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Price premium is the prime factor of organic farm's profit in West Bengal

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Abstract

Organic farming is an approach to sustainable agriculture with devoid of chemical inputs. If 16 essential nutrients required for plant growth could be applied in proper quantities/doses through organic inputs, yield of crops does not decrease. The present study indicates that despite higher cost of cultivation, the production was lower in organic than inorganic system. But price of the organic product was higher than inorganic, which leads organic farm's profitability. Besides, there exists a definite positive association between consumer's monthly income and his willingness to pay higher price for organic products.

Keywords: Inorganic farming, organic farming, quality of product, price premium, consumer's willingness

Organic farming is one of several approaches to sustainable agriculture and many of the techniques used (e.g. inter-cropping, crop rotation, mulching, integration of crops and livestock) are practiced under organic agricultural as well as organic farming system. What makes organic farming unique, as regulated under various laws and certification programmes, is that (1) almost all synthetic inputs are prohibited and the natural inputs are approved in the production process, and (2) "soil building" crop rotations are mandated. These are the basic rules of organic production.

In reality, organic farming is a system of farming which devoid of chemical inputs and in which the biological potential of the soil and underground water resources are conserved and protected from the natural and human induced degradation or depletion. Organic farming allows the powerful laws of nature to increase both agricultural yields and disease resistance. Organic farming is also a rule based agricultural system in which the operator has to follow the standards of organic farming set by the certification organization.

It is the basic fact that crop requires 16 essential nutrients for plant growth. When one applies chemical fertilizer then the assurance is only for one, two, or three nutrients. When the application of organic manure is done, the availability of all the 16 essential nutrients is almost assured by some quantity. Besides nutrients, the activity of micro-organisms increase manifold in organic farming. Therefore, if equal quantity of nutrient is applied through organic manure, then the question of decrease in yield does not arise. Secondly, the leaching and evaporation losses of irrigation water will be lesser under organic conditions. Furthermore, the moisture retention capacity of the soil increases which helps to grow crops even under drought condition. In view of the above, the present study has been conducted to examine the economic viability and impacts of organic farming in West Bengal. The reference period of the study is 2007-08 to 2009-10.

Objectives

The specific objectives of the study are

(i) To study the comparative economics of crop production under organic and inorganic farming;

(ii) To study the impact of organic farming in relation to quality of produce and price premium;

Database

Only primary data have been used in this study programme. The primary data have been collected by personal interview using pre-tested survey schedule specially prepared for this purpose. Different aspects of farm operation have been obtained for both organic and inorganic farming systems. These aspects are (i) input and output record of organic and inorganic farms, (ii) cost of cultivation as well as cost of production record for selected crops of both group of farmers, (iii) record of price received from sale of products in market.

METHODOLOGY

Selection of areas

The study has been confined to two districts, namely, North 24 Parganas and Jalpaiguri in southern and northern part respectively of West Bengal. In the second stage, two blocks one from each district has been selected purposively. Two NGOs namely, SEVA and LKP, have been working in these two blocks for promoting organic farming. In the next stage, two villages viz., Panji village of Baduria block and Purba Satali village of Kalchini block of North 24-Parganas and Jalpaiguri district respectively have been selected randomly.

Selection of farmers

In the first stage, all the listed farmers have been sub-divided into five categories based on size of land holdings viz., (i) sub-marginal (below 0.50 ha), (ii) marginal (0.51 ha to 1.00 ha), (iii) small (1.01 ha to 2.00 ha), (iv) medium (2.01 ha to 4.00 ha) and (v) big (4.01 ha and above). In the next stage, 30 farmers from each organic and inorganic farming system have been selected from each village based on simple random sampling with proportional allocation. Thus, all total 120 farm households have been selected for in-depth study.

Analytical Framework

To examine the economic viability of organic farming, the comparative economics of crop cultivation as well as crop production for selected crops grown in both organic and inorganic farms have been worked out following the standard cost concepts, which are as follows:

- *Cost* A_1**:** (Hired human labour wage + Bullock labour wage + Hired machinery charges + Cost of seeds / seedlings + Cost of fertilizers + Cost of manures + Cost of insecticides & pesticides + Cost of bio-pesticides + Irrigation charges + Interest on working capital (@4% pa, e.g. KCC) + Land revenue & taxes + Depreciation on farm implements & machinery + Miscellaneous expenses).
- *Cost* A_2**:** (*Cost* A_1 + Rent for leased in land)
- Cost B_1**:** (*Cost* A_2 + Interest on fixed capital: It has been calculated as per duration of a specific crop, on the basis of an assumption of @ Rs. 0.20 per day, i.e., Rs. 6.00 per month (30 days).
- *Cost* B_2**:** (Cost B_1 + Rent for own land: It has been calculated on the basis of rent for leased in land prevailing at the area during the study period.
- *Cost C***:** (*Cost* B_2 + Imputed value of family labour).

