Status of organic farming in India

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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 and the cost of cultivation was higher primarily due to purchased off-farm inputs, organic farming was not found economically feasible. 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.

Keywords: Economics, organic farming, productivity, soil quality.

GROWING awareness of health and environmental issues associated with the intensive use of chemical inputs has led to interest in alternate forms of agriculture in the world. Organic agriculture is one among the broad spectrum of production methods that are supportive of the environment. According to *Codex Alimentarius* (FAO/WHO)[1], 'organic agriculture is a holistic production management system which promotes and enhances agroecosystem 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'. The commonly used term 'conventional agriculture' refers to the standard, dominant farming approaches promoted and researched by most government and agribusiness groups and practised by farmers and growers throughout the world. Usually, conventional agriculture imposes no restrictions on management and encourages using chemical fertilizers, pesticides, etc. for yield maximization under a given set of farming conditions.

Organic farming is gaining gradual momentum across the world. Based on the global survey on organic farming carried out in 2007/2008 (ref. 2) by the Research Institute of Organic Agriculture (FiBL), the International Federation of Organic Agriculture Movements (IFOAM) and Foundation Ecology and Agriculture (SOEL), organic agriculture is now practised in more than 130 countries with a total area of 30.4 million hectares in 0.7 million number of organic farms. This constitutes about 0.65% of total agricultural land of the world (Table 1). Global demand for organic products remains robust, with sales increasing by over US$ 5 billion a year. Organic Monitor estimates international sales to have reached US$ 38.6 billion in 2006, double that of 2000, when sales was at US$ 18 billion. Consumer demand for organic products is concentrated in North America and Europe; these two regions comprise 97% of global revenues. Asia, Latin America and Australasia are important producers and exporters of organic foods[3].

In India, about 528,171 hectare area is under organic farming (this includes certified and area under organic conversion) with 44,926 number of certified organic farms. This accounts for about 0.3% of total agricultural land. Indian organic farming industry is estimated at US$ 78 million and is almost entirely export oriented. According to Agricultural and Processed Food Products Export Development Authority (APEDA)[4], a nodal agency involved in promoting Indian organic agriculture, about 585,970 tonnes of organic products worth of Rs 301 million are being exported from India. Growing awareness, increasing market demand, increasing inclination of farmers to go organic and growing institutional support have resulted in more than 200% growth in certified area during the last two years.

Need for survey and assessment

There has been a lot of debate in recent years about the feasibility of organic farming under Indian conditions[5–7].

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Table 1. Land area of major countries under organic agriculture during 2007–08 (ref. 2)

Country	Area under organic agriculture (ha)	Percentage of total agricultural land	Number of organic farms
Australia	12,294,290	2.8	1550
China	2,300,000	0.4	1600
Argentina	2,220,489	1.7	1486
USA (2005)	1,620,351	0.5	8493
Italy	1,148,162	9.0	45,115
Uruguay	930,965	6.1	630
Spain	926,390	3.7	17,214
Brazil	880,000	0.3	15,000
Germany	825,539	4.8	17,557
UK	604,571	3.8	4485
Canada	604,404	0.9	3571
France	552,824	2.0	11,640
India	528,171	0.3	44,926
World total	30,418,261	0.65	718,744

The most often debated questions related to organic farming include its production potential, economic feasibility and the possible environmental benefits like improved soil quality and health[8]. Unlike Europe and USA[9–13], very few long-term organic farming experiments are available in India (these were initiated only recently by Indian Council of Agricultural Research (ICAR) in the last 4–5 years) which could answer our questions scientifically. However, there were farmers who have been cultivating their lands under organic farming conditions for the last 5–10 years and some of them have been certified by internationally accredited organic certifying agencies. It has been envisaged that scientific study of these farms may yield clues regarding the production potential, economic feasibility and likely benefits of organic farming in terms of improved soil fertility/quality. Hence this survey was undertaken with an objective to compare the productivity, economics and soil quality of certified organic farms in comparison to the conventional farms to ascertain the real benefits of organic farming.

