

## **COST AND RETURN ANALYSIS OF INORGANIC AND ORGANIC AGRICULTURE: A LITERATURE REVIEW**

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### **Abstract**

This paper reviewed the global and Indian organic and inorganic agriculture scenarios, especially in the areas of cost of cultivation and return from farming practices. The after-effects of the green revolution have encouraged farmers to start organic farming. It can be seen that the area of organic agriculture is emerging and is very much under discussion between government and non-governmental organisations, policy makers, researchers, agricultural scientists, environmentalists and planners. In view of this, numerous studies have been conducted worldwide on organic and inorganic agriculture by various scholars in the field of agricultural economics and developmental economics. Furthermore, scholars' perspectives on the studies carried out, differ in methods and systems of agriculture. The majority of the studies advocate that organic farming in most cases; costs are relatively lower than that of inorganic farming and organic farms have obtained relatively higher net-returns than inorganic farms. It has been argued that organic farming is productive and sustainable. The study suggests that the government had to set a minimum support price for organic vegetables, which encourage the establishment of exclusive organic vegetable marketing centres and the development of organic vegetable supply chain systems. The farmers should be trained in the production of vermicompost. Moreover, provision of subsidies for inputs such as seeds, bio-fertilizers, bio-pesticides etc., credit facilities, adequate training programmes, sufficient inputs and a regulated market for organic products are also required for the enhancement of organic farming in India.

**Key words:** Organic farming, benefit cost ratio, conventional method, sustainable agriculture

### **Introduction**

Modern agriculture technologies, supported by policies and fuelled by agrochemicals, machinery and irrigation, are known to have increased agricultural production and productivity. While these technologies have greatly contributed to addressing the food security of India, farmers using these technologies must rely on the inputs they have purchased. Small farmers, who are short of cash by definition, are therefore lagging behind large farmers in the adoption of technology. Fertilizers and pesticides, two major inputs of green revolution technology, need fossil fuels and/or expensive energy and are associated with serious environmental and health problems. It is perhaps because of these input issues and their negative impacts that the government organisation noted that inorganic agriculture as practiced today accounts for about one-fifth of the anthropogenic greenhouse effect. Conventional farming practices, along with irrational use of chemical inputs over the last five decades, have not only resulted in a loss of natural habitat balance and soil health, but have also resulted in many hazards such as soil quality degradation, reduced groundwater levels, soil salinisation, fertiliser and pesticide pollution, genetic erosion, adverse environmental effects, and reduced food quality (Ram, 2003). Farmers no longer find agriculture a viable proposition and, in fact, a large number of farmers have committed suicide (Deshpande, 2002). Some of the factors that contributed to the current agricultural crisis could be the rise in the price of industry-made advanced inputs and the slow withdrawal of investment by the government, as well as market intervention and, more significantly, the shift from subsistence farming to commercial farming. In other words, local indigenous farming techniques have been wiped out and replaced by modern techniques, resulting in an unsustainable farm enterprise. It is in this context that alternative farming techniques and strategies for growing crops should be identified in the larger interest. The principle of organic farming attracts farmers worldwide because of its various advantages over modern agricultural practices. Essentially, it is an agricultural system that promotes and strengthens biological processes without recourse to inorganic remedies such as chemicals and genetically modified organisms. Organic farming is productive and sustainable (Reganold et al., 1993;

Letourneau and Goldstein, 2001; Mader et al., 2002). Many state-sponsored agencies, non-governmental organizations and individuals have recently begun experimenting with organic food production methods. The most widely accepted definition of organic farming is “Organic agriculture is a holistic production management system that promotes and enhances the health of agro ecosystems, including biodiversity, biological cycles and soil biological activity. It emphasises the use of management practices in preference to the use of off-farm inputs, taking into account the need for locally adapted systems for regional conditions. This is achieved by using, where possible, agronomic, biological and mechanical methods, as opposed to the use of synthetic materials, to fulfil any specific function within the system” (FAO, 1999). The term 'conventional farming' refers to a production system that employs a wide range of pre-planting and post-planting practices, synthetic fertilizers, insecticides, herbicides and pesticides. It is characterised by a high level of crop specialisation. Organic farming, on the other hand, is characterised by a diversity of crops. This paper has examined the issues related to cost and return among organic and inorganic agriculture in the light of recent developments at global and national level. In this context, the paper seeks to review the previous literature and for this purpose, the studies have been classified into four categories on the basis of their nature namely cost of cultivation in organic and inorganic agriculture, yield of crop in organic and inorganic agriculture, price of product in organic and inorganic agriculture and return from organic and inorganic agriculture.