The calculated Cost C is considered as Total Cost of Cultivation

The computation of cost of cultivation as well as cost of production for 2 root vegetable crops and 1 leafy vegetable crop in the study area have been worked out, following the applied cost concepts on the basis of input prices of organic and inorganic farm production systems prevailing in the study area. The prevailed output prices and cost of cultivation

of the selected crops have been used in computation of Return/Cost ratio during the study period. The formulae followed for these computations were as follows:

$$Cost\ of\ Cultivation\ (₹/ha) = \frac{Cost\ C}{Operated\ area\ in\ hectare}$$

$$Cost\ of\ Production\ (₹/quintal) = \frac{Cost\ C + Marketing\ cost}{Total\ production\ in\ quintal}$$

$$Return/Cost\ Ratio = \frac{Total\ output\ in\ monetary\ term}{Cost\ C}$$

Net Farm Income (₹/ha) = Gross Revenue (₹/ ha) - Cost C

Tabular presentation for understanding the comparative economics of crop production under organic and inorganic farming through the estimation of *Cost of Cultivation*, *Cost of Production* and *Return – Cost Ratio* has been done.

The estimation and test of significance

To test whether there is a significant difference between organic and inorganic farming in respect of total cost, net return and return – cost ratio, the difference between average values of estimated total cost per hectare, net return per hectare and return - cost ratio for selected crops under organic and inorganic practices in the study area has been tested having used *t* test for mean difference. The test of significance is based on the underlying assumptions:

1. The two populations are normal distributions with mean μ_1 *and* μ_2 and a common standard deviation (s.d.*) is* σ.
2. The two samples are randomly drawn and independent.

We test the null hypothesis H_0 ($\mu_1 = \mu_2$) against the alternative hypothesis H_1 ($\mu_1 \neq \mu_2$).

The appropriate test statistic is *Fisher's t*, which, under H_0, follows *t* distribution with $(n_1 + n_2 - 2)$ degrees of freedom (d.f.).

An estimate of the common but unknown *s.d.* (σ) is obtained from

$$s = \sqrt{\frac{n_1 S_1^2 + n_2 S_2^2}{n_1 + n_2 - 2}}$$

Where, S_1 = Sample standard deviation of group 1

S_2 = Sample standard deviation of group 2

n_1 = Number of observation in group 1

n_2 = Number of observation in group 2

The observed value of the statistic is

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

With *degrees of freedom* $(n_1 + n_2 - 2)$

Where, $\bar{x}_1$ = Sample mean of group 1

$\bar{x}_2$ = Sample mean of group 2

n_1 = Number of observation in group 1

n_2 = Number of observation in group 2

Since the alternative hypothesis is both-sided, *t* test is two-tailed.

The results of the *t* test have been presented in tabular form.

The tabular analysis for studying the impact of organic farming in relation to quality of produce and price premium based on perception of consumers' of various income groups has been done. An exercise has been carried out to get an estimate of the degree of association between consumer's level of monthly income and his willingness to pay higher price for organic products. For the purpose we used the χ^2 statistic that tests the independence of attributes. The result was tested against the null hypothesis:

H_0 = Consumer's monthly income level and consumer's willingness to pay higher price are independent, with alternative hypothesis being

H_1 = Consumer's monthly income level and consumer's willingness to pay higher price are associated.

$$\chi 2 = \sum \left\{ \frac{(f_0 - fe)^2}{fe} \right\}$$

Where, f_0 = Observed frequencies of respective cells

f_e = Expected frequencies of respective cells

This approximately follows a chi-square distribution with degrees of freedom (d.f.) = (number of rows – 1) x (number of columns – 1)

Results and discussion

Comparative economics of Radish and Carrot cultivation

Radish and carrot are two important root vegetable crops grown commercially during summer (off-season) also in contrast to the growing season in winter in West Bengal and other parts of India. Therefore, like other off-season vegetables radish and carrot fetch also higher return. These are well preferred by the local people. Majority of grower of the state follows inorganic way of cultivation method for these crops. The cost of cultivation per hectare of radish and carrot was higher for organic than inorganic farm. The productivity per hectare comes out as 152.49 qtl. and 153.13 qtl. in organic farm and 164.97 qtl. and 156.74 qtl. in inorganic farm for radish and carrot respectively. The higher productivity in inorganic farms was contributed by the use of inorganic fertilizers. Applied organic manures were not enough to become substitute of inorganic fertilizers in respect of nutrients values for both the crops. The expenses for bio-pesticides and chemical pesticides in organic and inorganic radish and carrot cultivation were almost same. The estimated gross return, net return and return-cost ratio was higher for organic farm as compared to inorganic one for both the crops (Table 1).

