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Economic Viability of Organic Farming: An Empirical Experience of Wheat Cultivation in Punjab§

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Abstract

The present study has assessed the economic viability of organic wheat cultivation in Punjab by collecting primary data from 85 organic growers and 75 inorganic growers spread over 30 villages in the districts of Patiala and Faridkot for the period 2008-09. The area under organic farming has been found about 27 per cent of the total operational area in *rabi* season for the sample organic growers. The major share of organic area has been found under wheat crop, which accounted for 15 per cent of the total operational area of sample organic growers. The total variable cost on per acre basis for the cultivation of organic wheat has been found less as compared to inorganic wheat. The net returns over variable cost of organic and inorganic wheat have been observed as ₹ 21895/acre and ₹ 16700/acre for organic growers. The lower crop yield in organic wheat (6.7q/acre less) was well compensated by the higher price it fetched in the market. A wider varietal distribution has been observed for organic than inorganic wheat cultivation. The regression analysis has revealed that with one per cent increase in expenditure on farmyard manure + jeev amrit , biodynamic and machine labour, the organic wheat productivity would increase by 0.114 per cent, 0.703 per cent, 0.556 per cent, respectively, showing significant impact on value productivity. The study has observed that though organic wheat cultivation has been found more profitable for the growers in the study area, the significant reduction in its productivity level poses a serious challenge in term of food security for the nation.

Key words: Organic farming, Wheat cultivation, Organic wheat, Punjab

JEL Classification: Q12, Q16

Introduction

The state of Punjab, known as 'Food Bowl' of the country, is the largest surplus state in terms of foodgrains. It has a total geographical area of 50.36 lakh hectares out of which almost 83 per cent is under cultivation with cropping intensity of 189 per cent. The agriculture in the state is highly intensive in terms of use of land, capital, energy, and all other agricultural inputs, including irrigation water. With only 1.5 per cent of geographical area of the country, the state has been able to produce over 21 per cent of the total national wheat (GoP, 2008-09). This increase in agricultural production has been at the cost of unsustainable use of resources like land, water and chemical inputs, the externalities of which are being felt now. The adverse effects of intensive use of chemicals (fertilizers as well as pesticides) in agriculture has been realized more than ever before in terms of escalating costs, decelerating soil fertility, etc. People support now chemical-free agricultural production using organic manure and inputs. Some farmers have even started

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adopting organic farming in the state, though on a smaller scale.

Catherine and Ivettte (2007) have observed that a shift to organic farming in developing countries can produce 80 per cent of the present yield and in the developed countries, it can match up to 90 per cent of the yield. Choubey (2006) using the NSSO survey data on cultivation practices, has shown that the north-east hill states have retained traditional practices and have shown inclination towards organic agriculture which could be harnessed for the development of the region with ecological benefits. Kshirsagar (2008) has revealed that organic farming is a system of farm management to create an eco-system which can achieve sustainable productivity without the use of external inputs like chemo-synthetic fertilizers and pesticides.

The potential of organic farming in generating socially and environmentally beneficial effects is enormous. However, it is essential to assess its performance in terms of its economics which ultimately influences the adoption of any technology. Ramesh *et al*. (2005) have found that organic farming could give higher or equal yields of different cropping systems compared to chemical farming after an initial period of three years. The so-called transition effect, in which the yield declines in the first 1-4 years of transition to organic agriculture, follows a yield increase when soils develop adequate biological activity. Another study (Thakur and Sharma, 2005) on comparative economics of Organic Farming System (OFS) vis-à-vis Inorganic Farming System (IFS) has favoured OFS, in terms of both higher yield as well as profitability. However, no knowledge is available on various economic aspects of organic farming/produce with regards to input-use pattern, potential yield, profitability to farmers, etc. in the state. Therefore, the present study was taken up with the following specific objectives in Punjab:

- To find the status of organic wheat cultivation in the state,
- To study the productivity and profitability of organic and inorganic wheat cultivation in the state, and
- To identify various factors affecting the value productivity of organic as well as inorganic wheat in the state.

