in India have a fairly well-developed perception about organic produce, are interested in buying certified organic foods, and even willing to pay more for them. To gain access to this market, however, certification is a prerequisite. As well as achieving this, the following issues are also important for developing countries: increasing technical know-how amongst the farmers about organic farming and organic inputs; good post-harvest handling (e.g. cold storage, quality grading, and packaging support); effective and efficient infrastructure and export logistics (to enable the fresh produces to arrive in good condition in the country of destination); and good and trustworthy relations with importers, traders and wholesalers in the target markets. This sector enables to meet the necessary requirements of producing and marketing organic foods, both the domestic and export markets; and can secure an extra premium for the poor farmers. Through research, development, extension and small- scale trials, enable the rapid expansion of organic farming and so significantly develop livelihood among the farmers, BPL families for both farm & non-farm activities. Organic farming used to be the principal farming method before "modern agriculture" was introduced. After two World Wars, chemicals that were used as weapons were converted into fertilizers and pesticides for "peaceful" use. Rural people came to adopt "modern" technology in order to lessen workload while the societal base shifted from agriculture to manufacturing and services. Consequently, organic farming became marginal and regarded as old-fashioned and laborious technique with low productivity. Among the industrialized countries, organic farming movements are generally categorized into two types: the "Euro-American type" and the "Japanese type" (ADB.2005b). The "Euro-American type" movement was initiated by farmers who wished to Historical Development, Present Situation and Prospects of Organic Farming. Later, organic certification was created to distinguish and add values to the products. The "Japanese type" movement was initiated by consumers fearing for the pesticides' harmful effects, and evolved into autonomous and cooperative relationship between farmers and consumers. The penetration of agricultural modernization started in the 1960s in the "majority world". Organic farming has regained its recognition as a protest against the environmental degradation and control by the global capitals, and also

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as its promising premium products mainly for export. Today, organic farming is spreading worldwide. It is reported that 37 million hectares of agricultural land are certified according to organic standards (FiBL and IFOAM 2010) covering 0.9% of the world's agricultural land. The coverage rate is high in Oceania (2.9%) and Europe (2.1%), and it is low in Asia (0.23%) and Africa (0.09%). The occurrence of multi-nutrient deficiencies and overall decline in the productive capacity of the soil due to non-judicious fertilizer use, have been widely reported. Such concerns and problems posed by modern-day agriculture gave birth to new concepts in farming, such as organic farming, natural farming, biodynamic agriculture, do-nothing agriculture, eco-farming, etc. The essential feature of such farming practices imply, i.e., back to nature. Although organic farming is expanding, this proposed research work tries to examine expected roles and future prospects of organic farming from the lessons learned by reflecting the historical development and examining present situation of organic farming in the country.

**2. Formulation and presentation of the problem:** Setting green goals is a common practice for low cost, pro-nature growth and sustainability. Task of reclaiming wasteland, desert land etc., and providing nutritional food security, livelihood security, economical security to weaker, BPL, smaller & marginal farmers and to all can be made possible through organic agri-biotech farming. Organic farming rejuvenates natural resources & re-in lives mother earth that provide a variety of benefits to the mankind. Rural people migrate to cities in the hope of finding jobs and for improving their livelihood & economy but most of them are forced to live in slums consequently, triggering negative environment affecting health and livelihood of the urban population. The rural migration can be reduced by providing employment and income through eco-friendly farming & greening of degraded areas, diversification in agriculture and ensuring food accessibility under "Food for work" scheme. The cost of environmental degradation is mostly borne by the poor. Air and water pollution, soil degradation, flood and drought, desertification, degradation of fragile ecosystems are some of the important environmental problems that need to be addressed for poverty alleviation and sustainable economic development. National Programme on Organic Production (NPOP) is faced with the problem of lack of awareness about multiple roles/benefits of organic farming, especially their role in eco-friendly & sustainable development, bio-remediation of agricultural land, supply of quality food, fodder, and bio-fertilizer. The Organic farming & production suffers from low level of technology, low level of investment, inadequate research and extension, weak planning capability, wastage in harvesting and processing, market imperfections, low level of people's participation and NGOs involvement, lack of private sector participation, transport and marketing of produce grown by the people, lack of inter sartorial coordination. A survey was made on certified organic farms in the country to ascertain the real benefits and feasibility of organic farming in terms of the production potential, economics and soil health in comparison to the conventional farms. The study revealed that organic farming, in spite of the reduction in crop productivity by 9.2%, provided higher net profit to farmers by 22.0% compared to conventional farming. This was mainly due to the availability of premium price (20–40%) for the certified organic produce and reduction in the cost of cultivation by 11.7%. In cases, where such premium prices were not available but the farm inputs are local & indigenous the cost of cultivation was less making organic farming economically feasible, safe and employment generating. However, there was an overall improvement in soil quality in terms of various parameters, viz. physical, chemical, biological properties, availability of macro- and micronutrients, indicating an enhanced soil health and sustainability of crop production in organic farming systems.

