

# The Comparative Cost and Profit Analysis of Organic and Non-organic Farming Practices in the Mid Himalayan Region

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## ABSTRACT

The experiment was laid out in split plot design with three farming practices as main plots and four cropping systems as subplots with three replications. Among the farming practices organic farming practice (7571.40 kg ha<sup>-1</sup>) resulted in significantly highest MGEY where as production efficiency was found to be significantly higher under organic farming practice (20.74 kg ha<sup>-1</sup> day<sup>-1</sup>) which remained at par with integrated farming practice (19.97 kg ha<sup>-1</sup> day<sup>-1</sup>) and were found superior over inorganic farming practice. With non premium pricing inorganic farming practice resulted in lowest cost of cultivation and higher B:C ratio and Integrated farming practice resulted in higher net returns over organic farming practice. While, with the premium pricing of organic produce organic farming practice resulted in higher gross and net returns over inorganic farming practices. It is the premium price that makes organic systems more profitable. However, even without premiums, organic systems may be more profitable than conventional systems in the long run as organic management will enhance overall farm value.

## Highlights

- ① Organic farming practice resulted in higher Maize grain equivalent yield and production efficiency over integrated farming practice and inorganic farming practice.
- ② Premium price makes organic systems more profitable over conventional farming.

**Keywords:** conventional, farming practice, inorganic, organic, premium price

Sustainable development has caught the imagination and action all over the world for more than a decade. Environmental impacts of agricultural production processes, in fact, are influenced by the climate, the soil type, the agricultural practices and many other factors that make impacts extremely variable and, subsequently, hard to control and reduce. In this context, organic farming aims at being climate friendly with respect to conventional farming, by granting a lower carbon footprint and reduced environmental impacts. India is bestowed with lot of potential to produce all varieties of organic products due to its agro-climatic regions. In several parts of the country, the inherited tradition of organic farming is an added advantage. This holds promise for the organic producers to tap the market

which is growing steadily in the domestic market related to the export market. Organic farming systems have attracted increasing attention over the last one decade because they are perceived to offer some solutions to the current problems in the Indian agricultural sector. However, some farmers are reluctant to convert because of the perceived high costs and risks involved in organic farming. Despite the attention which has been paid to organic farming over the last few years, very little accessible information actually exists on the costs and returns of organic farming in India. So, since profitability is the most important factor for a farmer, in this paper the objective of our study was to analyze the economics of organic *vis-a-vis* non-organic (conventional) farming practices in India.



## METHODOLOGY

The present study entitled, "Comparative performance of organic and inorganic farming practices on productivity of different cropping systems" was carried out at Organic Research Farm, Department of Organic Agriculture, College of Agriculture, CSK HPKV, Palampur. The present experiment with twelve treatments, combinations of three farming practices i.e.  $M_1$ - inorganic farming practice (RDF),  $M_2$ - integrated farming practice {Vermicompost (5 t ha<sup>-1</sup> for cereals and 2.5 t ha<sup>-1</sup> for pulses) + 50% RDF through chemical fertilizers} and  $M_3$ -organic farming practice {Soil treatment with jeevamrit (10%), seed treatment with biofertilizers + vermicompost (10 tonnes vermicompost ha<sup>-1</sup> for cereals and 5 tonnes vermicompost ha<sup>-1</sup> for pulses) followed by 3 sprays of organic liquid manure (vermiwash 10%) at 15 days interval} in main plots and four cropping systems i.e.  $S_1$ - maize – wheat ,  $S_2$ - maize – gram,  $S_3$ - mash – wheat and  $S_4$ - mash – gram cropping systems in sub plots was laid out in split plot design with three replications to examine the performance of organic and inorganic farming practices on productivity of different cropping systems. The crops were raised in accordance with the recommended package of practices for the region (Anonymous 2007a and 2007b; Rameshwar *et al.* 2014). Yields were harvested from net plot. For comparison between cropping sequences, the yields of crops were converted into maize-grain equivalent yield (MGEY) on price basis (Rana *et al.* 2011). Productivity (kg ha<sup>-1</sup> day<sup>-1</sup>) was obtained by dividing total production in terms of maize equivalent in sequence by 365 days. Economics of the crop sequences was computed based upon the prevailing prices of inputs used and the output realised. The cost of cultivation of different crops individually and for crop sequences were calculated. The yields of different crops in various crop sequences were converted into gross returns in rupees. Further, net returns and benefit to cost (B:C) ratio was also calculated as per the formulae given below:

$$\text{B: C ratio} = \frac{\text{Net returns (₹ ha}^{-1}\text{)}}{\text{Cost of cultivation (₹ ha}^{-1}\text{)}}$$

$$\text{Net returns (₹ ha}^{-1}\text{)} = \text{Gross returns (₹ ha}^{-1}\text{)} - \text{Cost of cultivation of crop (₹ ha}^{-1}\text{)}$$

## RESULTS AND DISCUSSION

### Maize Grain Equivalent Yield (MGEY)

Results from the study suggest that MGEY was significantly affected by different farming practices during both the years under study. The results revealed that organic farming practice ( $M_3$ ) produced significantly highest MGEY followed by integrated farming practice ( $M_2$ ). While, inorganic farming practice ( $M_1$ ) resulted in significantly lowest MGEY. The higher MGEY under organic farming practice was owed to high yields of pulses under organic management and also to their higher prices over cereals. The mounting effect of these two factors resulted in higher MGEY under organic management. The results are in conformity with that of Abadi *et al.* (2012) and Jaybhay *et al.* (2015) who reported superiority of equivalent yields under organic farming practice over conventional farming practice.

A perusal of the data (Table 1) further revealed that maize – wheat ( $S_1$ ) cropping system resulted in significantly highest MGEY during both the years of experimentation. This was followed by mash – wheat ( $S_3$ ) and maize – gram ( $S_2$ ) cropping systems during the first year. However, during the second year maize – wheat cropping system ( $S_1$ ) remaining at par with mash –wheat cropping system ( $S_3$ ) resulted in significantly higher MGEY over other cropping systems. These were followed by mash – gram ( $S_4$ ) and maize – gram ( $S_2$ ) cropping system which did not differed significantly. Mash – gram ( $S_4$ ) cropping system resulted in lowest MGEY during both the years. The higher tonnage of cereals under maize –wheat cropping system was the prime cause of higher MGEY under this sequence.

### Production efficiency

The production efficiency was found to be significantly higher under organic farming practice ( $M_3$ ) which remained at par with integrated farming practice and both were found to be superior over the inorganic farming practice ( $M_1$ ) during both the years. Among cropping systems, significantly higher production efficiency was recorded under maize – wheat cropping system ( $S_1$ ) which remained at par with mash – wheat cropping system ( $S_3$ ). Maize – gram ( $S_2$ ) and mash – gram ( $S_4$ ) cropping systems remaining at par with each other resulted