Table 1: Comparative economics of Radish and Carrot cultivation

(₹ per hectare)

Cost Items	Radish		Carrot	
	OFS	IFS	OFS	IFS
	3 yrs. average	3 yrs. average	3 yrs. average	3 yrs. average
1	2	3	4	5
Cost A_1	37,694.61	22,813.00	39,978.51	23,816.94
Cost A_2	37,694.61	22,813.00	39,978.51	23,816.94
Cost B_1	37,712.61	22,831.00	39,996.51	23,834.94
Cost B_2	39,862.22	24,964.56	42,143.04	25,971.37
Cost C	44,458.26	29,123.91	46,953.30	29,429.09
Yield(qtl/ha)	152.49	164.97	153.13	156.74
Price(Rs/qtl)	558.73	298.44	681.13	411.99
By product	0.00	0.00	0.00	0.00
Price of by prodt.	0.00	0.00	0.00	0.00
Gross return(Rs)	85,200.74	49,233.65	104,301.44	64,575.31
Net return(Rs)	40,742.48	20,109.74	57,348.14	35,146.22
R / C ratio	1.92	1.69	2.22	2.19
Total cost/ha	44,458.26	29,123.91	46,953.30	29,429.09
Total cost/qtl	291.55	176.54	306.62	187.76

Source: Field survey

It has also been observed that there was more or less same expenditure on seed and plant protection materials in both the systems of farm operation and comparatively lower expense for irrigation purpose in organic farm. But the study revealed a large difference in Cost C between organic and inorganic system. In fact, huge amount has been incurred in per hectare cost of manures in organic farms as compared to per hectare cost of fertilizers in inorganic farms (Table 2).

Table 2: Comparative *Cost* A_1 of Radish and Carrot cultivation

(₹ per hectare)

Cost Items	Radish				Carrot			
	OFS		IFS		OFS		IFS	
	3 yrs. average cost (₹)	Share to Cost A_1 (%)	3 yrs. average cost (₹)	Share to Cost A_1 (%)	3 yrs. average cost (₹)	Share to Cost A_1 (%)	3 yrs. average cost (₹)	Share to Cost A_1 (%)
1	2	3	4	5	6	7	8	9
Hired human lab. wage	5,483.32	14.55	5,438.32	23.84	5,874.13	14.69	4,528.49	19.01
Bullock lab. charge	1,519.60	4.03	1,499.32	6.57	1,543.35	3.86	1,551.10	6.51
Hired machinery charge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cost of seed / seedling	11,017.02	29.23	10,862.14	47.61	10,825.82	27.08	10,881.16	45.69
Cost of fertilizers	0.00	0.00	2,591.47	11.36	0.00	0.00	3,735.22	15.68
Cost of manures	17,191.06	45.61	0.00	0.00	18,794.30	47.01	0.00	0.00
Cost of pp materials	0.00	0.00	409.56	1.80	0.00	0.00	563.39	2.37
Cost of bio-pp materials	488.57	1.30	0.00	0.00	505.13	1.26	0.00	0.00
Irrigation charge	1,630.57	4.33	1,793.94	7.86	2,055.83	5.14	2,327.72	9.77
Interest on working cap.	341.97	0.91	195.75	0.86	357.45	0.89	207.36	0.87
Land revenue & tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deprn.on farm implet.	22.50	0.06	22.50	0.10	22.50	0.06	22.50	0.09
Miscellaneous expenses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cost A_1	37,694.61	100.00	22,813.00	100.00	39,978.51	100.00	23,816.94	100.00

Source: Field survey

However, as the return – cost ratio was higher in organic farms, the vegetable enterprise with radish and carrot grown by organic way were more profitable for the farmers than their counterpart. The reason behind this higher return was the higher price of organic produces. The significant price premium of organic radish and carrot was reflected by 87.22% and 65.33 % respectively over the price of inorganic produce. Perhaps, the consumers paid this maximum price premium for radish and carrot for its use as tasty salad crop.