Methodology

The survey was conducted during 2008–09 in Maharashtra, Karnataka, Tamil Nadu (including Puducherry), Kerala and Uttarakhand involving 50 certified organic farms and 50 comparable conventional farms. The list of organic farms was obtained from the accredited organic certification agencies in India. These selected organic farms are from Pune district of Maharashtra, Belgaum and Hubli districts of Karnataka, Coimbatore and Erode districts of Tamil Nadu, Auroville in Puducherry, Ernakulum, Iddukki and Wayanad districts of Kerala, and Dehradun and Haridwar districts of Uttarkhand. These farms are currently being certified by the Natural Organic Certification Association (NOCA), Pune; Association for Promotion of Organic Farming (APOF), Bangalore; Control Union (Skal International), Indian Organic Certification Agency (Indocert), Cochin; IMO Control Pvt Ltd, Bangalore; Lacon Quality Certification Pvt Ltd in Tamil Nadu and Kerala, and Uttaranchal Organic Commodity Board (UOCB), Dehradun.

Replicated soil samples (from the top 0–15 cm depth) were collected from each certified organic farm and from nearby conventional farms having similar soils. A total of 300 soil samples were collected for the analysis. The analysis included soil physical (bulk density), chemical (pH, EC, organic carbon), biological (dehydrogenase, alkaline phosphatase, microbial biomass carbon) parameters and macro (N, P and K) and micronutrient (Zn, Cu, Fe, Mn) status of soil by adopting standard analytical methods[14].

Salient findings

On an average, the mean land holdings of each certified organic farm was 12.7 hectares. The average age of these certified organic farms was 6 years (ranges from 3 to 20 years). The average number of cattle possessed by each organic farm was around 11–12. Different manures used for supplying plant nutrients in organic farms include farm yard manure (FYM), vermicompost, Narayan Devraj Pandey (NADEP) compost, green manures, biofertilizers, neem cake, fish meal, biogas slurry, bone meal, press mud, biodynamic preparations, Jeeva amrit, Panchagavya, effective microorganisms (EM), minerals like gypsum, rockphosphate, etc. Different plant protection materials used in organic farming include neem oil, fermented butter milk, Jeevamrit, Panchgavya, cow urine, plant extracts like *Aloe vera*, datura, pongamia, cassia, garlic, ginger, chilly and bio-agents like *Trichoderma*, *Pseudomonas*, *Verticillium*, HNPV and Bt spray. Different crops grown under these certified organic farms and their productivity levels in comparison to conventional farms are given in Table 2.

On an average, the productivity of crops in organic farming is lower by 9.2% compared to conventional

Table 2. Productivity of crops (t/ha) in organic versus conventional farming

State	Crop	Organic farming	Conventional farming	Per cent increase (+)/ decrease (–) in organic farming
Maharashtra	Vegetables	11.0	13.0	–15.3
	Fruit crops	11.4	13.6	–16.1
	Rice	2.0	2.5	–20.0
	Wheat	1.2	1.5	–20.0
Karnataka	Soybean	0.9	1.1	–18.2
	Chickpea	0.8	0.8	0.0
	Fruit crops	8.0	9.0	–11.1
	Groundnut	1.2	1.4	–14.2
	Sugarcane	120	140	–14.3
Tamil Nadu and Puducherry	Cotton	0.6	0.8	–25.0
	Cashew	1.3	1.0	+30.0
	Banana	25.0	30.0	–16.6
	Mango	8.0	6.0	+33.3
	Guava	20.0	23.0	–13.0
	Coconut	28,250 nuts	28,750 nuts	–1.7
	Rice	5.0	6.0	–16.6
Kerala	Pepper	1.38	1.40	–1.4
	Banana	23.6	27.2	–13.2
	Coconut	31,000 nuts	30,500 nuts	+1.6
	Coffee	1.23	1.31	–6.1
	Turmeric	22.5	25.0	–10.0
Uttarakhand	Rice	3.77	3.82	–1.3
	Wheat	3.12	3.92	–20.4
	Potato	12.0	15.0	–20.0
Mean				–9.2

farming. There was a reduction in the average cost of cultivation in organic farming by 11.7% compared to conventional farming. However, due to the availability of premium price (20–40%) for organic produce in most cases, the average net profit was 22.0% higher in organic compared to the conventional farming (Table 3).