Methodology

The study pertains to the districts of Patiala and Faridkot where more number of organic growers were found during field investigations. Based on the concentration of organic growers/acreage, one block from each district, namely Nabha from Patiala and Kotkapura from Faridkot were selected for the field survey. A complete list of organic growers in these two blocks was prepared in consultation with extension specialists/key informants in the area. Also, the farmers who did not use chemical fertilizers and chemical pesticides/weedicides during the past three years were considered as the 'organic' growers in the present study. The organic growers were found widely scattered across a number of villages in these blocks. A random sample of 75 organic growers, spreading over about 30 villages of the Nabha block and 10 organic growers from 1 village of Kotkapura block, thus totaling 85 organic growers, was taken. These growers were not the exclusive organic crops growers, rather cultivated crops following both organic as well as inorganic cropping systems. Of their total operational area, about 27 per cent was put under organic and the remaining 73 per cent was put under inorganic crops. Besides, 75 fully inorganic growers were also randomly chosen from the area that formed the control group for a comparison. A comparative study was also made between organic wheat and inorganic wheat cultivated by the organic growers. Thus, the study was based on the total sample of 160 farmers (85 organic growers and 75 inorganic growers).

Farmers though grow several crops like wheat, paddy, sugarcane, vegetables, fodders, etc. in the study area, study was restricted to wheat only, keeping in view it as the most commonly produced crop. The reference period for the study was 2008-09. The primary data were collected through personal interview method using a specific-structured schedule.

Analysis of Data

Different statistical tools such as average, percentage, student's t-test, etc. were applied to carry out analysis. The Cobb-Douglas function specified for the study was:

$$\log Y = \log A + b_1 \log x_1 + b_2 \log x_2 + \ldots\ldots\ldots\ldots + b_n \log x_n + u \quad \ldots(1)$$

For inorganic wheat crop, the variables were:

Y = Value productivity of wheat grains (₹/acre)

X_1 = Seed cost (₹/acre),

X_2 = Seed treatment cost (₹/acre),
X_3 = Irrigation (No.),
X_4 = Fertilizers cost (₹/acre),
X_5 = Zinc sulphate cost (₹/acre),
X_6 = Pesticide cost (₹/acre),
X_7 = Herbicide cost (₹/acre),
X_8 = Machine labour cost (₹/acre),
X_9 = Human labour cost (₹/acre), and
u = Error-term.

For organic wheat crop, the variables were:

Y = Value productivity of wheat grains (₹/acre),
X_1 = Seed cost (₹/acre),
X_2 = Irrigation (No.),
X_3 = FYM and jeev amrit cost (₹/acre),
X_4 = Organic pesticides cost (₹/acre),
X_5 = Bio-dynamics cost (₹/acre),
X_6 = Interculture cost (₹/acre),
X_7 = Human labour cost (₹/acre),
X_8 = Machine labour cost (₹/acre), and
u = Error-term.

Results and Discussion

Status of Organic Farming in Punjab

Cropping Pattern

Cropping pattern of the sample farmers presented in Table 1, revealed that paddy and wheat were the main crops in *kharif* and *rabi* seasons, respectively among both the groups. During the study year (2008-09), area under paddy and wheat was about 81per cent and 85 per cent of the total operational area of sample organic and about 89 per cent and 91 per cent of the total operational area of sample inorganic growers. In the *kharif* season, of the total operational area of sample organic growers, 5 per cent each was under fodder, cotton and sugarcane and 4 per cent under vegetables, while among sample inorganic growers, it was about 4.50 per cent under fodder, followed by vegetables (3.8 %) and cotton (1.8 %). During the *rabi* season, of the total operational area about 5 per cent of the sample organic growers remained engaged under sugarcane followed by fodder (4%) and vegetables (5%), while for sample inorganic growers, about 4.19 per cent of the total operational area was under fodder crop, followed by vegetables (4%). The percentage of the total operational area under fodder, sugarcane,