Comparative economics of Kalmishak cultivation

An important and too much preferable leafy vegetable crop grown commercially in the study area was kalmishak. The crop is grown throughout the year in West Bengal. Majority of the growers

of the state follows inorganic way of cultivation method for kalmishak. The cost of cultivation per hectare of kalmishak was estimated at ₹ 50,713.15 and Rs. 35,598.36 for organic and inorganic methods, respectively. The productivity of kalmishak was observed as 196.96 qtl / ha in organic farms and 208.81 qtl / ha in inorganic farms. The higher productivity in inorganic farms was observed due to use of chemical fertilizers. The crop is too much responsive in synthetic fertilizers also. But, it has been found that gross and net return in organic farms was significantly higher than inorganic one. The net return of kalmishak was almost double in organic farms as compare to inorganic farms. The reason behind this higher return was the too higher price (₹ 507.02/qtl) of organic kalmishak than inorganic one (₹ 303.89 / qtl). In fact, the price of organic kalmishak was almost 67 % higher than the price of inorganic kalmishak. Despite the higher cost for per quintal production of kalmishak under organic system than the inorganic one, the return - cost ratio was higher for organic kalmishak (1.97) than the inorganic kalmishak (1.78). This indicated that the leafy vegetable kalmishak grown by organic method was more profitable for the farmers than the kalmishak grown by inorganic method. Another important point could be underlined here that the imputed value of family labour was ₹ 7600.83 / ha and ₹ 5883.73 / ha for organic and inorganic farming respectively. This is an opportunity for employment of under employed family labour (Table 3).

Table 3: Comparative economics of Kalmishak cultivation

(₹ per hectare)

Cost Items	Kalmishak	
	OFS	IFS
	3 yrs. average	3 yrs. average
1	2	3
Cost A_1	40,956.08	27,563.10
Cost A_2	40,956.08	27,563.10
Cost B_1	40,974.08	27,581.10
Cost B_2	43,112.32	29,714.63
Cost C	50,713.15	35,598.36
Yield (qtl/ha)	196.96	208.81
Price (₹/qtl)	507.02	303.89
By product	0.00	0.00
Price of by prodt.	0.00	0.00
Gross return(₹)	99,862.66	63,455.27
Net return(₹)	49,149.51	27,856.91
R / C ratio	1.97	1.78
Total cost/ha	50,713.15	35,598.36
Total cost/qtl	257.48	170.48

Source: Field survey

The cost of seeds in both organic and inorganic farms was same. It was ` 11,385.73 / ha in organic farms and ` 11,382.61 / ha in inorganic farms. But, the expenses for bio-pesticides (` 368.63 / ha) and irrigation (` 1500.67 / ha) in organic farms were less as compared to expense of chemical pesticides (` 525.08 / ha) and

irrigation (` 1853.44 / ha) in inorganic farms for cultivation of kalmishak. Besides, the applied organic manures were of ` 15,067.70 / ha in the organic farms. And, the expense for applied synthetic fertilizers in inorganic farms for kalmishak cultivation was ` 984.04 / ha. Though, the huge quantities of organic manures were not enough for substitution of inorganic fertilizers of inorganic farms in respect of nutrients values (Table 4).

Table 4: Comparative *Cost* A_1 of Kalmishak cultivation

(₹ per hectare)

Cost Items	Kalmishak			
	OFS		IFS	
	3 yrs. average cost (₹)	Share to Cost A_1 (%)	3 yrs. average cost (₹)	Share to Cost A_1 (%)
1	2	3	4	5
Hired human lab. wage	11,091.14	27.08	11,470.25	41.61
Bullock lab. charge	1,062.98	2.60	1,064.31	3.86
Hired machinery charge	0.00	0.00	0.00	0.00
Cost of seed / seedling	11,385.73	27.80	11,382.61	41.30
Cost of fertilizers	0.00	0.00	984.04	3.57
Cost of manures	15,067.70	36.79	0.00	0.00
Cost of pp materials	0.00	0.00	525.08	1.91
Cost of bio-pp materials	368.63	0.90	0.00	0.00
Irrigation charge	1,500.67	3.66	1,853.44	6.72
Interest on working cap.	449.23	1.10	253.37	0.92
Land revenue & tax	0.00	0.00	0.00	0.00
Deprn.on farm implet.	30.00	0.07	30.00	0.11
Miscellaneous expenses	0.00	0.00	0.00	0.00
Cost A_1	40,956.08	100.00	27,563.10	100.00

Source: Field survey

Results of "*t* – test for Equality of Means" for root vegetable crops

Results of test for equality of means for root vegetable crops indicate that the total cost per hectare, net return per hectare and return – cost ratio for cultivation of root vegetable crops (Radish and Carrot) and leafy vegetable crop (Kalmishak) under organic method are substantially higher than inorganic method of cultivation (Table 5).

