Prospects of Organic Farming

B. Suresh Reddy

1 Introduction

Green Revolution (GR) technologies, supported by policies, and fueled by agrochemicals, machinery and irrigation, are well known for its enhanced agricultural production and productivity. While these technologies greatly helped to address food security and food sovereignty needs, farmers using these technologies, have to depend on external inputs which constitute the major cost of production for small-holder farmers. The manufacture of fertilizers and pesticides, the two major inputs of GR technologies, needs fossil fuels and/or expensive energy, and these are associated with serious environmental and health issues. It is perhaps owing to these input issues and their negative impacts the Intergovernmental Panel on Climate Change (IPCC) has noted that agriculture as practiced today (GR agriculture), accounts for about one fifth of the projected anthropogenic greenhouse effect. This will produce about 50% of CH_4 and 70% of N_2O of overall emissions.

Modern agricultural farming practices and irrational use of chemical over the last four decades resulted in loss of natural habitat balance, loss of soil health and caused many hazards such as soil erosion, decreased ground water level, soil salinisation, pollution due to use of fertilisers and pesticides, genetic erosion, ill effects on environment, reduced food quality and increased the cost of cultivation, making the farmer poorer from year to year [1–4]. In farming, pest management is an important aspect that needs to be addressed always. Globally about 50% of all food and cash crops are lost to pre- and post-harvest pests [5]. Even in India, with the existing protection levels, based on significant advances in crop protection research during the past 40 years, still about 30% of the pre-harvest crop yield worth Rs. 45,000 crore is lost annually [6]. The use of pesticides in modern farming practices for

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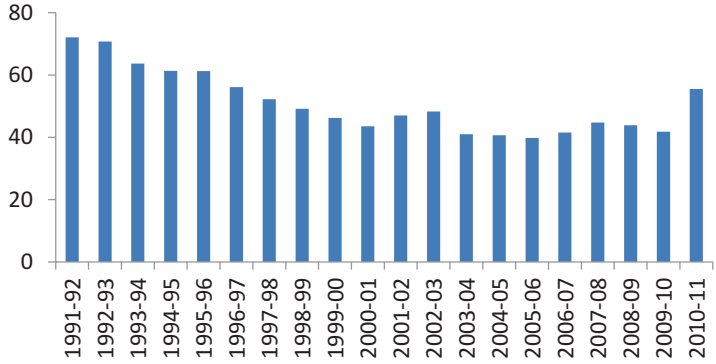

Fig. 1 Consumption of pesticide (technical grade) in India in 000' tonnes (Source: Ministry of Agriculture, GOI [11])

obtaining increased yields has been viewed as a sine qua now for the success of the agricultural sector. However, most of the pesticides may affect non-target organisms, contaminating soil and water [7]. The pesticide consumption in India has increased from 434 metric tonnes in 1954 to over 55,540 metric tonnes in the year 2010–11 (see Fig. 1) accounting for 30% of the cropped area. Today, pesticide consumption in India is less than 1 kg/ha as against 4.5 kg/ha in USA and 11 kg/ha in Japan [8]. Therefore, an indiscriminate use of pesticides has led to a number of environmental problems [1, 2]. According to Mancini et al. [9], in India, 60% of all the pesticides is applied to cotton crop, accounting for only 4% of the total cropped area. It is alarming to note that about 17.53% of the total pesticides are used only in Andhra Pradesh (A.P.) Thus remaining as the largest consumer of pesticides in the country followed by Uttar Pradesh and Maharashtra states as second and third largest consumers at 16.68 and 12.68% respectively.

As a result of all these higher investments, farmers find that agriculture is no more a viable proposition and in fact, a large number of farmers are in stress [10]. Perhaps shooting up of price of factory made external inputs and the government slow withdrawal of investment as well as market intervention and more significantly, shifting of subsistence farming (mainly with homegrown inputs) to commercial farming (largely with purchased inputs) would have also contributed for the present crisis. In other words, the local indigenous farm techniques are being wiped out and replaced by modern techniques, thus resulted unviable and unsustainable farm enterprise [11]. It is in this context that alternative farm techniques and strategies for growing crops ought to be found in the larger interest. Owing to the merits of organic cultivation as compared to modern agricultural practices, such principle is attracted across the world. Many state supported agencies, Non-Governmental Organizations (NGOs) and individuals started experiments on organic methods of food production in the recent past.

The popular and most accepted definition of organic farming is, "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 fulfil any specific function within the system", [12]. The term "conventional farming" refers to a production system which employs a full range of pre- and post-plant tillage practices (e.g, plough, discplant, cultivate), synthetic fertilizers and pesticides. Conventional agriculture basically refers to a system of agriculture, where chemicals are used in cultivation of crops. It is characterized by a high degree of crop specialization. By contrast organic farming is characterized by a diversity of crops.

Organic farmers rely on natural farming methods and modern scientific ecological knowledge in order to maximize the long-term health and productivity of the ecosystem, thus enhance the quality of the products and protect the environment. Proponents of organic methods believe that it is a more sustainable and less damaging approach to agriculture [13]. Organic agriculture has its roots in traditional agricultural practices in small communities around the world. Farmers passed down knowledge of effective practices onto subsequent generations. Organic agriculture became visible on a wider scale in the 1960s, when farmers and consumers became concerned on the amount of chemicals used in crop and animal production. Since then, it has developed into a more cohesive and organized movement and it is now the fastest growing food sector globally.

As organic foods cannot be distinguished from conventional products at a glance, consumers depend entirely on third-party certification, i.e. the process according to which public or private certification bodies provide assurance that organic products have been produced and handled according to applicable standards. Organic standards have long been used to represent a consensus about what an "organic" claim on a product means, and to convey that information to consumers. Certification not only leads to consumer trust in the organic system and products, but also gives organic farming a distinct identity and makes market access easier. Thus, in contrast with food labelled as "environment-friendly", "green" or "free range", the organic label denotes compliance with very specific production and preparation methods. If farmers use the organic label, they must receive certification that the product complies with applicable standards following third-party inspections of their operations. Organic standards usually include the use of only natural agricultural enhancers, conservation of natural resources, maintenance of biodiversity and preservation of the ecosystem. Owing to the fact that organic farmers must take into account their impact on their immediate ecosystems, these methods are generally adapted to local conditions.

Overall, the benefits of organic agriculture are expected to be environmental, social and economic. After reviewing these benefits in further detail, the history of the organic movement and of the work of the Food and Agriculture Organization of the United Nations (FAO) on organic agriculture will be briefly outlined in order to provide a background to this study on national legislation on organic agriculture.

2 Background

Literature review has revealed that opinions about organic farming are divided, especially among the experts. Disagreements about the profitability and yield increase in organic farming are acute, but there is a strong consensus on its eco-friendly nature and inherent ability to protect human health. There are strong views against organic farming, mainly on the grounds of practicability of feeding a billion people, its financial and economic viability, availability of organic inputs and the know-how. However, many studies revealed that organic agriculture is productive and sustainable [14–18]. There are also many people approve organic agriculture, advocate a careful conversion of farms into organic, so that yield loss is taken care of to the greatest extent possible. Presently, there is a lack of government subsidies or support to make the conversion to organic easier or cheaper. Questions about the yield and financial viability of organic farming are crucial and there are no empirical studies available in the Indian context comparing the economic and ecological returns of organic farms vis-à-vis conventional farms. This chapter is an attempt to fill this gap. It attempts to bring together different issues in the light of recent developments in organic farming. It traces the history of organic farming and reviews the global and Indian scenario with reference to organic farming. Based on the quantitative and qualitative research done with small and marginal farmers in Andhra Pradesh state of India, this analyses the economic and ecological returns of organic farming vis-à-vis conventional farming and there by contributes to overall policy discourse on organic farming for better micro-level interventions.