### **Cost of Cultivation in Organic and Inorganic Agriculture**

Tholkappian (2014) found that the average cost of organic banana was marginally less than the conventional banana. The author found that the average cost of organic banana was found to be marginally lower in Erode by 2.0 per cent, whereas in Thanjavur, the average cost of the organic banana was found to be lower than conventional banana by 5.4 per cent. Sudheer (2013) found that cost of cultivation of conventional holdings were higher than organic holdings. The study found that the cost differentials could not only be attributed to savings due to non-use of chemical fertilizer by organic farmers. The cost advantage of organic farming was spread across other inputs. Ghimire et al. (2013) found that the cost of cultivation per Ropani of Tomato growers was 5.9 per cent lower after adopting organic farming methods. While organic cultivation was associated with higher cost on seeds and manure and the cost of labor, reduction in the use of chemical fertilizers and pesticides reduced the cost under organic cultivation. However, the study reported that the average cost per kg was higher by 8.2 per cent after adoption of organic farming. Forster et al. (2013) found that Cotton's cost, Soyabean and wheat was less than conventional farms in Madhya Pradesh. Cost of cultivation of cotton, soyabean and wheat was higher in conventional farms by 30.0 per cent, 66.0 per cent and 49.0 per cent, respectively. The main reason for cost differential was the higher input cost on fertilizers and pesticides in conventional farms. Mehmood et al. (2011) in their study in Sheikhpura district of Punjab province, Pakistan, found that the average cost per acre of wheat under organic method was less than the conventional method. The cost of organic wheat was 20.3 per cent lower than the conventional wheat. Thennarasu et al. (2011) found that sugarcane farmers who adopted bio-inputs in the Cuddalore district, Tamil Nadu, incurred an average production cost of Rs.57,827 per ha to Rs.57,193 per ha incurred by non-adopters. The cost incurred by the sample bio-input adopters was found to be marginally (1.1 per cent) higher than no adopters. Singh et al. (2011) in their study in Patiala and Faridkot district, Punjab, show that organic wheat cultivation was less than conventional wheat. Cost of cultivation of organic wheat growers was 4.6 per cent lower than in-organic wheat. Namdev et al. (2011) in their comparative study of organic and conventional paddy economics in Jabalpur district, Madhya Pradesh found that the average cost per acre under organic farms was less than the conventional farmers. The organic paddy cost was 40.5 per cent lower than the conventional paddy cost. Reddy (2010) in his study in Anantapur, Andhra Pradesh observes that cost in organic farms were less than in conventional farms. The author found the average cost of cultivation of organic cultivation was 19.9 per cent less than the cost incurred in conventional farming. The cost differentials were due to more expenditure on pesticides and chemical fertilizers in conventional farms. The authors also found that organic agriculture incurred less expenditure on bullock labour, owing to lower livestock holdings among organic farmers. Samie et al. (2010) in their study in Sheikupura district, Pakistan explored that the average cost of organic wheat was 14.6 per cent lower than the cost of conventional wheat. Charyulu et al. (2010) found mixed results regarding the cost of organic and conventional cultivation in the production system. The Organic Cotton was found to have