Table 1. The organic and inorganic cropping patterns in Punjab: 2008-09

(acre)

Crop	Organic growers			Inorganic growers
	Total area	Organic crops area	Inorganic crops area	Area
		Kharif		
Paddy	8.62 (81.24)	1.37 (15.89)	7.25 (84.11)	9.00 (89.90)
Cotton	0.50 (4.71)	0.50 (100)	-	0.18 (1.80)
Sugarcane	0.50 (4.71)	-	0.5 (100)	-
Fodder	0.57 (5.37)	0.57 (100)	-	0.45 (4.50)
Vegetables	0.42 (3.97)	0.42 (100)	-	0.38 (3.80)
All crops	10.61(100)	2.86 (26.95)	7.75 (73.05)	10.01 (100)
		Rabi		
Wheat	9.12 (85.96)	1.37 (15.03)	7.75 (84.97)	9.18 (91.70)
Sugarcane	0.50 (4.71)	0.5 (100)	-	-
Fodder	0.45(4.24)	0.45 (100)	-	0.42 (4.20)
Vegetables	0.54 (5.09)	0.54 (100)	-	0.41 (4.10)
All crops	10.61 (100)	2.86 (26.95)	7.75 (73.05)	10.01(100)

Note: Figures within the parentheses indicate percentages to total

vegetables and cotton was more in organic growers than inorganic growers.

The area under organic farming was about 27 per cent of the total operational area in *kharif* as well as *rabi* seasons. The major share of organic area was under wheat and paddy crops, each of which accounted for about 15 per cent of the total operational area of sample organic growers. In *kharif* 2008-09, the average area under organic crops was maximum for paddy (1.37 acre), followed by fodders (0.57 acre), sugarcane (0.50 acre) and vegetables (0.42 acre), while during *rabi* season, the average area was maximum under wheat (1.37 acre), followed by vegetables (0.54 acre), sugarcane (0.5 acre) and fodder (0.45 acre).

Crop Varietal Distribution

A wide varietal distribution of wheat was observed under organic than inorganic cultivation. For organic wheat, the area was maximum under PBW 343 (40%), followed by 'Bansi' (30%), C-306 (20%) and others (10%). The area under inorganic wheat was also maximum under PBW 343 (75 %), followed by other varieties (25%).

Input Use Pattern of Organic/inorganic Wheat Cultivation

The input-use and cost pattern of organic and inorganic wheat was studied and is presented in Table 2. The organic pesticides used in organic wheat were

Table 2. Input-use and cost pattern of organic and inorganic wheat crops by selected sample farmers of Punjab: 2008-09

(per acre)

Particulars	Organic growers				Inorganic growers	
	Organic wheat		Inorganic wheat		Inorganic wheat	
	Quantity	Value (₹)	Quantity	Value (₹)	Quantity	Value (₹)
Seed (kg)	41	633 (8.20)	40	614 (8.36)	40	614 (7.67)
Seed treatment	-	-	-	92 (1.25)	-	92 (1.13)
FYM+ jeev amrit (q)	82	1336 (17.26)	35	570 (7.76)	40	652 (8.04)
Vermi compost (q)	4.5	136 (1.76)	-	-	-	-
Organic pesticides	-	117 (1.51)	-	-	-	-
Plant protection spray (No.)	-	-	1	50 (0.68)	1.20	61 (0.75)
Urea (kg)	-	-	125	656 (8.93)	140	733 (9.03)
DAP (kg)	-	-	80	710 (9.67)	87	771 (9.50)
Herbicides (No.)	-	-	1	398 (5.42)	1	398 (4.91)
Irrigation (No.)	3.8	65 (0.84)	3.5	60 (0.82)	3.8	65 (0.80)
Human labour (hours)	189	2835 (36.62)	124	1860 (25.33)	124	1860 (22.98)
Tractor (hours)	5.6	1229 (15.88)	5	1107 (15.08)	5.6	1229 (15.15)
Harvesting/threshing (hours)	3	1240 (16.02)	3	1125 (15.32)	4	1500 (18.49)
Marketing (hours)	6	150 (1.94)	4	100 (1.36)	5	125 (1.54)
Total cost (₹)	-	7741	-	7342	-	8112