This chapter has been organized into six sections including this introduction. Section "Background" presents history of organic farming, status of organic farming at global, national and state level. Third section is on study area, data and methodology of the study. Socio-economics and ecological aspects of organic farmers are discussed in comparison with conventional farmers in section "Empirical Results". Farmers' perception on organic farming is presented in section "Organic Farming: Farmer's Perceptions". In the last section, some Conclusions are made based on the empirical evidence.

2.1 History of Organic Farming

Organic farming or natural farming has no doubt emerged from Asian countries like India and China, where agriculture has been the mainstay of people and farmers have nurtured and groomed this art over several centuries. However the organic movement as such began as a reaction of agricultural scientists and farmers against the industrialization of agriculture. Advances in biochemistry, (nitrogen fertilizers) and engineering (the internal combustion engine) in the early twentieth century led to profound changes in farming. Plant breeding produced hybrid seeds. Fields grew in size and cropping became specialized to make efficient use of machinery and

reap the benefits of the green revolution. Technological advances during World War II spurred post-war innovation in all aspects of agriculture, resulting in such advances as large-scale irrigation, fertilization, and the use of pesticides. Ammonium nitrate, used in munitions, became an abundantly cheap source of nitrogen. DDT, originally developed by the military to control disease-carrying insects among troops, was applied to crops, launching the era of widespread pesticide usage.

Gustav Simons [19] wrote an important book on the relationship between the health of soils, growth of plants and the health of mankind. In Germany, Rudolf Steiner's Spiritual Foundations for the Renewal of Agriculture [20], led to the popularization of biodynamic agriculture. The term organic farming was first used by Lord Northbourne. The term is derived from his concept of "the farm as organism" and which he expounded in his book, Look to the Land [21], wherein he described a holistic, ecologically balanced approach to farming. The British botanist, Sir Albert Howard often referred to as the father of modern organic agriculture worked as an agriculture advisor during 1905–1924 in Pusa, Samastipur, India, where he documented the traditional Indian farming practices. He regarded such practices as superior to modern agricultural science. His research and further developments of these methods was recorded in his book, "An Agricultural Testament" [22], which influenced many scientists and farmers of the day. He adopted Northbourne's terminology in his book, "The Soil and Health: A Study of Organic Agriculture" in 1947.

In 1939, Lady Eve Balfour established the pioneering Haughley Experiment on her Suffolk farmland in England and continued for more than 40 years. It was the first scientific comparison of organic and conventional farming. Lady Eve Balfour, shared some of her experiences in a book called the Organics classic: The Living Soil. Japanese farmer and writer, Masanobu Fukuoka, invented a no-till system for small-scale grain production in the early 1940s and called it "Natural Farming". In the post-world war era, the green revolution launched in Mexico with private funding from the US, encouraged the development of hybrid plants, chemical controls, large-scale irrigation, and heavy mechanization around the world. Although science tended to concentrate on new chemical approaches, sustainable agriculture was the topic of interest. In the US, J. I. Rodale [23] began to popularize the term and methods of organic growing, particularly through promotion of organic gardening. Carson [24], a prominent scientist and naturalist, published *Silent Spring*, describing the adverse effect of DDT and other pesticides on the environment, launching the worldwide environmental movement. By the 1970s, global movements concerned with pollution and the environment increased their focus on organic farming.

In 1972, the International Federation of Organic Agriculture Movements (IFOAM), was founded in Versailles, France. It is an umbrella organisation for organic agriculture which developed international basic standards for organic agriculture and went to establish IFOAM accreditation programme (1992) to accommodate certifying agencies and set up international organic accreditation service [25]. IFOAM is dedicated to the diffusion of information on the principles and practices of organic agriculture across national and linguistic boundaries. Fukuoka released his first book, *One Straw Revolution* (1975) with a wide ranging impact on the agricultural world. In the 1980s, various farming and consumer groups world-

wide began pressing for government regulation of organic production. This led to legislation and certification standards being enacted beginning in the 1990s. In the year 1991, European Union regulations gave guidelines for the production of organic crops in the European community. Similarly in the year 1999 a joint FAO/WHO intergovernmental body produced a set of guidelines for organic production. Since the early 1990s, the retail market for organic farming in developed economies has grown by about 20% annually due to increase consumers' demand. Though small independent producers and consumers initially drove the rise of organic farming, as the volume and variety of "organic" products grows, production will increasingly be large-scale.

2.2 *Global Status of Organic Farming*

Organic agriculture is developing rapidly and today at least 170 countries produce organic food commercially. There were 43.1 million hectares of organic agricultural land in 2013, including in conversion areas [26]. As per Fig. 2, the regions with the largest areas of organic agricultural land are Oceania, (17.3 million hectares), Europe (11.5 million hectares), Latin America (6.6 million hectares) and Asia

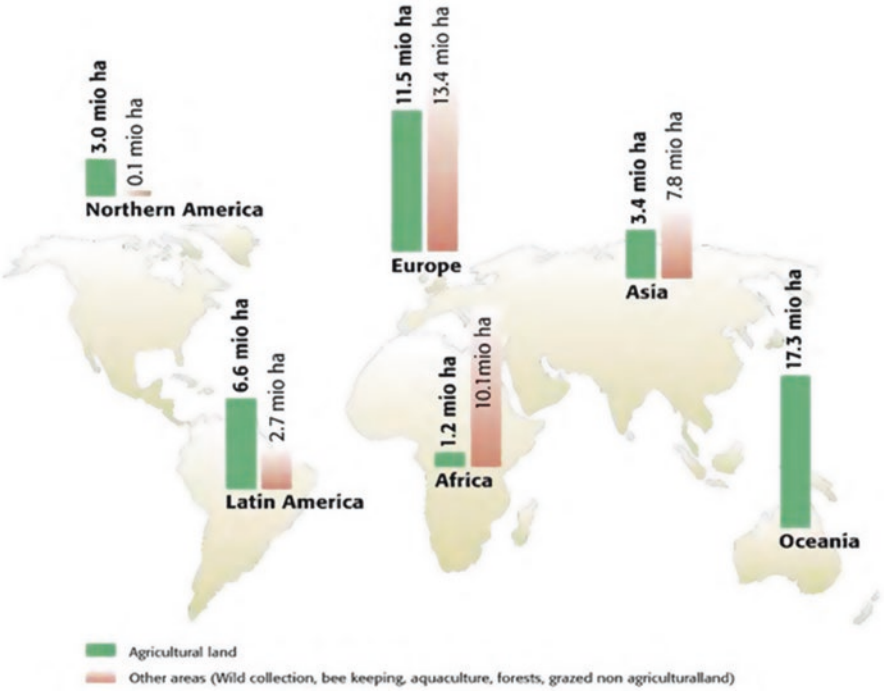

Fig. 2 Agricultural land and wild collection areas in 2013 (Source: FiBL/IFOAM (2015)) [27]

(3.4 million hectares, 8%), North America (3 million hectares, 7%) and Africa (1.2 million hectares, 3%). In Europe, organically managed land increased by 0.33 million hectares (+ 4%) and by 0.18 million hectares (+27%) in Africa [28]. There were almost 2 million producers in 2013. Thirty six percent of the world's organic producers are in Asia, followed by Africa (29%) and Europe (17%). The countries with the most producers are India (650,000), Uganda (189,610), and Mexico (169,703). Global sales of organic food and drink reached 72 billion US dollars in 2013. Revenues have increased almost fivefold since 1999. In Europe, organically managed land increased by 0.33 million hectares (+ 4%) and by 0.18 million hectares (+27%) in Africa. In India, only 0.03% of the area is under organic farming, though there is huge scope for bringing more and more land under organic farming [26].