Organic agri-biotech farming as a green growth business model is driven by a unique supply/demand situation where frontrunner producers take advantage of an opportunity in the market. The business model is nourished by governmental financial support schemes, innovation, consumer patterns and pulls from the market. To achieve these objectives new research & study, new types of skills, multidisciplinary policy approaches and interactions between stakeholders, such as farmers, processing industries and consumers will be needed. Public-private partnership is one way of establishing cooperation between legislators and businesses. Organic farming will ensure environmental, food and livelihood securities, alleviate poverty and mitigate the adverse impacts of pollution and health hazards. It will reduce regional disparity, bring desirable peace, prosperity and happiness and ensure an optimistic future for generations to come. Organic farming has the potential to provide benefits in terms of environmental protection, conservation of non-renewable resources and improved food quality. When the question comes how to fight against world overheat? Organic Farming is the spontaneous answer at the ground level, as it a system of "GO WITH NATURE" philosophy. Organic Farming is a global need for greening of environment & a weapon against climate war. It is very effective in addressing environmental challenges, livelihood security and sustainable development. Sustainability is not an option but imperative. Future development must be ecologically sound, self-sustaining and

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equitable in its distribution of resources and opportunities. National Agriculture Policy, 2000 (APEDA,2003),underlines the need for diversification in agriculture with the promotion of integrated and holistic development of rain fed areas on watershed basis and augmentation of biomass production through agro and farm forestry with community involvement. Without greening environmental deterioration and economic decline will be feeding on each other leading to pollution, poverty, poor health, political upheaval and unrest. Poverty and environmental crisis are closely linked calling for holistic approach and lasting solutions through greening of all degraded areas and organic farming with people's participation. Green revolution based farming system has become unprofitable as costs of production have risen, and farmers are seeking alternative, more profitable crops. Organic farming, with its ecological and social benefits, and premium prices, may offer an ideal alternative for sustainable livelihood development. Global sales of organic foods are increasing. Already more than 90 developing countries including 15 that are classified as 'Least Developing Countries' (LDCs), are benefiting significantly from the global organic market. The proposed study will help in achieving ecological security, environmental and economic balance and hold the country in pride position amongst developed nations of the world. Organic farming will ensure sustainable management of land, water, forest and biodiversity. Integrated development of these natural resources will bring desirable peace, prosperity, happiness, livelihood security and sustainable development.