**Table 1:** Effect of treatments on cost of cultivation, gross returns, net returns and B:C ratio

Treatments	MGEY	Production Efficiency	Cost of Cultivation	Gross returns	Net returns	B:C ratio
<b>2014-15</b>						
<b>Farming Practices (M)</b>						
Inorganic (M <sub>1</sub> )	6319.94	17.31	45,965	1,15,868	69,903	1.49
Integrated (M <sub>2</sub> )	7036.73	19.28	52,338	1,26,195	73,857	1.39
Organic (M <sub>3</sub> )	7310.99	20.03	66,004	1,30,219	64,216	0.98
LSD (P=0.05)	198.15	1.45	—	2594	2594	0.07
<b>Cropping systems (S)</b>						
Maize-wheat (S <sub>1</sub> )	7957.34	21.80	63,243	1,55,884	92,641	1.55
Maize-gram (S <sub>2</sub> )	6181.78	16.94	55,085	1,08,889	53,805	1.01
Mash-wheat (S <sub>3</sub> )	7564.65	20.73	54,453	1,39,077	84,625	1.60
Mash-gram (S <sub>4</sub> )	5853.12	16.04	46,294	92,526	46,231	0.99
LSD (P=0.05)	305.99	1.71	—	4376	4376	0.09
<b>2015-16</b>						
<b>Farming Practices (M)</b>						
Inorganic (M <sub>1</sub> )	6618.26	18.13	44,605	1,19,909	75,304	1.66
Integrated (M <sub>2</sub> )	7288.77	19.97	51,318	1,30,464	79,146	1.53
Organic (M <sub>3</sub> )	7571.40	20.74	64,984	1,34,498	69,514	1.08
LSD (P=0.05)	222.90	1.32	—	3151	3151	0.06
<b>Cropping systems (S)</b>						
Maize-wheat (S <sub>1</sub> )	8001.11	21.92	62,336	1,57,033	94,697	1.61
Maize-gram (S <sub>2</sub> )	6303.77	17.27	53,725	1,11,720	57,995	1.11
Mash-wheat (S <sub>3</sub> )	8000.63	21.92	53,546	1,44,827	91,280	1.76
Mash-gram (S <sub>4</sub> )	6332.39	17.35	44,934	99,582	54,647	1.21
LSD (P=0.05)	278.73	1.58	—	4271	4271	0.09

in significantly lower production efficiency during both the years of study.

### Cost of cultivation

Organic farming practice resulted in higher cost of cultivation during both the years under study in comparison to inorganic farming practice. However, inorganic farming practice resulted in lower cost of cultivation over integrated and organic farming practices during both the years. Among cropping systems, maize – wheat cropping system resulted highest cost of cultivation over all other systems. It was followed by maize – gram (S<sub>2</sub>) and mash – gram (S<sub>3</sub>) cropping systems. Mash – gram cropping system (S<sub>4</sub>) resulted in lowest cost of cultivation during both the years under study. The higher production cost incurred in organic farming practice can mainly attribute to both high labour cost and production cost of vermicompost. As the preparation and use of organic materials and the

organic management was more labour intensive. These results are in line with those of Kipsat *et al.* (2004) and Adamtey *et al.* (2016).

### Gross Returns

The gross returns of farming systems was significantly highest under organic farming practice (M<sub>3</sub>) when compared to inorganic farming practices. This was followed by integrated farming practice and lowest under inorganic farming practice (M<sub>1</sub>). Highest gross returns were obtained under organic farming practice (M<sub>3</sub>) while, lowest gross returns were recorded under inorganic farming practice (M<sub>1</sub>) during both the years under study. Data further revealed that the organic farming practice and integrated farming practice recorded about 12 and 09 per cent higher gross returns over inorganic farming practice, respectively. The higher gross returns under organic farming practice is ascribed to higher yields of pulse crops under organic



treatment and their higher prices per kg over cereal crops. Similar results were reported by Vidyavati *et al.* (2011). Amongst the cropping systems maize – wheat cropping system ( $S_1$ ) resulted in significantly highest gross returns followed by mash – wheat cropping system ( $S_3$ ) and maize – gram cropping system ( $S_2$ ). While, lowest gross returns were recorded in mash – gram cropping system ( $S_4$ ). At the end of the experiment the mash – gram cropping system ( $S_4$ ) recorded lowest gross returns. While, maize – wheat ( $S_1$ ), mash – wheat ( $S_3$ ) and maize – gram ( $S_2$ ) cropping systems recorded about 52, 45 and 12 per cent higher gross returns over mash – gram cropping system.