2.3 Organic Farming in India

India has traditionally practiced organic agriculture, but the process of modernization, particularly the green revolution, has led to the increased use of chemicals. In recent years, however, limitations of agriculture based on chemical use and intensive irrigation have become apparent and there has been a resurgence of interest in organic agriculture. Renewed interest in organic agriculture is mainly due to two concerns, falling agricultural yield in certain areas as a result of, *inter alia* excessive use of chemical inputs, decreased soil fertility and environmental concerns. Exports also played a role but perhaps lesser than in other countries.

The 10th five year plan encouraged the promotion and encouragement of organic farming using organic waste, Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) [29]. Even the 9th five year plan had emphasized the promotion of organic produce in plantation crops, spices and condiments using organic and bio-inputs for the protection of environment and promotion of sustainable agriculture [25]. There are many state and private agencies involved in promotion of organic farming in India. These include several ministries and government departments at both central and state levels, universities and research centres, NGOs like Navadanya, Deccan Development Society, Key Stone Foundation, AME, TIMBAKTU Collective and Organic Farming Association of India and producers organizations and certification bodies besides various processors and traders.

The Government of India has also launched the National Programme for Organic Production [30]. The national programme involves the accreditation programme for certification bodies, norms for organic production, promotion of organic farming etc. The NPOP standards for production and accreditation system have been recognized by the European Commission and Switzerland as equivalent to their country standards. Similarly, the United States Department of Agriculture (USDA) has recognized NPOP conformity assessment procedures of accreditation as equivalent to those in the US. With these recognitions, the Indian organic products duly certified by the accredited certification bodies of India are accepted by the importing countries.

Currently, India ranks 33rd in terms of total land under organic cultivation, and 88th in agricultural land under organic crops to total farming area. According to the Agricultural and Processed Food Product Export Development Authority (APEDA), the cultivated area under certified organic farming has grown almost 17-fold in last one decade, i.e. from 42,000 ha in 2003–04 to 7.23 lakh ha in 2013–14. As on March 2014, India has brought 4.72 million ha area under organic certification process, which includes 0.6 million ha of cultivated agricultural land and 4.12 million ha of wild harvest collection area in forests. An estimated 69 million hectares, however, are traditionally cultivated without using chemical fertilizers and could be eligible for certification under the current practices, or with small modifications. Certifying these farms remains a challenge, however, as many of these farms are small holdings (nearly 60% of all farms in India are less than 1 ha). Small-scale, poor farmers may be unable to afford the cost of certification, they may be illiterate and unable to maintain necessary records, or may be using indigenous cultivation systems not recognized in organic certification systems. These farms mainly produce for home consumption, and to supply the local markets in case of irregular surpluses. Such barriers pose difficulties for farms to reap potential benefits of organic certification.

The current market for organic foods in India is pegged at Rs. 2500 crore, which according to ASSOCHAM, is expected to reach Rs. 6000 crore by 2015. Domestic market is also growing at an annual growth rate of 15–25%. As per the survey conducted by ICCOA, Bangalore, domestic market during the year 2012–13 was worth INR 600 crore. Thus, a huge potential is seen in the nascent Indian organic sector. Organic products, which until now were mainly being exported, are now finding consumers in the domestic market also. The current status (data) of organic farming in India is given in Table 1.

India produced around 27,132,966 MT (Table 2) of certified organic products including all varieties of food products namely Basmati rice, pulses, honey, tea, spices, coffee, oil seeds, fruits, processed food, cereals, herbal medicines and their

Table 1 Details of data with respect to organic products in India during the year 2012–13

Number of products exported	135
Total quantity exported	165,262 metric tones
Value of total export	US$ 374 million
Total certified area (including under cultivation, forest and wild harvest)	5.21 million hectare
Organic crops/ commodities/products produced in India	Sugarcane, cotton, basmati rice, pulses, tea, spices, coffee, oil seeds, fruits and their value added products, organic cotton fiber, functional food products etc.
Countries importing Indian organic products	EU, US, Switzerland, Canada, South East Asian countries and South Africa
Share of Indian organic products in export	Oil seeds – soybean (41%) lead among the products exported followed by cane sugar (26%), processed food products (14%), basmati rice (5%), other cereals & millets (4%), tea (2%), spices (1%), dry fruits (1%) and others

Source: APEDA [31]

Table 2 Export of organic products by APEDA for the year 2014–15

Particulars	Quantity in metric tonnes	Value in lakhs
Floriculture	35,446.58	88,781.03
Fresh fruits and vegetables	2,500,961.88	7,47,413.65
Processed fruits and vegetables	1,006,679.44	6,67,035.89
Animal products	2,163,060.54	3,312,830.32
Other processed foods	3,012,631.55	2,489,305.42
Cereals	18,414,186.79	5,827,979.92
Total	27,132,966.78	13,133,346.23

Source: DGCIS Annual export, Govt. of India [32]

value added products. This production is not just limited to the edible sector; it includes organic cotton fiber, garments, cosmetics, functional food products, body care products, etc. India exported 86 items last year (2014–15) – a total volume of 27,132,966 MT. The export realization was around US $ 19,847 millions. Organic products are mainly exported to EU, US, Australia, Canada, Japan, Switzerland, South Africa and the Middle East.

The states of Uttaranchal and Sikkim have declared their states as organic states. In Maharashtra, since 2003, about 500,000 hectares has been under organic farming (of the 1.8 crore ha of cultivable land in the state). Organic cotton production was concentrated in low productivity and high uncertainty areas such as Vidarbha, since the early 1990s. The Vidarbha Cotton Growers' Association, set up in 1994 with 135 members, has tied up with international agencies for exports (GOI 2001). In Gujarat organic production of chickoo, banana and coconut was found to be more profitable, though field crops and mango had both lower input costs as well as yields [33]. In Karnataka by the year 2005, 1513.25 hectares was under certified organic farming, and while 4750.00 hectares was under non-certified organic farming. Groundnut, jowar, cotton, coconut and banana are being grown under organic conditions-the major reasons for shift include sustained soil fertility, reduced cost of cultivation, higher quality of produce, sustained yields, easy availability of farm inputs and reduced pest and disease attacks. The Government of Karnataka released a state organic farming policy in 2004. Most of the area in the north eastern states is being used for organic farming. In Nagaland, 3000 hectares are under organic farming with crops like ginger, Soya bean, kholer, maize, large cardamom, passion fruit and chilly. The state of Rajasthan has more than 6000 hectares under organic farming. States like Tamil Nadu, Kerala, Madhya Pradesh, Himachal Pradesh and Gujarat are promoting organic farming vigorously.

Farmers' organizations, such as Chetana have been established for marketing organic products. This programme was implemented in three states: Andhra Pradesh (Asifabad and Karimnagar), Maharashtra (Vidarbha, Akola and Yavatmal) and Tamil Nadu (Dindigul and Tuticorn). The programme was started in the year 2004 with 240 farmers and by the year 2007 more than 5500 farmers were participating in the program. A total of about 20,000 acres and total raw cotton yield of 5000 tons was expected, which means about 1700 tons of lint. Food crop yield was 8000

metric tons, mainly pulses. The farmers have to face several problems while converting from conventional farming to organic. Lanting (2007) identified some of them as follows: premium price is not paid for these products because they are in the transition stage, storage facility is needed, with cash paid (preferably 70% of the crop value) for the stored products [34]. Rural banking should be strengthened and loaning process should be made simpler. Hence the government could give a helping hand in the first 3 years of changing over to organic farming by providing preferred access to organic farmers. This could help to reduce the dropout rate.