**3. Solution approach:** The present study has been undertaken with the help of substantial and extensive fieldwork. Quantitative and qualitative methodologies were used to determine the potential contribution of organic farming to nutritional food & livelihood security. Quantitative methodologies included household surveys while qualitative methodologies involved group sustainable livelihoods analyses. The essential data collected from secondary sources as well from primary sources have been analyzed. The methodology for the study is based on farming system approach. The present study in an innovative effort for dovetailing two separate concepts. Under the first study for the nutritional food and income security & green growth provided by organic farming various farming systems across seven (7) states of India were identified ensuring wide agro ecological coverage. Hill Food Crops, Rain fed Cash Crops, Rain fed Food Crops, Soybean Farming, Plantation Crops, Irrigated Mixed Farming, Medicinal & Aromatic Plants Farming and Vegetable Farming, were selected for the study. These selected farming systems were spread over seven (7) states of viz. Himachal Pradesh, Uttaranchal, Rajasthan, Madhya Pradesh, Chhattisgarh, Gujarat and Uttar Pradesh states in India. The study investigated 14 crops viz. 1. Banana, 2.Sugar cane, 3.Potato, 4.Paddy, 5.Soybean, 6.Pearl Millet, 7.Yellow & Black Mustard, 8.Medicinal & Aromatic Plants, 9.Wheat 10.Cabbage, 11.Ragi, 12, Barley 13.Black Gram and 14.Pulses. The 14 villages were selected in such a manner that these fairly represented different farming systems. Finally, a sample of 286 farmers was randomly selected out of which 143 organic farmers and the rest 143 farmers were practicing inorganic farming techniques. The data was collected through personal interviews and a structured questionnaire was used for gathering information. In the second study, organic agri-biotechnology as green growth & sustainable development has been carried out. Under the three certified organic farming clusters five capital assets (physical, human, financial, social and natural) were assessed using primary and secondary data. Primary data was collected by adopting rapid and the participatory methods using appropriate analysis tools (FAO, (2008)). During data collection for present study every key indicator of different capital assets was evaluated at cluster/village level of 1500 hectare organic farming with the participation of the community and was evaluate on fixed marked methods according to their importance. The rapid methods referring to primary data, rapid case studies, key informants interviews and focused group discussion etc. while participatory methods used in an extractive mode of in-depth studies. In the process of *stage I* of rapid methods the secondary data related to different kinds of capital assets was collected from different departments of Government agencies working on poverty alleviation, village panchayat, other NGOs and development societies etc. In the *Stage II* of participatory approach sample households in the village participated in group discussions. The key issues of discussion were the status of the five capitals and employment activities in the village. These exercises continued for three to four days in each of the selected villages and different activities like collective mapping of the local area, developing a time line, ranking the importance of problems inside a matrix, wealth ranking, doing observation walks, producing seasonality calendar etc. The process of PRA was very successful for putting together the information within limited time. Further the group gathering was stratified in to different categories on the basis of gender and land holding to assess the information about vulnerability context relating to poorest of the poor farmers in the village.

Various key indicators was used to access the different kinds of capital assets and these indicators are ranked into very good, good, moderate, poor and severe based on the availability and accessibility by the farmers in each of the village

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/cluster of the three districts. The key indicators again scored on fixed mark i.e., 45 for very good, 30 for good, 15 for moderate, 08 for poor and 02 for severe. Most of the indicators were evaluated in the ascending order of changes from lower to higher values but few are in descending order. For instance if water table increased substantially then it ranked very good and scored with 45 marks but if migration was higher than it ranked very poor and scored only 2 marks. Care was taken to involve both male and female member in eliciting the information. The simple method of percentage was used to access the present status of livelihoods capital assets in all the three clusters. In terms of measurement the total scored value of each indicator was averaged to avoid any complexities of double scoring because of higher or lesser number of indicators in different capital assets. And the percentage of average value of each indicator to total average value of all indicators was calculated. The value in percentage of each capital asset depicts the present status of livelihoods capital in the form of pentagon in all the three clusters. In each cluster the source of livelihoods focused mainly on seven core activities i.e., organic farming, labor wages in organic farming and non-agriculture activities, selling of non-timber forest organic produce, organic nursery of plants, bio-produce trading, livestock and other profession (extracting oil from *bio* seeds, compost, bio-culture, plant protection etc). The data was derived from on-farm and off-farm activities based on the village level study. The concept of rural income generating activities and different kinds of dependencies was elaborated broadly to the farmers before commencing the study of different kinds of livelihoods sources of the villagers in each village. The farmers including men and women was asked directly and indirectly their sources of income from different activities in particular months of a year. Impact was measured based on the information collected from the sample households and their mutual observations on different indicators of particular capital assets. Accordingly the indicators was categorized under different capital assets such as financial, physical, natural, social and human capital. To examine the status of working days for male and female farmers in the villages, a seasonal calendar activity was prepared for 2010-11. Initially the working hours from early morning 5.00 o'clock to late night up to 9.00 o'clock of male and female farmers was divided into different activities i.e., organic farming related work, domestic work, livestock and poultry farm, non-timber organic forest produce, non-organic farming labor wages and any other business or profession. The male and female farmers of sample households were asked separately about how much time they are spending on particular activity during a day. Obviously, except routine work the working hours of male and female for different activities varied from season to season and even from month to month. Further these hours was converted into days assuming 8 hours as working hours in a day. Following the above process seasonal calendar activities was prepared, which depicts per households person days of working on specific items in particular months. Almost all the sites of different agro-climatic zones have been visited during the field survey. The process of inclusive growth & sustainable development in the study area is evident from structured credit groups of certified organic farmers, linkage with credit institution, natural vegetative cover as resource for various value added organic input, soil health, food quality, livelihood, income generation employment opportunities etc. The organic farming contributes in livelihood security, local employment generation, nutritional food security and inclusive green growth.