Yields relative to comparable conventional systems are directly related to the intensity of farming of the prevailing conventional systems. This is not only the case for comparison between regions, but also between crops within a region, and for individual crops over time[15]. In areas of intensive farming system, shifting to organic agriculture decreases yield; the range depends on the intensity of external input use before conversion[9,16,17]. In the so-called green revolution areas (irrigated lands), conversion to organic agriculture usually leads to almost identical yields[18,19]. In traditional rainfed agriculture (with low external inputs), organic agriculture has shown the potential to increase yields[20,21].

The replacement of external inputs by farm-derived organic resources normally leads to a reduction in variable input costs under organic management. Expenditure on fertilizers and sprays is substantially lower than in conventional systems in almost all the cases. In a few cases, higher input costs due to the purchase of compost and other organic manure have been reported. Studies have shown that the common organic agricultural combination of lower input costs and favourable price premiums can offset reduced yields and make organic farms equally and often more profitable than conventional farms[10,11,22]. Farms that did not include organic price premiums have given mixed results on profitability. The economics of organic cotton cultivation over a period of six years indicated that there is a reduction in cost of cultivation and increased gross and net returns compared to conventional cotton cultivation in India[18].

The soil quality parameters in organic and conventional farms in different states are given in Table 4. The bulk density of soil is less in organic farms which indicates better soil aggregation and soil physical conditions. Improvement in soil organic matter decreased the bulk density by dilution of the denser fraction of the soil[23]. There was a slight increase in soil pH and electrical conductivity in organic farms compared to conventional farms. On an average there was 29.7% increase in organic carbon of soil in organic farms (1.22%) compared to the conventional farms (0.94%) which is a good indicator of soil quality as it works as a sink for all nutrients and known for improving all soil physical and biological properties of soil. Regular organic additions (manures and root biomass) have the largest effect in soil organic matter. Dehydrogenase, alkaline phosphatase and microbial biomass carbon were higher in organic soils by 52.3%, 28.4% and 34.4% respectively compared to the conventional farms. This clearly indicates higher microbial activity in organically amended soils which is essential for nutrient transformations and increased availability of these nutrients to the plants. Increased nutrient avail-

Table 3. Economics of crop production in organic versus conventional farming

State	Crop	Cost of cultivation (Rs/ha)			Net returns (Rs/ha)		
		Organic farming	Conventional farming	Per cent increase (+)/decrease (–) in organic farming	Organic farming	Conventional farming	Per cent increase (+)/decrease (–) in organic farming
Maharashtra	Vegetables	25,000	26,000	–3.8	25,000	29,000	–13.8
	Fruit crops	70,000	78,000	–10.2	50,000*	47,000	+6.4
	Rice	10,000	11,500	–13.0	20,000*	18,000	+11.1
	Wheat	8,000	9,000	–11.1	10,000*	9,000	+11.1
Karnataka	Soybean	7,200	7,800	–7.7	9,000	10,350	–13.0
	Chickpea	6,700	7,250	–7.6	4,700	4,750	–1.1
	Fruit crops	20,000	23,500	–14.9	84,000*	64,500	+30.2
	Groundnut	13,000	14,500	–10.3	17,000	23,000	–26.0
	Sugarcane	55,000	60,000	–8.3	101,000	108,000	–6.5
Tamil Nadu and Puducherry	Cotton	10,000	10,000	0	11,000*	10,000	+10.0
	Cashew	12,500	14,000	–10.7	13,500*	6,000	+125.0
	Banana	60,000	80,000	–25.0	240,000*	170,000	+41.2
	Mango	25,000	30,000	–16.6	135,000	90,000	+50.0
	Guava	20,000	25,000	–20.0	80,000	90,000	–11.1
	Coconut	30,000	34,000	–11.7	111,250	109,250	+1.8
	Rice	25,000	20,000	+25.0	37,500*	40,000	–6.2
Kerala	Pepper	36,500	40,200	–9.2	88,600*	44,300	+100.0
	Banana	61,000	75,000	–18.6	194,000*	145,000	+33.8
	Coconut	50,000	60,000	–16.6	166,000*	120,000	+38.3
	Coffee	40,000	54,000	–25.9	75,000*	48,000	+56.2
	Turmeric	87,000	140,000	–37.8	130,000*	85,000	+52.9
Uttarakhand	Rice	18,000	20,700	–13.0	28,800*	17,750	+62.2
	Wheat	20,000	23,000	–13.0	17,500*	16,000	+9.3
	Potato	20,000	18,000	+11.1	28,000	42,000	–33.3
Mean				–11.7			+22.0

*Premium price available to organic produce.