Sanghi [35] argues that organic farming is an intensive process, mostly limited to resource rich farmers, and the export market and depends heavily on external support systems for price, market intelligence and certification of produce, among others. Hence he says that the scope of coverage and social relevance of the organic farming is also limited. Instead he proposes ecological farming whose main objectives are maintenance of high productivity, reduction in production cost and enhancement of self-reliance. It caters to both the poor-resource and the rich-resource; the process is simple, addresses local market and the scope of coverage and social relevance is also high. There are four main steps in ecological farming: the first being the adoption of non-chemical pest management methods; the second step is to focus on selling pesticide-free produce in the local market; the next step is to establish community managed seed banks; and finally the fourth step is to adopt non-chemical method of nutrient management. It has been argued that the ecological method is indigenous but is gradually disappearing due to constraints in labour availability. Sanghi sees a great scope for its revival by utilizing the incentives of labour under the National Rural Employment Guarantee (NREG) act.

2.4 Organic Agriculture in Andhra Pradesh

In A.P, in the early 1980s, the Permaculture Association of India popularized the concept of 'Permaculture' (permanent agriculture). Permaculture is the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems. It is the harmonious integration of landscape and people providing their food, energy, shelter and other material and non-material needs in a sustainable way. The philosophy behind Permaculture is one of working with, rather than against, nature; of protracted and thoughtful observation rather than protracted and thoughtless action; of looking at the systems in all their functions, rather than asking only one yield of them; and of allowing systems to demonstrate their own evolutions [36]. The Deccan Development Society (DDS) an internationally well known NGO working with dalit women groups, has developed a farm on the principles of Permaculture in Zaheerabad region of deccan area. DDS encouraged sustainable agricultural practices in a big way and has been a pioneer in the country. More than 5000 women farmers in an area of more than 20,000 acres adopt sustainable agricultural practices, which are environment friendly, and are based on the traditional knowledge and are

environment friendly. Similarly, the Centre for Sustainable Agriculture (CSA) based at Hyderabad, through several NGOs in the state, has promoted non-pesticidal management of pests in the state, where in the use of pesticides and chemical fertilizers is discouraged, while the use of local resources is encouraged. The small success from few villages could be scaled up into more than 7 lakh acres in last 3 years in 1500 villages benefiting more than 3 lakh farmers. The Community Managed Sustainable Agriculture program is being implemented by the Society for Elimination of Rural Poverty, the Government of Andhra Pradesh and the, Sustainable Agriculture Network of NGOs, with technical support from the Centre for Sustainable Agriculture. Today there are 50 villages which have become pesticide free and seven villages which have become completely organic. The concept of non-pesticidal management of pests is being promoted among the farming community through the Indira Kranthi Pathakam of the Government of Andhra Pradesh. The Timbaktu Collective is another organization which has been promoting organic farming practices since a long time in Ananthapur district. Timbaktu Organic was initiated in 2005 by Timbaktu Collective in association with Adisakthi, Ananthasakthi and Mahilasakthi Mutually-aided Thrift Co-operative Societies (MATCS) promoted by the Collective, with financial support from Sir Dorabji Tata Trust, Mumbai. The goal of this venture is that the small and marginal farmers of the area improve their livelihood on a sustainable basis using organic farming.

The Government of Andhra Pradesh has initiated programmes related to organic farming through the Department of Agriculture and Horticulture. The Agriculture Department is proposing to take up promotion of organic farming in the state during the year 2008–09 by implementing several schemes with an outlay of Rs. 18.29 crores. These schemes include organization of vermicompost units, establishment of vermi-hatchery units, distribution of green manure seed on subsidy, supply of bio-fertilizers on subsidy and certification of organic farming. The Andhra Pradesh state's policy on organic farming is yet to be finalized and the draft developed in this regard is being discussed at various levels.

Similarly the Horticulture Department of A.P is implementing the organic farming scheme under the State Horticulture Mission (SHM) from the financial year 2008–09. To get the certification, the organic farming scheme is proposed to be implemented in 12 districts of A.P. in the coming 3 years. These include Ranga Reddy, Medak, Mahbubnagar, Nalgonda, Warangal, Khammam, Kurnool, Kadapa, Guntur, Prakasam, Chittoor and Paderu ITDA and Vishakhapatnam. The organic farming scheme is being implemented in an area of 6567 hectares by selecting clusters of 50 hectares in compact blocks. The crops covered under the scheme include chillies, ginger, mangoes, cashew and vegetables. As per the SHM guidelines, the assistance per cluster is Rs. 9 lakhs. Over a period of 3 years, all the farmers will be formed into groups, and trainings will be provided by experienced persons and personnel of the certification agency. The NGOs are actively participating in the scheme; they are responsible for obtaining certification by the accredited certification agency with whom the agreement is entered. All the NGOs except Pilupu (in Ranga Reddy district) have entered into an agreement with M/s Vedic Organic Certification Agency. The SHM is providing an assistance of upto Rs. 15,000 per

hectare over a period of 3 years. Rs. 7000 is given in the initial year followed by Rs. 4000 each in the second and third years to each farmer upto a maximum of 4.00 hectares per farmer. A technical support group member is allotted to one or two districts for monitoring the scheme periodically. The NGO shall identify the traders to market the organic produce at a higher price. Acharya NG. Ranga Agricultural University is also conducting comparative research between organic farming and conventional farming since 2007 Rabi (last three crops) in all its research stations in the state. Each research station is conducting trials on the predominant crop grown in that area.

3 Case Study of Andhra Pradesh

The state of Andhra Pradesh (undivided state: in 2014 it was bifurcated into Telangana and Andhra pradesh) chosen for the study is the fifth largest state in India in terms of both surface area and population. Based on physiographic, soil types, crops and cropping pattern, the state has been divided into nine agro climatic zones, namely, high altitude and tribal zone, North coastal zone, Godavari zone, Krishna zone, Southern zone, Northern Telangana zone, Central Telangana zone, Southern Telangana zone and Scarce rainfall zone.

Andhra pradesh state is richly endowed with natural resources and has a geographical area of 274.40 lakh hectares and an estimated population of 8.46 crore [37]. The population of SCs and STs constitute 16.41 and 7.0% respectively. The overall literacy rate in A.P, as per 2011 Census, is 67% as against the literacy rate of 74% at all India level. The average land holding size in the state during 2011–12 is 1.08 hectares. About 70% of the state's population is engaged in agriculture. Over 80% of those involved in agriculture are small and marginal farmers and landless labourers who own a mere 35% (3.5 million hectares) of the total 10 million hectares of cultivated land. About 24.49 million bovines (cattle and buffaloes), 35.16 million sheep and goats, 0.75 million pigs and 123 million poultry are distributed across some 10 million households engaged in agriculture. Andhra Pradesh has the distinction of being home to most of the diversified livestock resources across nine agroclimatic zones with different production systems. Livestock farming is one of the most sustainable and dependable livelihoods options as an alternate to their dependable resources in rural areas, especially for small and marginal farmers and agricultural labourers who hold 70% of the total livestock resources and 20% of the total land holdings. Small ruminants and backyard poultry are reared primarily by the landless adivasi, the traditional small-ruminant farming castes such as kurma, golla, and dalits. The size of bovine herd is closely linked to private land ownership, with the number of bovines increasing with land holding size. In all agricultural settings across AP, women play a greater role than men in agriculture-related activities work and food preparation besides looking after almost 80% of the day-to-day livestock management. The net area sown for 2011–12 was 111.60 lakh hectares constituting about 40.57% of its total

geographical area. Similarly the state has about 62 lakh hectares of forest area. Gross area irrigated in A.P during the year 2011–12 was 67.85 lakh hectares. Wells account for a major share of 25.44 lakh hectares (50.0%) followed by canals for 18.17 lakh hectares (35.71%) and 5.49 lakh hectares under tanks (10.79%). A highest ever priority has been accorded to the development of irrigation infrastructure in backward and drought prone regions of the state. The state government has initiated a historical mission named 'JALAYAGNAM' with the aim of completing 86 projects (44 Major, 30 Medium, 4 Flood Banks and 8 Modernization) in a record time. These projects are expected to create a new irrigation potential of 97.07 lakh acres besides stabilizing 22.53 lakh acres. The state also has initiated a project for encouraging micro irrigation systems for achieving water use efficiency. The area under micro-irrigation systems for the year 2011–12 comes to 8.95 lakh hectares.