**4.Finding:** Under the research study organic farmers and crops from seven states across the India, in different agro-climatic conditions are selected. They are Chhattisgarh, Gujarat, Himachal Pradesh, Madhya Pradesh, Rajasthan, Uttaranchal and Uttar Pradesh states. And for the comprehensive study of green growth and sustainable development factors among organic farmers and growers, Organic Farmers Interest Group were studied in the Chhattisgarh state-three districts namely Sarguja, Korea and Jagdalpur are selected. Random sample of fifteen organic clusters and fifteen inorganic clusters were interviewed regarding their cost of cultivation in major crops grown by them from each of the three districts. In Sarguja 15 Groups comprising 300 Members covering 5.99.73 hectares of organic farming were investigated. In Korea 15 Groups comprising 300 Members covering 481.453 hectares of organic farming were studied. While in Jagadalpur 15 Groups comprising 300 Members covering 525.075 hectares were covered. The data for both input and output quantities and their unit prices were collected from sample farmers. The study pertains to the cropping year 2011-12. Various key indicators are used to access the different kinds of capital assets and these indicators are ranked into very good, good, moderate, poor and severe based on the availability and accessibility by the farmers in each of the village /cluster of the three districts. The key indicators again scored on fixed mark i.e., 45 for very good, 30 for good, 15 for moderate, 08 for poor and 02 for severe. Most of the indicators are evaluated in the ascending order of changes from lower to higher values but few are in descending order. For instance if water table increased substantially then it ranked very good and scored with 45 marks but if migration was higher than it ranked very poor and scored only 2 marks. Care was taken to involve both male and female member in eliciting the information. The simple method of percentage is used to access the present status of livelihoods capital assets in all the three clusters. In terms of

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measurement the total scored value of each indicator was averaged to avoid any complexities of double scoring because of higher or lesser number of indicators in different capital assets. And the percentages of average value of each indicator to total average value of all indicators are calculated. The value in percentage of each capital asset depicts the present status of livelihoods capital in the form of pentagon in all the three clusters. In each cluster the source of livelihoods focused mainly on seven core activities i.e., organic farming, labor wages in organic farming and non-agriculture activities, selling of non-timber forest organic produce, organic nursery of plants, bio-produce trading, livestock and other profession (extracting oil from *bio* seeds, compost, bio-culture, plant protection etc). The data is derived from on-farm and off-farm activities based on the village level study.

The concept of rural income generating activities and different kinds of dependencies are elaborated broadly to the farmers before commencing the study of different kinds of livelihoods sources of the villagers in each village. The farmers including men and women are asked directly and indirectly their sources of income from different activities in particular months of a year. Impact is recorded and measured based on the information collected from the sample households and their mutual observations on different indicators of particular capital assets. Accordingly the indicators are categorized under different capital assets such as financial, physical, natural, social and human capital. To examine the status of working days for male and female farmers in the villages, a seasonal calendar activity was prepared for 2009-10. Initially the working hours from early morning 5.00 o'clock to late night up to 9.00 o'clock of male and female farmers are divided into different activities i.e., organic farming related work, domestic work, livestock and poultry farm, non-timber organic forest produce, non-organic farming labor wages and any other business or profession. The male and female farmers of sample households are asked separately about how much time they are spending on particular activity during a day. Obviously, except routine work the working hours of male and female for different activities varied from season to season and even from month to month.