relatively lower cost (per quintal) both in Punjab (129.5 per cent) and Gujarat (22.0 per cent). The cost reduction was largely attributed to the relatively lower cost of organic farmers on seeds, fertilizers and plant protection in organic farming. Naik (2010) found that the cost of cultivating Organic tomato in Belgaum District, Karnataka was marginally less than cost of cultivating tomato in conventional farms. The author found that reason for lower cost of organic tomato was due to relatively higher cost incurred in conventional farms on chemical fertilizer and plant protection. Banerjee (2010) in their study in Bihar showed that on an average (three years) organic banana (main crop) had lesser cost than conventional bananas by 29.4 per cent. The ratoon crop under organic cultivation experienced lower cost of cultivation by 37.7 per cent. Sharma et al. (2010) in their study in Punjab found that the cost of organic paddy cultivation was less than the cost of conventional paddy. This cost differential is due to higher cost of fertilizers, nursery raising and plant protection. The study also found that organic farms had to incur higher cost of human labour. Adhikari (2009) finds that organic carrot had marginally lower (1.2 per cent) cost of production per hectare than the cost in conventional farms. Organic farming practices resulted in significant savings in cost incurred on seed and plant protection. However, organic farming practices lead to higher cost of labour and cost of manure and fertilizers. Gosavi (2009) in his study in Maharashtra found that organic costs were 30.0 per cent lower than conventional cultivation. The cost differentials were mainly due to costs incurred on pesticides and fertilizers. Kshirsagar (2008) revealed that organic sugarcane farmers had 14.2 per cent lower costs than conventional farmers. The reasons for lower cost of organic cultivation was reduced cost due to non-use of chemical fertilizer, reduced cost in seed and planting (16.8 per cent), irrigation (18.5 per cent) and plant protection (22.7 per cent). Eyhorn et al. (2007) found that organic cotton cultivation incurred a lower cost of cultivation during two years of study (2003 and 2004) in Madhya Pradesh. In 2003 and 2004, the organic cotton cost was 13.0 per cent and 20.0 per cent lower than conventional cotton. The reduction in costs was mainly due to lower expenditure on seeds, fertilizer and pest management. Sujatha et al. (2006) in their study in Karimnagar, Andhra Pradesh found that the production cost of organic paddy and cotton was Rs.19578.64 and Rs.42186.76, which was 18.1 per cent and 22.5 per cent lower than conventional paddy and cotton. Reddy et al. (2004) in their two-year study of rice and groundnut cropping system found that in rice cultivation, the cost of organic farming is higher than conventional farming. This was mainly due to relatively higher cost of procurement and application of fully organic farm yard manure and Neem leaf. In the case of groundnut cultivation, the authors found that the cultivation of Organic and conventional systems did not differ.

### **Summary of Review on Comparison of Cost**

1. As evident from the review of cultivation under organic farming in most cases, costs are relatively lower than that of the costs in conventional farming.
2. Majority of the reviewed studies show that the costs incurred by organic farms are lower than the cost incurred by the Conventional farms (Banerjee, 2010; Raj et al., 2005; Eyhorn et al., 2007; Forster et al., 2013; Ghimire et al., 2013; Gosavi, 2009; Kumar et al., 2009; Mehmood et al., 2011; Naik et al., 2012; Namdev et al. 2011; Reddy, 2010; Samie et al., 2010; Sharma et al., 2010; Kshirsagar, 2006, 2008; Singh et al., 2011; Sudheer, 2013; Sujatha et al., 2006; Thakur et al., 2005; Tholkappian, 2014).
3. There were also few studies that found mixed results. These studies found lower cost for organic farming in some of the sample crops and locations and vice-versa for other crops and locations (Charyulu et al., 2010; Ramesh et al., 2010; Reddy et al., 2004; Singh et al., 2011).
4. Besides, some studies found the cost incurred under organic farms is similar or only marginally different from conventional farms. (Adhikari, 2009, Naik, 2010, Thennarasu et al.. 2011, Tholkappian 2014a).
5. Again it must be noted that majority of the studies showing lower organic costs were conducted in areas of green revolution where input intensive conventional farming is practiced. Hence costs saving due to avoiding costly inputs like chemical fertilizers and plant protection inputs have played an important role in reducing the cost of organic agriculture.

6. Despite higher expenditure by many organic farms on labour cost, the over-all cost advantage is retained by the organic farms. It is important to note that many of these studies have also included imputed cost of family labour in their cost calculation (Kshirsagar, 2006; Charyulu et al., 2010, Naik et al., 2012; Sudheer, 2013; Sujatha et al., 2006; Samie et al., 2010). Despite this, these studies found that the costs incurred by organic farms are generally lower than the Conventional farms' cost.
7. It is important to note that the studies covering pepper, lemon, banana and coffee have obtained lower organic costs than conventional counterparts (Banerjee, 2010; Ramesh et al., 2010; Tholkappian, 2014a).