The average annual rainfall of the state amounts to 830 mm, the range being 690 mm (Rayalseema region) to 950 mm (coastal Andhra). While the average annual rainfall of Telangana region in the state is 860 mm. Cereals and millets account for a lion's share under food crops (38.94% of the total area) followed by commercial crops (20.19%), oil seeds crops (14.09%) and pulses (14.02%). Rice under cereals; groundnut, sunflower and castor under oil seeds, cotton, chillies and sugarcane under commercial crops; and Bengal gram, blackgram, redgram and green gram under pulses constitute the major crops grown in the state, whereas an area of 25.59 lakh hectares is under various horticultural crops. Mango and sweet orange occupy a predominant position in acreage under fruits besides vegetables and flowers.

Anantapur district in Andhra Pradesh has high inter-annual variations in precipitation. Normal rainfall of the district averages 552 mm (see Table 3) which is bound to influence crop yields of the region. Most of the rainfall is received during June to September, although recently rainfall has become unreliable with a distribution is highly erratic distribution. The soils are mainly shallow, barren, sandy and only marginally fertile. The district is primarily characterised by rainfed agriculture. Most farmers are 'small and marginal' and grow a wide variety of both food and commercial crops (Oil seeds, pulses, millets and fibre crops) under dryland farming practices. Agriculture in Anantapur district of Rayalseema is practised on degraded and infertile soils with a majority of them being sandy soils. A large percentage of area is under groundnut. An erratic and deficient rainfall, rising costs of cultivation coupled with low market prices have led to a severe problem of indebtedness among farmers.

Interestingly, Anantapur has the least area under irrigated rice and highest rural livestock population in Rayalseema region. Large flocks of goat and sheep are managed extensively in the district. Certain parts of the district have a significant population of Adivasis (known as Scheduled Tribes), who happen to be among the most marginalised sections of the Indian society.

This study used an *ex post facto* research design. Both qualitative and quantitative methods were used for assessment of economic and ecological returns from millet-based bio-diverse organic farms vis-à-vis conventional farms. It used both

Table 3 Basic features of the selected state and district for the year 2011–12

Particulars	Andhra Pradesh	Anantapur district
Area in sq.km	274.40 lakh sq.km	19,130 sq.km
Normal rainfall (mm)	720.4	552
Population in lakh nos.	846.66	40.83
(a) Male	425.10	20.64
(b) Female	421.56	20.18
Literacy rate (per cent)	67.02	64.28
(a) Male	74.88	74.09
(b) Female	58.68	54.31
Average operation land holding (in hectares)	1.08	1.76
Gross cropped area '000 ha	13,759	1114.0
Gross irrigated area '000 ha	6785	171.9
Percentage of net irrigated area	45.60	15.43
Food grains production In '000 tonnes(2011–12)	18,402	298.0
Food grain yield in kgs per hectare(2011–12)	2588.7	1059.1
Total livestock population (numbers as per 2007 census)	60,200,863	5,517,104

Source: Bureau of Economics and Statistics (BES), Hyderabad; Government of A.P, 2013 and Director of Animal Husbandry, Andhra Pradesh, Hyderabad
Census of India [37]. www.ap.gov.in

primary and secondary sources of data. Quantitative information was collected using a semi-structured questionnaire and qualitative information was collected through focused group discussions.

This study was carried out in 11 villages coming under C.K. Palli, Ramagiri and Roddam mandals of Anantapur district with least net irrigated area and where organic farming methods are being adopted were selected for the study (Table 4). A total of 120 organic and 120 conventional farmers were selected from the state of Andhra Pradesh from 11 villages using proportionate random technique. Conventional farmers were selected using proportionate random sampling method representing similar dry land conditions except that of their organic farming practices. A thorough review of organic farming policies was conducted through a study of secondary sources. Secondary data on rainfall, net irrigated area and demographic features of the villages were collected from the mandal revenue office and village panchayat records. The study collected data from both primary and secondary sources. Quantitative information was collected using a semi-structured questionnaire during the year 2011–12. Data related to 2009–10 and 2010–11 was also collected using recall method, whereas, qualitative information was collected through focused group discussions. The analysis of the empirical data was basically done by comparing between the various size classes of large, medium and small farmers, and also by comparing between the organic and conventional farmers. The results of the study are discussed at two levels – at the household level and at the plot level.

Table 4 Study area and sampled households in Anantapur district of Andhra Pradesh

Andhra Pradesh –Anantapur district				
S.No	Mandal/ block	Village	No. of sample households	
			Organic farmers	Inorganic farmers
1	Roddam	Rachur	22	21
2	Roddam	Beedanpalli	9	9
3	Roddam	Shapuram	5	5
4	C.K.Palli	Venkatampalli	7	11
5	C.K.Palli	Boocharla	15	15
6	Ramagiri	Kondapuram	13	16
7	Ramagiri	Venkatapuram	5	7
8	Ramagiri	Gantimarri	20	11
9	Ramagiri	Kantiruddi	6	7
10	C.K.Palli	Narsingarayunipalli	9	8
11	Ramagiri	Kuntimaddi	9	10
		Total	**120**	**120**

4 Empirical Results

In this section, an attempt is made to understand the socio-economic profile of the farmers following organic and conventional agriculture. The socio-economic features, age group, literacy level, livestock population, market distance, farming experience, social participation, caste composition, landholding, net income and borrowings are some of the important variables researched in the study. However in this paper the discussion is focused on important variables like size-class, livestock, cropping system, crop and varietal diversity, average agricultural expenditure and economics of ground nut based cropping systems. This analysis is expected not only to provide information about the representativeness of the sample villages, but also to help in getting an insight into the organic farming practices of the sample farmers as against the practices of conventional farmers. Results of the soil sample analysis are also discussed in detail.

4.1 Socio-Economic Profile of the Sample Farmers

The socio-economic features, age group, literacy level, livestock population, market distance, farming experience, social participation, caste composition, landholding, net income and borrowings are some of the important issues focused in this study. This study indicated that most of the organic farming sample farmers were in the age group of 31–40 (31.67%) years, followed by those in 41–50 years (30%), whereas a majority of the conventional farmers were in the age group of 41–50 years (35.83%), followed by 31–40 years (32.5%). In order to understand the social and economic dynamics of

Table 5 Distribution of sampled households according to their size class during 2012–13 (N = 240)

Famer category	Organic farming	Conventional farming
Small farmer (0.1–5 acres)	66 (55.0)	88 (73.33)
Medium farmer (5.1–10 Acers)	38 (31.67)	21 (17.5)
Large farmer (Above 10 Acers)	16 (13.33)	11 (9.17)
Grand total	120 (100.00)	120 (100.00)

Source: Field Survey
Note: Figures in the parenthesis indicate the percentages

sample villages, one has to look into the social system, which largely determines people's perceptions, values and knowledge. Post stratification of the sample households of organic farming revealed that the majority belonged to Backward Classes (38.33%), followed by Scheduled Castes (31.67%). Even among the sample households adopting conventional agriculture, the majority belonged to scheduled caste (37.50%) communities, followed by backward communities (28.33%). Table 5 indicates that the size-class-wise distribution revealed that the majority were small farmers both in case of organic farming (55%) and conventional farming (73.33%). Among the organic farming sample households, only 13.33% belonged to large farmers. Most of the organic farmers belonged to Back ward communities and Scheduled Caste communities and were organized into groups to take up organic farming. Obviously the percentage of small farmers was high in this category.