Note: Figures within the parentheses indicate percentage of total under respective column

prepared by the mixture of many products like awk, sambola, onion, chilli, neem, etc. Its average cost was about ₹ 117 / acre. The jeev amrit was prepared by mixing the urine (10 litres) of cows, especially of indigenous varieties, with dung (10 kg) and was applied with irrigation to the crops after a week. Cost on bio – dynamics preparation was not included because very few farmers used this bio-fertilizer and it was provided by an NGO at nominal charges.

In the case of inorganic wheat, a considerable amount was spent on urea, DAP, herbicides and their applications to the crops. As organic growers developed their inclination towards resource conservation, used even less amount of urea, DAP and tractor hours, etc. on their inorganic wheat as compared to the total inorganic wheat growers in the study area. The average cost on marketing of organic wheat was ₹ 150/ acre as against ₹ 100/acre in case of inorganic wheat, it was because of less number of organic wheat buyers which led to an increase in marketing hours and consequently marketing cost.

Labour-use for Different Farm Operations

The labour hours spent in various operations of wheat cultivation were more in organic (189 hours/ acre) than inorganic (124 /acre) crops. (Table 3). The labour requirement was almost similar in some operations such as land preparation, sowing, irrigation,

Table 3. Labour-use pattern in different operations of wheat production under organic and inorganic crops in Punjab: 2008-09

(hours/acre)

Field operations	Organic growers		Inorganic growers
	Organic wheat	Inorganic wheat	Inorganic wheat
Land preparation	11 (5.99)	11 (9.11)	11 (9.18)
Sowing	1.5 (0.82)	1.5 (1.24)	1.5 (1.24)
Irrigation	17.5 (9.26)	17.5 (14.08)	17.5 (14.04)
FYM application	-	10 (8.07)	10 (8.06)
Preparation of vermicompost and its application	14 (7.42)	-	-
Preparation and application of organic pesticide	4 (2.06)	-	-
FYM manure preparation and application	28 (14.69)	-	-
Jeev amrit and biodynamics preparation and usage	13.5 (7.13)	-	-
Interculture	34.5 (18.25)	-	-
Chemical fertilizer application	-	14 (11.21)	14 (11.24)
Plant protection chemical application	-	5 (3.96)	5 (3.95)
Threshing /harvesting	32 (16.87)	32 (25.67)	32 (25.63)
Transportation	11 (5.82)	11 (8.86)	11 (8.76)
Others	22 (11.69)	22 (17.80)	22 (17.90)
Total	189	124	124

Note: Figures within the parentheses indicate percentages to total

Table 4. Economics of organic/inorganic wheat cultivation in Punjab: 2008-09

(₹/acre)

Particulars	Organic growers		Inorganic growers
	Organic wheat	Inorganic wheat	Inorganic wheat
Total input cost	7741	7342	8112
Interest on working capital	194	184	203
Total variable cost	7935	7526	8315
Yield(q/acre)	12.40	19.50	19.70
Price (₹/q)	2250	1050	1050
Value of main product	27280	20475	20685
Value of by-product	2250	3750	4000
Gross returns	29830	24225	24685
Return over variable cost	21895*	16700	16370

Note: * Significant at 1 per cent probability level (when compared organic wheat with inorganic wheat).

threshing/harvesting, transportation, etc. in organic and inorganic wheat cultivation but operations like interculture, manure preparations and application, bio-dynamics preparation and usage, and preparation and application of vermicompost were found high labour demanding. These labour-intensive operations enhanced the total labour requirement for organic wheat cultivation considerably. Hence, organic farming has been found more labour-intensive and generates more employment opportunities in the rural areas.