Further these hours are converted into days assuming 8 hours as working hours in a day. Following the above process seasonal calendar activities are prepared, which depicts per households person days of working on specific items in particular months. This study draws upon yearlong field research in Bastar, Sarguja & Korea community of small family farmers in the state of in Chhattisgarh. More specifically, it focuses on socio-ecological implications of organic agriculture for local livelihood strategies. Data were collected using a variety of methods. These included participant observation, open-ended interviews, archival research and surveys (both quantitative and qualitative). The sustainable rural livelihoods framework (Sarker, M. A. 2007) is the approach used in our analysis.

## IV. RESULTS

1. Findings showed that organic farm and non-farm livelihood activities were critical components of rural livelihoods in Bastar, Sarguja & Korea community of small family farmers in the state of in Chhattisgarh. Average monthly household income (Rs) ratio vs. contribution of income sources to total household income are expressed as percentage. Organic community farming contributed less to total monthly household income (8%) of total monthly household income) than wages (52%), social grants (28.9 %), organic home gardens (6%), small-scale enterprises (2.2%) and remittances (2.9%). Even though low, the contribution of organic farming to food security cannot be ignored considering the number of households that depend upon organic agriculture for food and income. Strategies to promote more productive organic farm and non-farm activities are needed to improve rural livelihoods. Sources of income and their contribution to total monthly household income among the community farmers and Organic Farmers Interest Group (OFIG) are analyzed.

2. The household survey, conducted in 2011-12, shows that wages received were the greatest contributor to household income. Fifty Two percent (52%) of total household income was generated from wages. This finding presents a strong case for the school of thought that recognizes the contribution of agriculture, but attaches more importance to non-agricultural activities (McIntosh & Vaughan, 1996; Gardner, 2005; Machete, 2004). Social grants were the second most important source of household income with a contribution of 28.9% to total household income followed by organic community farming (8.0%). The fourth contributor to household income was by organic home gardening contributing 6% and small-scale household economic enterprises (2.2%). In total, organic community and home gardens contributed 14% to total monthly household income. Even though low, the contribution of organic farming to food security and sovereignty cannot be ignored, considering the large number of rural households dependent on it. The study clearly

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suggests that non-farm income sources as a category contributed more to household income than organic farming among the participating households. Sources of income from small-scale commercial enterprises and contribution to total household income in Bastar, Sarguja & Korea are plotted. Specifying small-scale economic enterprises and analyzing the contribution of the various sources of income to total household income within the same category provided interesting results. Overall, study indicates that small-scale commercial enterprises contributed on average Rs. 931.14 annually. These results suggest that households in the Bastar, Sarguja & Korea uplands diversified their sources of income and/or livelihood activities to supplement organic agriculture-based livelihoods. This finding is substantiated by other studies that concluded that typical livelihood strategies in rural areas comprise diverse income sources. This means that while organic agriculture (potentially) plays a role in rural livelihoods, livelihood insecurity in India cannot be solved by promoting organic agricultural growth alone.

3. Organic farming is emerging as a sustainable alternative in reviving Indian agriculture especially in areas where the indiscriminate usage of chemical fertilizers and pesticides had resulted in loss in soil fertility and productivity with adverse effects on water quality, soil, plant and human health. Organic farming & organic products are the outcome of professionals and entrepreneurs in Bastar, Sarguja & Korea (Table: 8.3, 8.4, and 8.5). With the help and support from line department, relatives and friends OFIGs are still farming in the community, strengthening local association Organic Farmers Interest Group (OFIG) associations for sustainability since 2011, to promote the quality of life of small family through organic agriculture. A program for small-scale agro-industrialization and a local association for agro-tourism supporting farmers and local residents developing tourism linked to organics part of the story as well as development agencies, non-profit organizations, and prestigious academic institutions, supporting sustainable agriculture programs in Bastar, Sarguja and Korea. Today, Organic Farmers Interest Groups (OFIG) operates in the Bastar different areas commercializing a variety of foods (milk, honey, pulses, vegetables, rice, etc). After organic adoption their organic production will be “properly” certified organic - and Bastar’s agri-tourism program keeps expanding.