### Net Returns

The net returns were significantly highest under integrated farming practice ( $M_2$ ) followed by inorganic farming practice and significantly lowest under organic farming practice ( $M_3$ ) during both the years of study. Integrated farming practice and inorganic farming practice resulted in 14 and 8 percent higher net returns over organic farming practice, respectively at the end of the experiment in the second year. Although, organic farming practice resulted in higher gross returns over integrated and inorganic farming practices the higher cost of cultivation under organic farming practice due to high labor use and high cost of vermicompost caused lower net returns under organic farming practice. While, integrated farming practice resulted in significantly higher net returns over organic and inorganic farming practice. Amongst cropping systems at the completion of first year of crop cycle the net returns were significantly highest under maize – wheat cropping system ( $S_1$ ) followed by mash – wheat cropping system ( $S_3$ ) and maize – gram cropping system ( $S_2$ ). While, lowest gross return was recorded in mash - gram cropping system ( $S_4$ ). However, at the end of the second year of crop cycle net returns were significantly higher under maize – wheat cropping system ( $S_1$ ) which remained at par with mash – wheat cropping system ( $S_3$ ). During both years of the experiment the mash – gram cropping system ( $S_4$ ) recorded lowest net returns. While, maize – wheat ( $S_1$ ) and mash – wheat ( $S_3$ ) cropping systems recorded about 73 and 67 per cent higher net returns over mash – gram cropping system at the end of the experiment.

### Benefit Cost Ratio

The benefit cost ratio was significantly highest under inorganic farming practice ( $M_1$ ) followed by integrated farming practice and significantly lowest benefit cost ratio was resulted under organic farming practice ( $M_3$ ) during both the years under study. Inorganic farming practice which had the lowest cost of cultivation resulted in higher benefit cost ratio over integrated and organic farming practice during the period under study. The higher production cost under organic farming practice prevented it from reaping the benefits of higher MGEY and higher gross returns. Amongst cropping systems at the completion of first year of crop cycle the benefit cost ratio was significantly higher under mash – wheat cropping system ( $S_3$ ) which remained at par with maize – wheat cropping system ( $S_1$ ) and was followed by maize – gram cropping system ( $S_2$ ). While, lowest benefit cost ratio was recorded under mash - gram ( $S_4$ ) cropping system. Whereas, after the cessation of second year of crop cycle the benefit cost ratio was significantly highest under mash – wheat cropping system ( $S_3$ ) which was followed by maize – wheat cropping system ( $S_1$ ). These were followed by mash – gram cropping system ( $S_4$ ). The, lowest benefit cost ratio was recorded in maize – gram cropping system ( $S_2$ ). Pulse – cereal cropping system ( $S_3$ ) was able to deliver higher benefit because of the positive influence of pulses on soil and the following crop in this experiment.

Comparison between a conventional farm and an organic farm in conversion is unfair as during conversion, organic farms cannot earn premiums and yield reduction is common, until farmers learn and adjust to organic farming practices and the equilibrium of the agro-ecosystem is restored. Throughout this period, financial loss can be severe: less profitable crop rotations may be required; yields may decrease due also to higher weed infestations; and normally, three or four years have to pass until crop rotations become established and yields begin to increase. According to Dabbert and Madden (1986), the rotational effect on income is not over till the sixth year, when the legumes begin to deliver their maximum contribution to the farm's nitrogen supply. Wynen (2001) showed that organic farms that had been under organic management practices for longer times achieved higher yields than the latest entrants.

**Table 2:** Effect of treatments on gross returns, net returns and B:C ratio {on the basis of premium price (25% extra) on organic produce}

Treatments	Gross returns	Net returns	B:C ratio
<b>2014-15</b>			
<b>Farming Practices (M)</b>			
Inorganic (M <sub>1</sub> )	1,15,868	69,903	1.49
Integrated (M <sub>2</sub> )	1,26,195	73,857	1.39
Organic (M <sub>3</sub> )	1,62,762	96,758	1.47
LSD (P=0.05)	2,710	2,710	0.06
<b>Cropping systems (S)</b>			
Maize-wheat (S <sub>1</sub> )	1,68,472	1,05,229	1.71
Maize-gram (S <sub>2</sub> )	1,18,421	63,337	1.15
Mash-wheat (S <sub>3</sub> )	1,51,242	96,789	1.78
Mash-gram (S <sub>4</sub> )	1,01,630	55,336	1.16
LSD (P=0.05)	4,495	4,495	0.09
<b>2015-16</b>			
<b>Farming Practices (M)</b>			
Inorganic (M <sub>1</sub> )	1,19,909	75,304	1.66
Integrated (M <sub>2</sub> )	1,30,464	79,146	1.53
Organic (M <sub>3</sub> )	1,68,110	1,03,126	1.60
LSD (P=0.05)	3,414	3,414	0.07
<b>Cropping systems (S)</b>			
Maize-wheat (S <sub>1</sub> )	1,69,735	1,07,399	1.77
Maize-gram (S <sub>2</sub> )	1,21,515	67,790	1.26
Mash-wheat (S <sub>3</sub> )	1,57,506	1,03,960	1.95
Mash-gram (S <sub>4</sub> )	1,09,221	64,287	1.40
LSD (P=0.05)	4,484	4,484	0.09