Among the total sample of conventional farmers, 70% were non-literate, followed by primary educational level (8.33%) and VIII–X (7.5%). Among organic farmers too, the situation was the same, with the majority (60%) being non-literates, followed by primary education (11.67%). Among size classes, in both organic and conventional farming, small farmers had higher social participation followed by medium and large farmers. The reason was due to the thrift of their membership and credit institutions such as Self-Help Groups and occupational-related institutions.

4.2 Livestock

This is the most crucial aspect influencing the soil fertility management practice of both conventional and organic farmers. Both quantity and quality of livestock directly or indirectly influences soil fertility management. Higher the quantity of livestock, more is the access to organic manures. The livestock component of the farming system is crucial to help in maintaining soil fertility, supply of draught power and food for the family [38, 39].

It can be seen from Table 6 that among organic farmers the percentage of bullocks was less with small farmers. Livestock population has reduced because of the fodder and drinking water shortages caused due to recurring drought [40]. Especially,

Table 6 Size-class-wise distribution of sample HHs according to their livestock (per cent)

Livestock category	Conventional				Organic			
	Small	Medium	Large	All	Small	Medium	Large	All
Bullocks (Oxen)	47.00	28.43	41.92	40.27	35.42	39.43	54.54	43.85
Buffaloes	14.50	19.86	13.50	15.80	13.50	11.57	7.10	11.00
Cows	22 .00	20.86	35.25	26.14	26.67	27.00	36.36	30.01
Sheep	9.50	13.71	9.33	10.62	8.16	7.72	2.00	5.25
Goat	7.00	17.14	0.00	7.17	16.25	14.28	0.00	9.89
Grand total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Based on primary survey

bullock population is coming down more with large farmers [4, 41]. The reasons for this are reduction in farm size, increased mechanization, declining area under common lands and changing patterns in labour availability [42]. Another reason is that earlier, children from SC and BC communities worked for the landlords, but they are now going to school due to the awareness created by voluntary organizations and the emphasis given by government on primary education.

Among the sample households of conventional farmers, the majority (40.27%) are seen to have bullocks followed by cows (26.14%), buffaloes (15.80%), sheep (10.62%) and goats (7.17%). In case of organic farming sample HHs, the majority (43.85%) are bullocks. This is slightly (3.58%) higher than conventional farmers.

4.3 Agro-Biodiversity

Farmers of dry land regions developed diversified cropping systems to ensure that the most essential natural resources such as sunlight, wind, rainfall and soil are optimally utilized throughout the year. Crops that were developed over centuries were specifically bred to suit local soils, nutritional needs of people, livestock needs and climatic conditions. A large number of farmers, especially the women have been nurturing the agro-biodiversity and soil fertility without any sort of support from the government [43–45]. The lands of sample farmers of the study villages have hosted a wide range of crops.

Table 7 shows that crop diversity is more in the fields of organic farmers as compared with conventional farmers. The majority (52%) of the sample households adopting organic farming grow at least 5–6 types of crops in the lands owned by them. As much as 44% grow 3–4 crops in organic farms. Diversity provides some protection from adverse price changes in a single commodity and also better seasonal distribution of inputs [4, 46]. In conventional farming, the majority (52%) grow 3–4 crops. Only 1–2 crops are grown by 33.33% of the conventional farmers whereas it is only 2.67% in organic farming.

Table 7 Percentage of total no. of crops grown by sample households in their lands during the year 2011–12 (per cent)

Number of crops	Conventional farming	Organic farming
1–2 crops	33.33	2.67
3–4 crops	52.00	44.00
5–6 crops	14.67	52.00
7–8 crops	0.00	1.33
9–10 crops	0.00	0.00
Total	100.00	100.00

Source: Based on primary survey

4.4 Cropping System

Despite the constant encouragement for monocropping by the agricultural extension agencies and private seed, pesticide and fertilizer companies since the past three decades, farmers still follow intercropping and mixed cropping, as they realizing merits of such cropping system. It is evident from Table 8 that during the years 2009–10, 2010–11 and 2011–12 majority of the sampled farmers were adopting intercropping followed by mixed cropping system. In the case of conventional farming majority were following monocropping followed by intercropping during the years 2010–2011 and 2011–12. However during 2009–10 majority followed intercropping. Farmers value such diversity since it provides greater protection against the risk of crop failure [47]. The reasons given by farmers for crop diversity include access to diverse and nutritive food to the family members, availability of different kinds of fodder to feed the livestock, improvement in soil fertility, and effective utilization of farmland and to make sure that under no conditions of unfavorable environment and climate, the whole crop is lost [43, 48].

By practising inter/mixed cropping, the farmers combine crops with varying lengths of root depth, thus avoiding competition for space, moisture and nutrients. In mixed cropping system, root diversity at different levels below the ground physically stabilises soil structure against erosion and soil movement on steep slopes, and in tropical systems, the contribution of roots to soil organic matter is proportionately larger than from inputs above the ground. The natural process of biological nitrogen fixation by roots constitutes an important source of nitrogen for crop growth. It therefore provides a major alternative to the use of commercial nitrogen fertiliser in agriculture. Intercropping/mixed cropping safeguards against total failure of the crops during unfavourable climatic conditions and can help to increase production and income on dry lands [49].

While in monocropping system, the incidence of pest or spread of disease is easy as there is a single crop, the inter/mixed cropping system itself acts like a barrier to the establishment of pests, thereby reducing the damage. Moreover it becomes difficult for pests to locate food in the mixed cropping system. Interestingly, some of the crops in the mixed cropping system, simultaneously provide food for natural enemies of crop pests.

Table 8 Distribution of sample households according to their cropping system in Kharif 2011–12, 2010–11, 2009–10 in Andhra Pradesh state of India (percent)

Cropping method	2011–12		2010–11		2009–10	
	Organic farming	Conventional farming	Organic farming	Conventional farming	Organic farming	Conventional farming
Mono crop	7.5 (9)	40.83 (49)	5.0 (6)	40.83 (49)	10.0 (12)	26.67 (32)
Inter crop	42.5 (51)	40.0 (48)	54.17 (65)	42.50 (51)	45.0 (54)	56.67 (68)
Mixed crop	39.17 (47)	18.34 (22)	33.33 (40)	15.83 (19)	44.17 (53)	16.67 (20)
Strip crop	10.84 (13)	0.83 (1)	7.5 (9)	0.83 (1)	0.83 (1)	0.0 (0)
Total	100.0 (120)	100.0 (120)	100.0 (120)	100.0 (120)	100.0 (120)	100.0 (120)

Note: Figures in the bracket indicate actual numbers

4.5 Crop Rotation

Growing of different crops on a piece of land in a pre-planned succession is called crop rotation. Crop rotation ensures that the same soil nutrients are not used up by the crop every season. Crops which use different nutrients are grown alternatively to keep the nutrient balance in the plots. Farmers attach high value to this practice indicating the significant contribution of this practice to soil fertility maintenance since ages. Crop rotation itself does not involve any cost but involves the decision to change the crop every season in a particular plot.