4. The organic productive units analyzed have different agro-ecological patterns and farms sizes (figure-8.3). Farm size ranges from less than a hectare (farmers producing honey ‘renting’ the use of a forest area for their hives) to farms over 40 hectares. Most of these are connected to a local agro industry. In addition to size, land use patterns also vary significantly among farmer's shows three basic household typologies of organic producers found in the study area.

5. While some producers devote significant portions of the farm to timber (eucalyptus and/or sal trees etc.) others do not manage this resource. Despite this variability, farmers across municipalities do share two common land use trends: agro-ecological diversification and preservation of areas with native forest. Besides differences in size and land use, local organic producers are diverse in terms of their livelihood strategies.

6. The main differences across these different types of organic ‘practices’ are the relevance of agro-ecological income in the household, and their position in the socio-economic network of organic activists, business communities, consumers and farmers. Their soil is rich in organic humus & biomass that provides extra carbon mitigation potential. (*Agro-ecological income can be defined as benefits flowing from practicing organic methods, for instance in terms of extra wildlife to harvest or extra output resulting from conservation biological control where a bio-diverse non-sprayed farm eventually provide habitat and food sources to beneficial, which help control pests*). The study reflects: Family farmers (*Type-1*) rely extensively on the agro-ecological resources of the farm for productive and reproductive functions, and they have lower levels of economic and social capital—less income and less education, less influential connections and less access to information. Family farms are located outside the ‘town’ of the village often in places of difficult access, i.e. hilly terrain, dirt roads and limited communications. In contrast, most mixed households (*Type-2*) work with tourism and hire labor to plant, weed, harvest, and process. In mixed households, at least one adult work off-farm in local jobs as teachers or civil employees. Joining organic production does not prevent such households from establishing residency in the local area/region, which in practical terms means direct access to local services (phone, bus, stores, school, bank, pharmacy, etc) and networks (associations, gatherings, etc). A third category (*Type-3*) of organic households, which we refer to as “instrumental retreats”, corresponds to households which do not obtain significant agro- ecological income from organic production, but rather they use the ‘farm’ for personal, recreational, community service, and/or political articulation in the community. This category comprises professionals residing outside, including absentee owners, who sympathize with the local association for organic farming. These ‘instrumental

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retreats', which are also organic and part of the local association for organic farming, are partially productive. Some have fruit trees, or chicken, or hives. However, this category of organic agriculture may be better understood as spaces of social exchange. Meetings, assemblies, workshops, and symposia are articulated by these organic 'producers', who contribute with their knowledge and connections to the advancement of organic farming in the region. Organic vegetables and organic cereals are emerging as key crops in the study. The study indicates that it is beneficial to turn to organic farming of these crops for increasing the farm profitability and income security of small farmers in rain-fed and irrigated areas.

## V. DISCUSSION

Organic agri-biotech is viewed as a two-dimensional opportunity: first, for developing organic agribusiness, both for export and domestic market, by focusing on organic production of niche products (Dubey Kumar Rajesh 2013). Second, organic is also seen as an important livelihood option for small, resource-poor farmers with low-input costs and quality food production. Organic agriculture also holds last hope to the farmers income and livelihood in the so-called farmer suicide zones of India. India has two kinds of organic farmers. The large estate owners are contract farmers associated with the corporate sector, doing organic farming as agribusiness opportunity. And then there are those with small landholdings of rain-fed marginal farmlands, looking for options that would reduce their dependence on external inputs, reduce cost of cultivation, and provide food and income security using on-farm resources and family labor. The small farmers own one or two animals but have no access to credit, irrigation facilities, and adequate quantity of biomass and composting. The only resources available for organic farming are cow dung and urine, biomass from a few trees, and most of the land area marked for growing crops for self-consumption, etc. The organic movement, which was started by women's groups, NGOs, and farmers in the 70's and 80's, is increasingly receiving worldwide attention from the private sector, governments, and international organizations. Not only are the prices of fertilizers and other chemical inputs escalating, the doses required for maintaining the production level are also increasing over time. The study finding points towards a strong trend among farmers about making the farms self-sufficient by reducing the dependency on external inputs so as to provide economic security to the farming family. The study highlighted motivating factors of food and income security for the farmers to adopt organic farming.