Table 4. Soil quality parameters as affected by organic (Org.) and conventional (Con.) farming

Soil quality parameter	Maharashtra		Karnataka		Tamil Nadu		Kerala		Uttarakhand		All states average	
	Org.	Con.	Org.	Con.	Org.	Con.	Org.	Con.	Org.	Con.	Org.	Con.
Physical												
Bulk density (Mg m^{-3})	1.24*	1.28	1.27	1.30	1.24	1.28	1.18	1.27	1.22	1.25	1.23	1.27
Chemical												
$pH_{(1:2)}$	5.99	6.01	7.28	6.52	7.71	7.57	5.96	5.64	7.42	7.40	6.86	6.62
Electrical conductivity$_{(1:0.2)}$ (dS m^{-1})	0.12	0.12	0.17	0.13	2.85	2.98	1.74	1.18	5.87	5.85	2.15	2.05
Organic carbon (%)	1.49	1.11	0.98	0.65	1.28	0.84	1.55	1.44	0.81	0.66	1.22	0.94
Biological												
Dehydrogenase (µg TPF g^{-1} soil 24 h^{-1})	85.3	66.0	118.1	71.6	53.6	39.8	53.9	29.8	104.0	64.7	82.9	54.4
Alkaline phosphatase (µg p-nitro phenol g^{-1} soil h^{-1})	67.1	54.9	59.8	42.8	89.9	76.6	77.2	66.2	85.3	61.3	57.8	45.0
Microbial biomass carbon (µg g^{-1} soil)	237	169	269	183	302	241	258	195	339	255	281	209
Macronutrients (kg ha^{-1})												
Available nitrogen	215.9	150.8	181.2	150.0	183.9	171.4	244.4	209.1	257.2	246.5	216.2	185.4
Available phosphorus	10.41	6.60	32.04	36.70	18.02	15.05	16.61	13.52	36.63	31.60	22.72	20.69
Available potassium	529.4	537.9	422.6	290.8	477.4	411.5	337.0	314.7	389.2	351.8	431.0	381.3
Micronutrients (ppm)												
Zinc	1.12	0.91	1.16	0.81	2.97	1.18	2.58	1.47	5.48	5.19	2.46	1.91
Copper	4.94	4.32	3.45	3.71	1.98	1.44	4.62	2.95	2.35	2.01	3.46	2.87
Iron	4.25	4.07	3.96	3.29	12.80	8.41	46.84	32.57	45.48	37.29	22.63	17.21
Manganese	5.63	5.45	4.63	5.16	16.67	9.69	43.57	34.53	19.03	18.63	17.91	14.69

*Each value is the average of 30 soil samples.

ability in organic manure treatment could also be due to increased dehydrogenase and phosphatase activity. In general, increase in microbial biomass carbon in organic manure amended soils was due to increased availability of substrate-C that stimulates microbial growth, but a direct effect from microorganisms added through the compost is also possible[24]. In organically managed soils, both macronutrients (N, P and K) and micronutrients (Zn, Cu, Fe, Mn) were available in larger quantities compared to the conventional soils. It is well documented that there is a significant positive correlation between organic matter and micronutrient cation availability. Similar increase in soil quality by the addition of manures in organic farming was reported from India[21,25] and from the long-term organic experiments in Switzerland[26].

Conclusions

The study provides the following insights into the real organic farming situation in the country.

Organically managed farms recorded lower productivity and yield losses but there was an overall improvement in soil quality parameters, indicating better soil health. It is economically feasible to practise organic farming when the farmers are able to get premium price for their produce and with the reduced cost of cultivation by not depending upon the purchased off-farm inputs. Low productivity in organic farming highlights needs in the current international and national research activities. European countries, leaders in organic agriculture research, spend approximately €60 million per year on specific problems of organic food and farming[27]. Similar research efforts are required to improve the productivity of organic crops under Indian conditions. It is also worth examining the status of organic farming in different production systems and farming situations of the country with sufficient number of farms in each case for better appreciation of organic farming and to formulate research projects on a sound scientific basis.

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