Compared with monoculture cropping practices, multicrop rotations with two or three crops in a year can result in increased soil organic carbon content [50]. This is because of addition of large amount of biomass in the soil, both above as well as under the ground. Such crop planning is practiced in dry land regions. The complexity and diversity of such micro-environments created by farmers are often undervalued [51]. Table 9 clearly reveals that crop rotation is more (53.26%) in organic farming as compared with conventional farming, where crop rotation is followed in only 25.47% of the total sampled plots.

4.6 Per Acre Expenditure and Income

An attempt is made to arrive at the per acre average income of total sample HHs in the year 2011–12. This was calculated by subtracting cost of crop production from gross income of agricultural produce. The analysis was done with respect to groundnut based cropping system.

It is seen from Table 10 that the average per acre agricultural expenditure of the sample households practicing conventional agriculture is Rs. 11,023 and for those

Table 9 Crop rotation in the sampled plots (per cent)

Crop changes	Conventional farming				Organic farming			
	Small	Medium	Large	All	Small	Medium	Large	All
Crop rotation followed	11.43	16.67	40.43	25.47	56.00	55.17	38.46	53.26
Crop rotation not followed	88.57	83.33	59.57	74.52	44.00	44.83	61.54	46.74
Grand total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Based on primary survey

Table 10 Average per acre expenditure (in Rs.) of sample households during the year 2011–12

S. No.	Particulars	Conventional farming	Organic farming
1	Seed quantity	2584	2470
2	Organic fertilizer value	1090	2691
3	Chemical fertilizer	1442	–
4	Bio-pesticide	69	323
5	Pesticide	927	–
6	Human labour	1037	1220
7	Bullock labour	2254	2166
8	Machine labour	1620	1620
	Total	11,023	10,490

Source: Based on primary survey

practicing organic agriculture it is Rs. 10,490. It can be clearly seen that there were no expenses related to pesticide use and chemical fertilizers with organic farming. The expenses on bullock labour were slightly lesser in organic farming. This could be due to the slightly lesser usage of bullocks due to lesser livestock population (especially cows and bullocks) available with organic farmers. The same was revealed by the farmers in the focused group discussions. The expenses on seed were nearly same in both types of farming.

Table 11 reveals that the per acre income is quite less in both organic and conventional farming. The income is almost one-third of the expenditure incurred per acre. This is mainly due to poor yields due to excess rain. During the year 2011–12, it could be seen that income from grain yield was less in the case of organic agriculture as compared with conventional agriculture. Similarly, the per acre income of sample households practicing organic agriculture was Rs. 14,906 which is higher by Rs. 1832 per acre than the conventional agriculture. It was clearly reported by farmers that the yields were slightly higher in organic farms, the input costs were also much lesser in organic farms as compared with conventional agriculture. There is a scope for minimizing the economic cost and environmental loss under organic farming

Table 11 Average per acre Income (in Rs.) of sample households during the year 2011–12

S. No.	Item	Conventional agriculture	Organic agriculture
1	Grain yield	10,182	12,230
2	Fodder yield /stacks/bundles	2290	2276
3	Crop by-products	500	183
4	Uncultivated foods	102	217
	Total	13,074	14,906

Source: Based on primary survey

system as compared to conventional farming in the long run [52]. Based on their 3 years' experience in organic farming, farmers revealed during the FGDs that despite initial lesser yields in organic farms, the per acre net income was equal or more than conventional agriculture due to lesser input costs. This means that organic agriculture is more economically viable as compared to conventional agriculture. However, a series of focused group discussions with several organic farmers in 11study villages clearly brings out the fact that despite a yield reduction of 15–25% in the initial years of shifting to organic farming, lesser input costs in organic farming makes it economically more profitable than conventional agriculture. Some farmers reported during FGDs that the yield in organic farms even in the initial years of shifting from conventional agriculture was no less. It is interesting to notice that the input costs incurred for pest management and fertility enhancement are totally reduced for organic farmers. Though the income from fodder, crop by-products was higher for conventional farmers and uncultivated foods gave higher income in organic agriculture. This could be due to the wider adoption of inter/mixed cropping systems by the organic farmers which resulted in higher availability of uncultivated foods.

5 Organic Farming: Farmer's Perceptions

The present study, in addition to the quantitative data through household interviews, also tried to understand the farmers' perception – especially the women's – regarding the various aspects related to the organic farming. These include reasons for shift to organic farming, yield reduction during conversion, improved health due to organic farming, importance of livestock for organic farming, food habits of the organic farming families, access to uncultivated foods in organic farms, advantages of marketing by women's cooperative, marketing issues involved and advantages of organic farming. In addition to these things, the farmers clearly brought out the impact of organic farming on soil, human beings and livestock.

The farmers who have taken up organic farming were supported by the NGO TIMBAKTU by way of providing various inputs. These initiatives helped the farmers to reduce their inputs costs and also obtain the sustained yields. The major support extended to the farmers by TIMBAKTU include support for collection of cow urine which forms an important input for the preparation of *jeevamrutham*, an

organic fertilizer, provided the sprayer, support for taking up soil and moisture conservation works, supply of neem oil, provision of neem cake, provided the seeds of fox tail millet(*Setaria italica*), cow pea(*Vigna catjung*), jowar(Sorghum halepens) and castor (*Ricinus communis*), financial support for crop harvesting, support for marketing organic produce and training through farmers' field school.

5.1 Reasons for Shift to Organic Farming

Organic farmers followed traditional agricultural practices or conventional agricultural practices prior to shifting to organic farming. A combination of reasons encouraged the farmers to shift towards organic farming. The focused group discussions revealed that in chemical farming the input costs have increased and the soils were getting infertile. Due to climatic changes, the crops were not yielding well. At this juncture, the NGO, TIMBAKTU collective created awareness among farmers about organic farming and extended all possible support. The application of chemical fertilizers is spoiling the fertility of the land, crop yields are coming down and health is getting affected. At this juncture the farmers wanted to reduce inputs costs, improve health and get remunerative price for their produce; hence, the farmers quickly accepted the idea of organic farming proposed by TIMBAKTU. Another major reason for shift was that marketing of organic produce was taken care by TIMBAKTU. More importantly weighing of crop produce is done accurately by Dharani Cooperative which comprises of organic farmers as its members. Despite application of more and more chemical fertilizers, the crop yields were not satisfactory and hence, the farmers decided to turn to organic farming hoping that it may increase the crop yields.

5.2 Yield Reduction During Conversion

Regarding the reduction in yields during the conversion from organic to inorganic farming, the farmers during the FGDs expressed that there was not much yield loss for those farmers who had earlier applied good quantities of FYM. For others there was a reduction of 25% yield during the shift to organic farming. When asked how they could cope with this yield loss, the farmers said, "as the input costs have decreased, the net benefits were fine".