Economics of Organic/inorganic Wheat Cultivation

The net return over variable cost of organic wheat was higher (₹ 21895/acre) than of inorganic wheat (₹ 16700/acre) for organic growers. The net return over variable cost was ₹ 16370/acre for inorganic wheat for inorganic growers. The returns over variable cost of organic wheat were ₹ 5195/acre more in comparison to inorganic wheat, and were significant at 1 per cent probability level (Table 4).

Factors Affecting Value Productivity of Organic as well as Inorganic Wheat

Organic Wheat

The coefficient of multiple determinations (R^2) was 0.87 for organic wheat indicating that 87 per cent variations in the organic wheat yield were explained by the independent variables taken together in the model. The analysis further revealed that with one per cent increase on expenditure of farmyard manure + jeev amrit, biodynamic and machine labour would increase the value productivity of organic wheat by 0.114 per cent, 0.703 per cent, 0.556 per cent, respectively, showing significant impact on value productivity. The regression coefficient of other variables, viz. seed, irrigation, organic pesticide, interculture, and human labour has not shown any significant impact on the value productivity of the organic wheat (Table 5).

Table 5. Regression analyses for organic and inorganic wheat cultivation by organic growers in Punjab: 2008-09

Dependent variables Value productivity Explanatory variable	Estimate Organic wheat	Estimate Inorganic wheat
Constant	2.16313	2.03301*
Seed (₹)	0.169715	0.123635
Irrigation (No.)	0.0426	-0.0210
Seed treatment (₹)	-	0.498462*
FYM+ jeev amrit (₹)	0.114732*	-
Organic pesticide (₹)	0.0890	-
Bio-dynamics (₹)	0.70396*	-
Interculture (₹)	0.816666	-
Fertilizer (₹)	-	0 .0012
Pesticides (₹)	-	0.0214
Herbicides (₹)	-	0.0175
Human labour (₹)	0.139960	0.0503
Machine labour (₹)	0.556012*	0.19993*
R^2	0.87	0.89

Note: *Significant at 5 per cent level

Inorganic Wheat

The various determinants of value productivity of inorganic wheat, presented in Table 5, revealed that one per cent increase in cost of seed treatment and machine labour would increase the value productivity of inorganic wheat by 0.498 per cent and 0.199 per cent, respectively. These variables have been found significant at 95 percent probability level. The regression coefficient of other variables, viz. seed, irrigation, fertilizer, pesticide, herbicide and human labour have not shown any significant impact on the value productivity of the inorganic wheat.

Conclusions

The study has revealed that a major share of the organic area was under wheat crop which is about 15 per cent of the total operational area of sample organic growers. The total variable cost on per acre basis for the cultivation of organic wheat has been found less as compared to inorganic wheat. The net returns over variable cost have been found higher for organic (₹ 21895/acre) than inorganic (16700/acre) wheat for organic growers. The lower crop yield in organic wheat (6.7q/acre less) was well compensated by the higher price it fetched in the market. A wider varietal distribution has been observed for organic than inorganic wheat cultivation. The coefficient of multiple determinations (R^2) 0.87 for organic wheat has indicated that 87 per cent variations in the organic wheat yield could be explained by the independent variables taken together in the model. The study has further revealed that with one per cent increase in expenditure on farmyard manure + jeev amrit, biodynamic and machine labour would increase the value productivity of organic wheat by 0.114 per cent, 0.703 per cent, 0.556 per cent, respectively, showing a significant impact on value productivity. The regression coefficient of other variables, viz. seed, irrigation, organic pesticide, interculture, and human labour has not shown any significant impact on the value productivity of the organic wheat. In the case of inorganic wheat cultivation, one per cent increase in cost of seed treatment and machine labour, would increase the value productivity by 0.498 per cent and 0.199 per cent, respectively. These variables have been found significant at 95 per cent probability level. The study has clearly brought out that though, the organic wheat cultivation has been found much more profitable for the growers in the study area, the significant reduction in its productivity level poses a serious challenge in term of food security of the nation.

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