### **Price of Product in Organic and Inorganic Agriculture**

Tholkappian (2014) found that organic betel leaves' price was higher than the conventional betel leaves in Thanjavur District, Tamil Nadu by 28.6 per cent. The organic betel leaves commanded had a price of Rs. 18 per bundle (100 leaves), whereas the conventional farm had a price of Rs.14 per bundle. Tholkappian (2014a) found that the price per bunch of organic banana was not much different than conventional banana in Erode and Thanjavur districts of Tamil Nadu. The price was marginally lower for organic banana in Erode district by 1.3 per cent and higher by 2.4 per cent in Thanjavur district. Forster et al. (2013) found that Organic Cotton received a premium price in their study area in Madhya Pradesh during the entire study period. Organic cotton experienced a higher price by 20.2 per cent in 2007, 12.3 per cent in 2008, 10.5 per cent in 2009; and 8.2 per cent in 2010. However no premium price existed for Organic Soyabean and wheat due to local market conditions. Sudheer (2013) in his comparative study of organic and conventional farming covering paddy, redgram and groundnut did not find evidence of premium price. The author attributed this to lack of organic products certification, whereby they were selling in the market, without labelling at a 'normal' prices. Thennarasu et al. (2011) found that sugarcane farmers who adopted bio-inputs in Cuddalore district fetched the more price for their produce as non-adopters. Singh et al. (2011) in their study in Patiala and Faridkot district, Punjab show that the price fetched for organic wheat was higher than the price fetched for conventional wheat, by 114.0 per cent. While the conventional wheat obtained a price of Rs.1,050 per quintal, the organic wheat obtained a premium price of Rs.2,250 per quintal in the market. Ramesh et al. (2010) observed organic farming's status in relation to conventional farming in India. They found that the organic farming, in spite of the reduction in crop productivity by 9.2 per cent, provided higher net profit to farmers by 22.0 per cent compared to conventional farming. This was mainly due to the availability of premium price from 20 to 40 per cent for the certified organic produce and reduction in the cost of cultivation by 11.7 per cent. In cases, where such premium prices were not available and the cost of cultivation was higher primarily due to purchase off-farm inputs, organic farming was not found economically feasible. Sharma et al. (2010) in their study in Punjab, the price obtained by the organic paddy was higher than the price obtained by conventional paddy. Banerjee (2010) in their study in Bihar found that Organic Banana was receiving a premium price. The price of organic farming was less by 29.4 per cent. Samie et al. (2010) in their study in Sheikupura district, Pakistan find that the price of organic wheat (Rs.450 per mond) was the same as conventional wheat. Charyulu et al. (2010) found that premium price was available for organic wheat both in Punjab and Uttar Pradesh. For other crops the results were mixed. While organic sugarcane in UP, organic paddy in UP and Cotton in Punjab didn't get premium price, the organic sugarcane in Maharashtra, organic cotton in Gujarat and organic paddy in Punjab were getting a premium price. Kumar et al. (2009) found that after farmers switched away from chemical pesticides and fertilizers, they experienced a premium prices in the range of 14.0-33.0 per cent for vegetables, red gram (lentils), chilli peppers, cotton and rice. Despite non-certification, these organic produces commanded premium price due to growing recognition of the benefits of pesticide and fertilizer-free lentils, cereals and vegetables, in the urban retail market. Adhikari (2009) found that the organic carrots were not receiving premium price. This was due to the existence of same marketing channel for organic and conventional carrots, which did not differentiate between the organic and conventional produce. Eyhorn et al. (2007) found that organic cotton in Madhya Pradesh received a price premium during 2003 and 2004. A private company dealing in organic cotton, purchased the cotton with a 20.0 per cent price premium over actual market rates. Kshirsagar (2006) in his study of economics of organic and conventional sugarcane cultivation in Maharashtra found that Organic sugarcane farmers experienced higher premium price. Thakur et al. (2005) in their comparative study of Organic

Farming System vis-à-vis Conventional Farming System found availability of higher premium price in case of OFS for Maize (kharif), Wheat (rabi), Peas (also inter-crop) and Rajmah (bean).

### **Summary of Review on Comparison of Price**

1. Many of the available studies of economics of organic and conventional farming have not reported the price differences between organic and conventional products. Hence the inference is based on the findings reported by studies that have reported the price differences between organic and conventional products.

2. Majority of the studies revealed that organic produce obtained a premium price.

3. Majority of the reviewed studies show that the price obtained by organic farms is higher than the price obtained by the Conventional farms (Banerjee, 2010; Kumar et al., 2009; Naik, et al. 2012; Namdev et al., 2011; Kshirsagar 2006, 2008; Ramesh et al., 2010; Sharma et al., 2010; Singh et al., 2011; Thakur et al., 2005; Tholkappian, 2014). Studies also found that part of the sample crops and locations covered by them got premium price (Charyulu et al., 2010; Eyhorn et al., 2007; Forster et al., 2013).

4. There are also studies which found that organic crops did not command premium price or they were only marginally higher (Adhikari, 2009; Samie et al., 2010; Sudheer, 2013; Thennarasu et al., 2011; Tholkappian, 2014a). The main reasons for non-availability of premium price were lack of certification and local market conditions for certain produces.