The factor most feared by the inorganic farmers is the initial decline in farm productivity while switching over to organic farming. More than 81 percent of the farmers reported this decline which was reported to be in the range of 10-47 percent in the first year, depending upon the farming system. The crop yields were reported to regain the earlier level within 2-5 years. As a result of decline in productivity only 2-8 percent of the farmers reported income insecurity which ranged between 4-22 percent. But this is insignificant price to pay in comparison to the scenario, if one continues with inorganic farming. There is continuing productivity decline on inorganic farms and about 80 percent of the inorganic farmers confirmed this. The extent of decline has been reported to be 2-7 percent per year and in order to maintain the earlier level of productivity one has to increase the input level by 4-10 percent per year. There is also a class of farmers who cultivate food crops and vegetables organically for self-consumption and use all sorts of chemical inputs on rest of the farm to produce for the market. This group can be easily converted to green growth.

Local homogenous groups & associations of Organic Farmers Interest Groups (OFIGs) for organic farming were established in the region, for different organic input production units. Organic producers can be identified in the community of Bastar, Sarguja and Korea regions family farms, mixed households, and instrumental retreats. These three types of 'producers' do not differ so much in terms of their agro ecological practices (diversification), but in relation to the role that the income resulting from organic production plays in the households. This in turn is deeply correlated to the capacity of the household to access social and economic capitals. Households depending almost exclusively on agricultural incomes do not fully participate in the decision-making process of the association(s) they belong to and have less educational resources – a characteristic shared with non-organic small family farmers in the region such as tobacco producers. In contrast, organics have also fostered new typologies; the mixed household and the instrumental retreat. In mixed households, "organics" are an alternative extra source of income, and the tendency is to rely on services (tourism) rather than small-scale agro-industrialization. In instrumental retreats, unlike in the two previous types, organics are not that much of a productive, but a political tool. These institutional spaces serve to connect urban residents involved in OFIG to the local reality of the producers. At the same time, retreats open the rich socio-economic networks of the urban society to the rural community.

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## VI. IMPLEMENTATION

The worldwide promotion of organic agriculture for poverty reduction was pioneered by farmers themselves and was advocated by NGOs, who worked closely with poor farmers and witnessed the serious negative health and environmental consequences of agrochemicals (Dubey Kumar Rajesh 2013). More recently, governments and donors have taken note of organic agriculture's potential as a development strategy, due mainly to the following:

- Increasing global demand for safe food and potential price premiums for organic products;
- Under the WTO agreement, food exports must comply with higher phyto-sanitary standards and organic agri-biotech is more likely to be able to meet such requirements;
- Mounting evidence that organic agri-biotech can improve the incomes and living standards of poor farmers by building on assets which poor farmers have, i.e., land free from intensive use of chemicals, excess labor, and traditional knowledge of production system; and
- Studies which have illustrated how organic agri-biotech can contribute to health, social development and environmental restoration and/or protection.

Demand for safe and organic food is rapidly expanding in both the domestic and international markets. In the urban areas of most developing countries, supermarket chains are responding to increased demand for safe food by contracting farmers to produce crops and livestock organically or with reduced amounts of chemicals. Many of the poor farmers in remote areas possess a comparative advantage over farmers in intensive areas because the former's current practices are largely organic by default. Unlike their conventional counterparts, they will not require a transition period of 3-5 years before they can be certified organic.

This gives them an edge in terms of immediately capturing the benefits of producing certified organic products for the domestic and international markets. Organic agriculture is likely to benefit the poor living in marginal areas the most, by improving productivity and incomes, and promoting environmental sustainability. In contract organic rice farming in marginal areas has produced significant livelihood improvements for participating farmers (Setboonsarng, et al, 2005). Even in organic agriculture is reportedly more likely to be found in disadvantaged areas or areas unfavorable to conventional agriculture production (Häring, et. al., 2004). Due to declining commodity prices, countries are choosing instead to specialize in high-value crops, including organic products. Regarded as both an export opportunity and a sustainable development strategy, many Asian countries have formulated or are now in the process of formulating national policies for organic agri-biotech. Thailand, for example, announced the first policy on organic agriculture in 2001 and declared it as the National Agenda in 2005. Bhutan formally declared its National Strategy on Organic Agriculture in 2006.