5.3 Improved Health Due to Organic Farming

The farmers felt that stoppage of pesticide application had positive impact on their health. Hitherto on the day of pesticide spray to the field, the farmer could never sleep properly due to inhalation while spraying, whereas now with bio-pesticide

Table 12 Impact of organic farming on soil, human health, livestock and neighbouring farmers

On soils
• The soil became smooth; the colour of the soil has changed; the soil, while ploughing, is very loose; the root grub was controlled due to application of neem cake; moisture retention increased from 2–3 days to 6–7 days; manure effect lasts for 2–3 years compared to chemical fertilizers and more earthworms could be seen in organic farms
On human health
• No harmful effects of pesticides; change in food habits: Consumption of more quantities of Jowar and Bajra. Korra rice back into food plate; consumption of good quality cooking oil from Dharani co-operative; earlier body pains were present; less visits to doctor; tasty food and access to uncultivated greens
On livestock
• More variety in fodder; fodder quality improved: earlier they used to sprinkle Gamaxene on fodder to prevent the attack of a bug. Consumption of such fodder resulted in cough to the animal and dysentery. The animal used to be less energetic and always feverish
On neighboring farmers
• Across size-classes farmers were keen to join organic farming groups; started using more organic manures; are using bio-pesticides for pest management; methods of seed treatment with trichoderma, rhizobium and other mixtures is being adopted; borrowing seeds from organic farmers; lesser purchase of chemical fertilizers and adopted higher crop diversity in their farms

Source: Field study

sprays neem seed kernel extract and *Pancha patra kashayam*, there is no such problem. Earlier it was loss of money on pesticides**.** Despite sprays, the crops got damaged and the pests were not controlled. Their health got spoiled and they had problems like itching. Today, even if a bag of neem cake is applied for controlling pests, their health remains unaffected. Earlier the farmers were eating rice purchased in Public Distribution System and it was not doing good for their health, whereas now they consume foxtail millet rice and bread made out of Jowar and Bajra (Pearl millet). They are also consuming different kinds of pulses and uncultivated greens.

Along with the health of human beings, the livestock health too is improved (see Table 12). Fodder from organic farming fields is contributing to the good health of cattle. Earlier, for the *Noomalli* (bug) pest they sprayed gamaxene (BHC) to fodder stacks. Despite the ban BHC is still available. Now due to organic farming practices this is being not done. Due to this the livestock is eating "gamaxene-free fodder" and is keeping healthy. Hitherto, they showed symptoms such as coughing by animals, dysentery, less energetic and feverish.

5.4 Importance of Livestock

Lack of livestock is an important constraint for organic farmers that affected manurial needs and timely agricultural operations. In study village Chinnapalli, more than 50% of the households do not have livestock among the organic farmers. "Livestock is good for organic farming", says, Ramanjaneyulu of Chinnapalli

Village. With own bullocks, farmers can plough the land whenever moisture is available in the land, but if they depend on tractors, they need to give advance to its owner and wait for him to come and plough. By that time moisture in the soil may be lost and seed sowing cannot be taken up. Adding to this, another farmer says, "if the first showers come on time, those who do not own bullocks will face difficulty in ploughing the land". Another point made by the farmers was that the tractor owners have recently increased the per acre ploughing cost from Rs. 450 to Rs. 550, citing the hike in diesel prices.

Some of the farmers in Kondapuram village said that due to lack of bullocks, the land preparation costs went up. Hence, people wanted the financial support for cows and bullocks. Cows give urine whereas bullocks can be used for ploughing. Farmers of Gantimarri, speaking about the importance of livestock for organic farming said, "we face problems in organic farming due to lack of livestock". We need more support for livestock. The multiple benefits provided by livestock include availability of urine, dung, milk, milk products and timely land preparation. The organic farmers revealed during the FGDs that due to korra and jowar cultivation, the fodder availability has increased and hence, more livestock can be maintained with the existing fodder resources. A typical organic farmer with 3 acres of land produces 6 cart loads of groundnut hay +4 cart loads of jowar + half cart load of *korra grass.*

Despite being aware of the value of livestock in farming, the farmers are unable to afford them. Even those who owned livestock had to sell them due to some compulsions, and are now unable to buy them back again as they have to spend huge amount. "If there is no livestock, there is no chance of adding organic manure to our fields", says a farmer.

5.5 Change in Food Habits

With the shift towards organic farming, there is a change in the food habits of many organic farming households, both in terms of type of food and its quantity. In fact, these foods used to find a prominent place in their food basket hitherto. Organic farming families eat *korra* rice at least 4–5 times in a year. Some of the sample households even consume 20–30 times in a year. As compared to hitherto, they are eating more quantities of bajra and jowar. These crops are already being consumed, but now they are eating in more quantities and more frequently. It was revealed by women during the FGDs that the health of the family members of the organic farming households has improved. The indicators expressed by them include that earlier they had body pains, increase in the gap between the visits to doctor; they do not see a doctor even once in 10 days which they used to do earlier, the taste of food grown organically is good and good quality cooking oil is being provided from the Dharani cooperative which keeps us healthy. In study villages like Kondapuram, the farmers are keeping one-third of the total millet crop produced for consumption and the remaining is being sent to the market. Organic farming has increased the access to uncultivated greens in their farms and the frequency of diverse uncultivated greens has also increased among sample hhs.

5.6 Advantages of Marketing by Dharani Cooperative

The major advantage has been the correct weighing procedures adopted by the Dharani cooperative. On the contrary the traders in the open market deceive us. Last year in TIMBAKTU marketing, the price was fixed based on weight; whereas this year, it is fixed as per the general market rate. There is a assured market price for the crop produce. People are in need of money during the weeding stage. As they get financial support from traders, they are forced to sell back the produce to traders and in the process get exploited. In the open market, they lose nearly 8 kg of produce for each bag of groundnut. This is a huge loss. So for each acre on an average the yield is 20 bags which mean 20 × 8 kg = 160 kg, which when valued, comes to almost Rs. 2500–3000. During the groundnut season, if financial support is provided for weeding, the farmers will be relieved of traders, and hence, this 8 kg loss per bag to private traders in market can be avoided. After harvesting, the produce is picked up within a week. Cash is paid quickly, deducting the amount supported for the soil fertility enhancement. Hitherto, the traders used to take 15–30 days for making the payment for the produce sold. Dharani Cooperative farm provides loans for seeds and during harvest. An amount of Rs. 1200 per acre is given to each farmer for purchase of seed. Similarly, Rs. 1000 per acre is given to each farmer for crop harvesting. The loans are given at an interest rate of 1%, whereas if taken outside it will be 5%. The main requirement of the small farmers during the changing times is better access to capital and education [53].

Farmers have brought out an important constraint in marketing of their organic produce. Crops such as red gram have to be picked up quickly as there may be chances of attack by storage pests. Hence, they have to be lifted from farmers immediately and taken to the mills for making *dal*. If taken late, the stored grain is attacked by pests. "After harvesting, red gram must be converted immediately into *dal",* says Pallakka. Those who harvest the pigeon pea first have to wait till the other farmers harvest their produce. But such produce is in the danger of attack from pests during storage and hence needs to be picked up soon. But unless a substantial quantity of pigeon pea is available, Dharani Cooperative will not come to pick up the produce. The produce is picked up only after at least five farmers harvest their produce. As they have so many villages to procure, it is a problem for them too.

6 Conclusion

Organic farmers have been using a range of agricultural practices that are based on local resources. As a result of this the input costs were lesser and more importantly farmers had control over the things they wanted to do. Organic practices related to treatment of seed, soil fertility enhancement, pest management, and livestock care have provided employment to villagers and thereby supported their livelihoods. Based on the empirical evidence it can be concluded that organic farming is

economically viable. There was significant reduction in the input costs of organic farms. Each and every single farmer in the study area was appreciative of the marketing support extended to them, especially the accurate weighing procedure adopted by Dharani Cooperative. This enabled them to save an amount ranging between Rs. 2000 and Rs. 3000 per acre, which is a substantial gain for small and marginal farmers. Millets such as korra, jowar and bajra are back into farming system, enhancing the food and nutritional security of sampled households. Huge crop diversity and higher crop rotation was seen in the organic farms as compared with conventional farms. This has positive implications for soil fertility management, pest management and for withstanding risk of climate changes. It was argued by the organic farmers during the FGDs that there is a need for a strong support for livestock, especially bullocks and cows, for better results in organic farming. There is a great scope for the revival of organic farming practices by utilizing the incentives of labour under the National Rural Employment Guarantee (NREG) act [35]. It can be summed up that organic farming is doing better compared to conventional farming on several fronts.

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