5. Ramesh et al. (2010) covering pepper, banana, and coffee reported that premium price is obtained for most organic produce. Similarly, Banerjee (2010) reported premium price for banana, whereas Tholkappian, (2014a) reported marginal difference in price between organic and conventional banana.

### **Yield of Crop in Organic and Inorganic Agriculture**

Te Pas and Rees (2014) addressed the differences between conventional and conventional farming based on yield. The study results demonstrate that under organic management, yields were on an average 26 per cent higher than the counterpart. Highest yield increases in organic cropping systems were achieved in the least developed countries, in arid regions and on coarse soils. Tholkappian (2014) found that the organic betel leaves had 15.2 per cent lower yield than the betel leaves yield in the conventional farm. The organic farms yield was 4200 packs (of 100 leafs) per acre, whereas the conventional farm yield was 4950 packs (of 100 leafs) per acre. Ghimire et al. (2013) found that the yield of organic tomato growers was 11.0 per cent lower than yield rates under conventional tomato before adopting organic farming methods. Namdev et al. (2012) examined the cost and return analysis of conventional and organic farming practices for paddy cultivation in Jabalpur district of M.P. The average yield per hectare of paddy crop was found maximum among conventional farms (21.92 q/ha) than the organic farms (14.88 q/ha). The price of organic paddy was relatively higher than conventional paddy and the net income and output-input ratio were also higher among organic farm. Sharma et al. (2010) based on the 3 year experimental study (2008-2010) at model organic farm at Jodhpur, Rajasthan reported that the after 2-3 years the yield rates obtained at organic farms are higher than the yield rates obtained in the conventional farms. Mehmood et al. (2011) in their study in Sheikhpura district of Punjab province, Pakistan, found that the average yield per acre under organic farms were lesser than the conventional farms. Thennarasu et al. (2011) found that sugarcane farmers who adopted bio-inputs in Cuddalore district, Tamil Nadu obtained a yield of 123 tons per ha compared to 114 tons per ha obtained by non-adopters. The yield rates among the sample bio-input adopters were 7.9 per cent higher than non-adopters. Singh et al. (2011) in their study in Pataila and Faridkot district, Punjab, show that organic wheat yield was much lesser than conventional wheat. Conventional wheat had a yield of 19.5 quintal per acre which was 57.3 per cent higher than organic yield. Sharma et al. (2010) in his study of in Cuddalore district, Tamil Nadu found that farmers using organic input in sugarcane production were able to get 7.0 per cent higher yields than farmers who were not willing to adopt organic inputs. Panneerselvam et al. (2010) in their study cover five crops, including Cotton (irrigated), Cotton (rain fed), wheat, paddy and peanut and found that yield levels of sample organic farms for all these crops were lesser than

sample conventional farms. The study reported an average yield of 1322, 1044, 1250, 3392 and 1246 kg per ha for Cotton (irrigated), Cotton (rain fed), wheat, paddy and peanut, respectively in conventional farms. The reported yield rates from organic crops were lower by 22.0, 12.0, 39.9, 20.6 and 13.0 per cent respectively as compared to conventional crops. Samie et al. (2010) in their study in Sheikupura district, Pakistan found that the organic wheat yield was 11.7 per cent lower than the conventional yield. The yield of wheat was 25.7 mounds in organic farms compared to 29.1 mounds in conventional farms. Sharma et al. (2010) in their study in Punjab found that the yield difference between organic and conventional paddy were not significantly different. The organic paddy yield was 21.65 quintal that was only marginally lesser than 22.99 quintal of conventional paddy. Charyulu et al. (2010) found general lower yield levels in organic production system. The Organic Cotton was found to have relatively lower yield both in Punjab (36.3 per cent) and Gujarat (10.8 per cent). The organic paddy and wheat, both in Punjab (37.5 per cent and 74.5 per cent respectively) and UP (19.0 per cent and 10.7 per cent respectively), was experiencing relatively lower yield. However as an exception, Organic sugarcane had higher yield in UP (11.0 per cent) and was marginally higher in Maharashtra. Naik (2010) found that the yield of Organic tomato in Belgaum District, Karnataka was lesser than Tomato yield in conventional farms by 19.6 per cent. Similarly, the yield of Chilli in organic farms in Belgaum District, Karnataka was 18.5 per cent lower than yield of Chilli in conventional farms. Reddy (2010) in his study in Anantapur, Andhra Pradesh revealed that average yield in organic farms were lesser than conventional farms. The author found that farmers reported a yield reduction of 15.0 to 25.0 per cent during initial years of shifting to organic farming. Kumar et al. (2009) found that farmers have either maintained or marginally increased their yield after they switch away from chemical pesticides and fertilizers. They found that yield rates for cotton, chilli, pepper, and groundnut remained same as conventional agriculture. In the case of red gram and paddy, the organic yields were around 9.0 per cent higher than yield from conventional farming. Gosavi (2009) in his study in Maharashtra found that yields in organic farms were higher than conventional farms. The author found that organic yields were higher for fruits and vegetables (6.7 per cent), sugarcane (13.3 per cent), paddy (11.4 per cent), wheat (22.2 per cent), groundnut (22.2 per cent), and soyabean (31.1 per cent). The only crop where the author found lesser yield from organic farmers was Jowar that had 33.3 per cent lesser yield than their counterpart. Kshirsagar (2006) showed that organic sugarcane farmers had 7.7 per cent lower yield than conventional farmers. However the author notes the possibility of improving relative yield in organic sugarcane some years after the conversion. Sujatha et al. (2006) in their study in Karimnagar, Andhra Pradesh found the yield levels to be lower in organic paddy and cotton farms than the comparable conventional farms. These were 10.1 and 12.9 per cent lower than the yield rates in conventional paddy and cotton farms.