Table 5: Independent samples test (*t* – test for Equality of Means) for selected crops

Crops	Indicators (per hectare)	Across the system of farming (Organic vis-à-vis Inorganic)		
		t value	d.f.	Level of significance
1	2	3	4	5
Radish	Cost C	36.959	50	.000
	Net Return	25.946	50	.000
	R / C ratio	19.049	50	.000
Carrot	Cost C	33.993	42	.000
	Net Return	25.417	42	.000
	R / C ratio	21.074	42	.000
Kalmishak	Cost C	19.206	46	.000
	Net Return	31.669	46	.000
	R / C ratio	18.785	46	.000

Impact of organic farming in relation to quality of produces and price premium

To measure the impact on quality of organic farm product and its price, consumers' perception has been studied in eight selected markets, where organic vegetables are sold by the organic farmers. These output markets were chosen purposively for the study since the agricultural produces with both organic and inorganic technology flow to these markets. To assess the consumers' preference in this regard, a sample of 126 buyers from different income groups (Up to ₹ 10,000/- pm, ₹ >10,000/- to <20,000/- pm and ₹ 20,000/- and above pm) were selected. The selection of consumers is made purposively those who purchase produce from such outlets where both organic as well as inorganic products are available.

It is expected that the level of income would be an important factor in determining the consumer demand towards organic foods. To have an idea about consumers' attitude towards organic vegetables we had to rely on a proxy variable namely 'consumers' willingness to pay higher price for organic produce'. The sublime assumption being more willing the consumer is to pay higher price for organic product, the higher is his/her preference towards the product, it is expected to vary with the income level of the consumer. Hence, consumer of higher income group would prefer organic products more. Field level data get corroborated with our expectation.

We carried out an exercise to get an estimate of the degree of association between consumer's level of monthly income and his willingness to pay higher price for organic products. For the purpose we used the χ^2 statistic that tests the independence of attributes. From the Table 6, a 3x3 contingency table was prepared to test the degree of association between monthly income and consumer's response. The result was tested against the null hypothesis and the estimated value of χ^2 was:

χ^2 = 31.989 with 4 degrees of freedom which was significant at 0.99 level.

Table 6: Price premium (in %) that consumers' willing to pay for organic products

Willingness to pay price premium	Monthly Income (in Rs)			
	Up to 10000	10000- 20000	Above 20000	Total
Up to 20%	62 (95.4)	37 (77.1)	4 (30.8)	103 (81.7)
21% to 30%	3 (4.6)	9 (18.8)	8 (61.5)	20 (15.9)
31% to 40%	0 (0.0)	2 (4.2)	1 (7.7)	3 (2.4)
Total	65 (100.0)	48 (100.0)	13 (100.0)	126 (100.0)

Source: Market survey (Note: Figures in parenthesis indicate percentage)

From the result we get a clear indication of positive association between consumer's monthly income and his willingness to pay a higher price for organically produced crops. Hence, the null hypothesis was rejected.

Conclusion

Economics of organic vis-à-vis inorganic farm practices indicates that the cost of cultivation was higher and production was lower in organic than inorganic system but price of the organic product was higher than inorganic in the study area. This was resulted a favorable return / cost ratio for organic farming system. So, it may be concluded that price premium is too important for keeping the organic farming profitable.

The higher cost of production in organic farming is mainly due to the use of organic manures in huge quantity and the higher price of organic produce at present. Besides, the study reveals that there exists a definite positive association between consumer's monthly income and his willingness to pay higher price for organic products, which leads organic farm's profitability. So, low cost production technology is required for easy accessibility of organic produces to all the people in the state.

Policy implications

1. Formation of Farmers' Organization for a reasonable price premium.
2. Recommended doses of plant nutrients to be applied.
3. Interlinked credit with output for organic farm production should be initiated to facilitate export of organic produce and to encourage organic farmers.
4. The Government should provide start-up funding as subsidy for a large scale conversion programme through kinds, i.e. inputs of organic in nature.
5. Market structure for organic products need to be developed.
6. Marketing co-operatives by pooling the small and scattered produce from organic growers can improve the bargaining power and can thus effectively eliminate the margin appropriated by the market intermediaries.
7. The organic farm produce should be included under the public distribution system (PDS).
8. Organic food products should be integrated into public procurement, such as in schools, hospitals, etc., through the requirement of at least a certain percentage of organic foods, if these are available, to stimulate both a base market demand and improve the public information and consumer exposure to organics.

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