Thus, this conversion phase is the most challenging one for organic farmers and should not be taken for the purpose of comparative studies with other conventional farms. Also, the economics was calculated on the prevailing prices (Table 1) for all the crops and no premium price was applied for the organic produce and it provides us with the change in farm economics during conversion. However, to get a perspective the economic returns on the basis of premium pricing (25% higher over prevailing prices) of organic produce has been done and given in Table 2.

### Premium price

Farmers can receive premiums for various commodities thus, making organic agriculture more profitable. Data in table 2 revealed that even after applying premium prices for organic produce the trend of returns under all cropping systems remained similar as it was under non premium

pricing (Table 1). However, the gross returns and net returns were significantly highest under organic farming practice (M<sub>3</sub>). It was followed by integrated farming practice and lowest under inorganic farming practice (M<sub>1</sub>). Highest gross returns were obtained under organic farming practice (M<sub>3</sub>) while, lowest gross returns were observed under inorganic farming practice (M<sub>1</sub>) during both the years under study.

The benefit cost ratio was significantly higher under inorganic farming practice (M<sub>1</sub>) which remained at par with organic farming practice (M<sub>3</sub>) during both the years under study. Organic farming practice had the higher cost of cultivation which prevented it to generate higher benefits under non premium prices but as premium prices were applied on the organic produce it lead to increase in its net returns and subsequently benefit cost ratio under organic came at par with that of inorganic farming practice. Premiums depend on many factors – such



as commodity, location, access to organic markets and marketing skills of the farmer. In many cases, it is the premium price that makes organic systems more profitable over conventional systems. However, without premiums, organic systems may not be profitable than conventional system during early phases of conversion as shown in Table 1. However, many studies have warned that over reliance on price premium may jeopardize the long-term economic viability of organic farming (Clark *et al.* 1999). Since, the market for high-value crops can get saturated, and premiums can fall as a consequence, a strategy of diversification is advised in which lower premiums are given to all crops in the rotation.

## CONCLUSION

Generally, it is hard to conclude that which system is more profitable than the other as the profitability of a system is assessed only when economic costs are balanced against environmental and health costs of the system. At present, economic comparative studies only put economic inputs and outputs into the equation, and broadly overlook the environmental, social and health costs. Accounting for outcomes, such as costs associated with chemical run-off, spills, degradation of natural resources and human health etc. are lacking. Yet organic is most often delivering public goods such as environmental and health benefits. Taking the differences in external costs and benefits into account would give us the true profitability picture of the different systems. The findings of this study provide a number of insights into future possibilities for the adoption of organic farming as the general perception that inorganic farming practice results in higher crop yield over organic farming practice was disproved in this study. Integrated and inorganic farming practice resulted in higher yields of cereal crops *i.e.* maize and wheat. While, yields of pulse crops *i.e.* mash and gram was higher in organic farming practice over both integrated and inorganic farming practice. As the prices of pulses are higher than cereals, this led to significantly highest maize grain equivalent yield (MGEY) under organic farming practice at the end of the experiment over integrated and inorganic farming practices. Also, it is the premium price that makes organic systems more profitable. However, even without premiums, organic systems may be

more profitable than conventional systems in the long run as organic management will enhance overall farm value.

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