### **Summary of Review on Comparison of Yield**

1. The study evident that organic yields are, on average, lower than conventional yields. The studies also suggested that organic yields can catch-up or be higher than conventional yields. This was largely evident when sample organic farms were better managed as per their agro-ecological needs. Evidences also pointed out that organic farms could perform relatively well during time of droughts or in locations where less input intensive agriculture was practiced.

2. Majority of the studies reviewed show that the yield obtained from organic farms are lesser than the yield obtained from Conventional farms (Banerjee, 2010; Ghimre et al., 2013; Kirshingar, 2006, 2008; Mehamood et al., 2011 Naik, 2010; Naik et al., 2012; Namdev et al., 2011; Panneerselvam et al., 2010; Reddy, 2010; Samie et al., 2010; Singh et al., 2011; Sujatha et al., 2006; Tholkappian, 2014). However the evidences are not as clear as the global literature claims. In many studies, organic farms' yield is only marginally lower or similar (Adhikari, 2009; Charyulu et al., 2010; Forster et al., 2013; Kumar et al., 2009; Sharma et al., 2010; Tholkappian, 2014a). Similarly, there are studies which show relatively higher yields obtained by organic farms (Raj et al., 2005; Sharma et al., 2010; Thennarasu et al., 2011). Besides, some multi-crop studies showed mixed results (Charyulu et al., 2010; Gosavi, 2009; Ramesh et al., 2010). These studies found that in some crops organic farms have yield advantage and in other crops conventional farms have the yield advantage.

3. These studies which have taken conversion period into account have found that over years organic yield become equal or higher than conventional yields (Eyhorn et al., 2007; Forster et al., 2013; Sharma et al., 2010; Thakur et al., 2005). These studies have found that organic farming could give higher or equal yields compared to chemical farming after an initial period of conversion ranging between 3-4 years, when soils develop adequate biological activity.

4. Some studies have chosen study areas where NGOs or Companies support the organic farmers to adopt best possible organic farming methods, which depend upon the local agro-ecological conditions (Raj et al., 2005; Eyhorn et al., 2007; Forster et al., 2013). Hence availability of support and advice for implementing organic farming principles could be an important factor that enables organic farming to equal conventional farming yield.

5. Analysis of the available literature show that the organic yields consistently fared poorly in comparison to conventional yield in the case of food grains- rice (Charyulu et al., 2010; Namdev et al., 2011; Pannerselvam et al., 2010; Sujatha et al., 2006) and wheat (Charyulu et al., 2010; Pannerselvam et al., 2010; Ramesh et al., 2010; Samie et al. 2010; Singh et al., 2011; Mehmood et al., 2011). However, certain crops like cotton and sugarcane had an equal number of studies on opposing camps. That is accounting for by relatively more yields in organic farms.

6. The studies covering lemon and coffee, have obtained organic yields that were lesser than conventional yields (Ramesh et al., 2010). One study found organic yields to be relatively lower (Banerjee, 2010) and other study found marginal difference between organic and conventional yield (Tholkappian, 2014a). In the case of pepper, a study showed that organic yields were relatively lower (Ramesh et al., 2010) and one study showed that after the conversion period the yield rates of organic pepper match the yield rate of conventional pepper (Kumar et al., 2009).