Some countries, such as Cambodia and the Philippines the promotion of organic agriculture is led by Ministry of Trade. To the extent that international trade of socially and environmentally beneficial products such as organic products can expand, consumers in developed countries can directly contribute to poverty reduction in developing countries. Given the multi-dimensional nature of poverty and the organic agri-biotech d-base benefits of organic agriculture to the rural poor, the following section reviews the current knowledge on organic agri-biotech contributions within the context of the green growth & sustainable development (Dubey Kumar Rajesh 2013).

## VII. CONCLUSIONS

The organic movement, which was started by women's groups, NGOs, and farmers in the 70's and 80's, is increasingly receiving worldwide attention from the private sector, governments, and international organizations (Dubey Kumar Rajesh 2013). This study presents some of the fundamental conceptual issues in Organic agri-biotech for Green Growth & Sustainable Development (Dubey Kumar Rajesh 2013). A random study across states & different agro-climatic conditions reveals that: Organic agri-biotech for Green Growth & Sustainable Development is uniquely pro-poor and pro-women have strong potential to meet multi-policy objectives that go beyond reducing income poverty to include the achievement of the various farming communities. However, the review also shows that the magnitude of the impacts would be stronger for some farming communities than others.

With regards to organic agri-biotech contribution to improvements in income, food security and environmental sustainability the linkages are fairly well-defined and there is sufficient empirical and anecdotal data to support these.

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Organic agri-biotech contribution to improved profitability and therefore income, due to premium price and lower cost of production, is widely documented. Organic agri-biotechnology contribution to environmental sustainability is now a generally known fact and has been the main basis for subsidies program to support green growth & sustainable development. Organic agri-biotech's contribution to global partnership in development is increasingly being recognized in the international trade arena i.e. in WTO discussions. It is also generally accepted that improved employment opportunities in rural areas through organic agri-biotech could provide rural youths with jobs, reducing rural-urban migration and alleviating population pressures in urban slums. Organic agri-biotech's contribution to health improvements due to reduced exposure to pesticides is also widely recognized and very well documented. Organic agri-biotech's contribution to maternal and child health due to improved quality of food, although widely perceived by consumers of organic agri-biotech products, is more difficult to prove. Such a study would require longitudinal data which are expensive to collect and generally not available. Organic agri-biotech's impact on diseases is also largely anecdotal as establishing cause and effect and collecting supporting empirical data is difficult. In the case of organic agri-biotech's contribution to education, the linkage is indirect through higher spending on education, given improved household income through organic agri-biotech. While organic agri-biotech has the potential to address multiple targets, the magnitude of impacts on each will be context specific (Dubey Kumar Rajesh 2013). The extents of impacts vary greatly due to several factors i.e. nature of the agro-ecosystem, type of crop, stage of development, initial poverty status, etc. Most importantly, the extents of impacts would depend on the share of agriculture income in total household income. The above studies simply demonstrate that organic farming and agri-biotechnology are playing a vital role in promoting green growth and sustainable development at the global level and to small farmers and rural poor in particulars. The organic farming is low cost, eco-friendly, livelihood security and employment oriented activity (Dubey Kumar Rajesh 2013). Though there are a number of studies which are related to functioning of organic farming but only a few studies have been taken so far to assess the impact of organic farming & agri-biotechnologies on the green growth and socio-economic empowerment and sustainable development.

## VIII. DIRECTIONS FOR FUTURE RESEARCH

As organic agri-biotech is known to be more skilled labor intensive, it may increase rural employment potential and livelihood security especially among the small & marginal farmers (Dubey Kumar Rajesh 2013). The actual affect is context specific and needs further research. Finally, as for gender empowerment, the linkages have been defined as largely indirect and inconclusive. Organic agri-biotech could empower women by providing income opportunities but its impacts will depend on initial gender relations, as reflected in gender-based divisions of labor, decision-making, housework, and intra-household allocation of resources and assets (Dubey Kumar Rajesh 2013). Nevertheless, since organic agri-biotech practice is generally associated with higher level of social awareness, the risk of women being exploited under organic agri-biotech is lower and the quantifications needs further studies.

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