### **Return from Organic and Inorganic Agriculture**

Tholkappian (2014) found that the net return of organic betel leaves was higher than the conventional betel leaves in Thanjavur District, Tamil Nadu by 22.9 per cent. The organic farms had a net return of Rs.45,212 per acre, whereas the conventional farm had a net return of Rs.36,802 per acre. Singh et al. (2011) revealed highest grain yield of wheat was recorded in organic cultivation mode in the year 2010-11. Economic analysis of different cropping systems revealed that during 2006-07, 2007-08 and 2010-11, highest net return was recorded in organic mode of cultivation. Panneerselvam et al. (2010) made a comparative analysis of farm production, input cost, crop yield, and income between conventional and organic farming systems in two states of India: Madhya Pradesh and Tamil Nadu. The findings of the study indicated that organic farming reduced the input cost without affecting the net margin in all the three states. Sudheer (2013) found that net income of organic holdings was higher than conventional holdings. The net income per acre of organic farms for paddy, redgram and groundnut was 58.9 per cent, 49.3 per cent and 146.0 per cent higher than the net income from conventional farm. The net income from organic farms is also higher across small, medium and large farms for all crops, except red gram cultivated in small farm. Ghimire et al. (2013) found that the net return per ropani of tomato growers was 14.1 per cent higher after adopting organic farming methods. The net return per ropani for organic tomato is Rs.11,916 as compared to Rs.10,443 obtained by conventional tomato. Forster et al. (2013) in their experimental study during 2007-2010, revealed that the organic cropping system consisting of wheat, cotton and soyabean were obtaining significantly higher margin (25.0 per cent) than the conventional cropping system. Crop specific results indicated that the conventional cotton obtained a lower margin during (2009-2010) by 32.0 per cent. Naik et al. (2012) conducted an economic analysis of organic and conventional chilli cultivation and its marketing. The main aim was to analyse type, pattern and level of use of manures, fertilisers and plant protection measures and cost involved under both types of farming in Belgaum district of north Karnataka using budgeting technique. The study found that switching over to organic farming minimises environmental degradation and brings higher net returns. Thennarasu et al. (2011) found that sugarcane farmers who adopted bio-inputs in Cuddalore district, Tamil Nadu earned a net returns of Rs.82,665 per ha compared to Rs.74,646 per ha obtained by non-adopters. The net return earned by the sample bio-input adopters was found to

be 10.7 per cent higher than non-adopters. Mehmood et al. (2011) in their study in Sheikhpura district of Punjab province, Pakistan, found that the net returns per acre of wheat under organic farms were less than the conventional farms. The net return in the organic wheat was found to be 14.7 per cent lower than the conventional wheat. However, the benefit cost ratio of the organic farm (1.08) was higher than the conventional farm's benefit cost ratio (1.01). Namdev et al. (2011) in their comparative study of organic and conventional paddy economics in Jabalpur district, Madhya Pradesh found that the average net returns per acre under organic was higher than that of conventional farms. The net return obtained under organic paddy was 32.1 per cent higher than the net returns obtained under conventional paddy. Samie et al. (2010) have made a comparative analysis between economics of partial organic farming and conventional farming systems in Punjab, Pakistan. The results showed that Net Returns Per Rupee Invested was higher for all crops in the organic farming system than the conventional farming system under the assumption when family labour cost was zero in the organic farming system. The high NRPRI in organic farming system was due to less cash inputs. However, the conventional farming system's optimum per day profit was relatively higher (when family labour cost was included) than the organic farming system. Charyulu et al. (2010) in their study of economics and efficiency of organic farming in Gujarat, Maharashtra, Punjab and U.P covering cotton, sugarcane, paddy and wheat found that organic sugarcane and wheat were getting higher net and gross margins. Whereas organic paddy was obtaining lower net returns and the results were mixed for cotton. Banarjee (2010) has made a comparative economic analysis of banana cultivation. The study revealed that the cost of banana cultivation per hectare is very low which stood at Rs. 39,750 as compared to the cost of banana cultivation per hectare at Rs. 56,300. The study pointed out that banana cultivation under organic farming is highly viable for all categories farming compared to conventional farming under which the cost of cultivation for all activities is high. Eyhorn et al. (2007) found that organic cotton obtained a higher gross margin than conventional cotton during two years of study (2003 and 2004) in Madhya Pradesh. In 2003 and 2004, the margin under organic cotton was higher than conventional cotton. The study found that difference in gross margins was not significantly different with respect to the rotation crops (maize, pigeon peas, sorghum, soyabean, wheat and chilli). Kshirsagar (2006) has made a comparative cost and return analysis on organic and conventional farming. The study revealed that organic farming is labour intensive as compared to conventional farming, but its cost of cultivation is lower due to saving on chemical fertilizers, irrigation, seeds, and agrochemicals. By and large, it could be concluded that regarding cost, it is high in conventional and the return is high under organic farming. Sujatha et al. (2006) in their study in Karimnagar, Andhra Pradesh explored that the net returns were 2.0 per cent and 69.5 per cent higher than conventional paddy and cotton. Similarly, relatively higher benefit-cost ratio was obtained in organic paddy and cotton. Raj et al. (2005) in their comparative study of Organic and conventional farming in 2004 at Karimnagar, District, Andhra Pradesh, found that profitability of organic cotton along with their intercrop is significantly higher than that of conventional cotton and inter-crop. The study also found that the net-income in organic cotton (excluding intercrop) was only marginally higher than conventional cotton and was not significantly different. Thakur et al. (2005) in their comparative study of Organic Farming System vis-a-vis Conventional Farming System found that organic farmers were experiencing relatively higher net-income for peas, maize, rajmah and wheat. The study also found that net income increased 2-3 times over four years while it was stagnant or even declined in Conventional farming.

### **Summary of Review on Comparison of Return**

1. Most of the studies reviewed show that the organic farms have obtained relatively higher net-returns than conventional farming (Banerjee, 2010; Forster et al., 2013; Ghimire et al., 2013; Gosavi, 2009; Namdev et al., 2011; Naik et al., 2012; Reddy et al., 2004; Sharma et al., 2010; Kshirsagar 2006, 2008; Singh et al., 2011; Sudheer, 2013; Sujatha et al., 2006; Thakur et al., 2005; Thennarasu et al., 2011; Tholkappian, 2014).

2. Except one exception (Eyhorn et al., 2007) long term studies reporting net returns have shown that organic farms obtained a higher net return throughout the study period (Thakur et al., 2005) or over a period of years (Forster et al., 2013; Reddy et al., 2004). The higher net returns in these studies were largely experienced due to lower costs or premium price or a combination of both. In certain cases, higher yields have also come to play a role along with premium price and low cost.



3. A few studies show that net-returns obtained by organic farms were similar or marginally different from that of conventional farming (Adhikari, 2009; Raj et al., 2005, Tholkappian, 2014).

4. There are few studies on multiple crops that found instances where net-returns obtained by organic farms were both higher and lower than conventional farming (Ramesh et al. 2010; Charyalu et al., 2010). Only few studies found that net-returns obtained by organic farms were lower than the conventional farming (Eyhorn et al., 2007; Mehmood et al., 2011; Samie et al., 2010). The lower net returns in these studies were due to the fact that yield disadvantage could not be offset with the help of price and cost advantage or a combination of both.

5. Ramesh et al. (2010) studying coffee, pepper and banana crops have obtained crop wise organic net-returns that were higher than net returns obtained by conventional farms. However, Tholkappian (2014) studied about the banana crop and found that net-returns obtained by organic farms were marginally different from conventional farms.

## Conclusion

Based on the literature review, it can be summarised that organic farming opinions are divided, particularly among experts. Disagreements about the profitability and increase in yield of organic farming are also there. However, the majority of the studies advocate that organic farming in most cases; costs are relatively lower than that of the costs in inorganic farming and organic farms have secured relatively higher net-returns than inorganic farms. Most of the studies also supported that organic produce obtained a premium price. The study also revealed that over the last decade, the organic agriculture sector has received greater attention due to it being seen as a possible solution to existing agricultural sector problems. Organic farming can deliver benefits in terms of environmental protection, conservation of non-renewable resources and improvement of food quality. India has a great deal of potential to produce all organic products varieties due to its diverse agro-climatic regions. In several parts of the country, the heritage of organic farming is an added advantage. The study suggests that the government had to set a minimum support price for organic vegetables, which encourage the establishment of exclusive organic vegetable marketing centres and the development of organic vegetable supply chain systems. The farmers should be trained in the production of vermicompost. Moreover, provision of subsidies for inputs such as seeds, bio-fertilizers, bio-pesticides etc., credit facilities, adequate training programmes, sufficient inputs and a regulated market for organic products are very much required for the enhancement of organic farming in India.

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