

## **A Comparative Economic Analysis of Organic and Inorganic Wheat in Punjab**

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### **Abstract**

*The present study revealed the comparative economic analysis of organic and inorganic wheat in Punjab. Concentration of organic wheat growers was more in Ferozepur, Moga, Sangrur and Patiala so 70 organic wheat growers were selected, also amongst them primary data about inorganic wheat were collected from 54 farmers who also cultivated inorganic wheat along with organic wheat. Productivity of organic wheat was 12.25 quintals/acre while of inorganic wheat was 20.11 quintals/acre. Fertilizer cost in organic wheat cultivation was cut down about 16 per cent as only on-farm inputs were used. Operational cost of organic wheat was Rs 12157 per acre and for inorganic wheat was Rs 11702 per acre. Returns over variable cost were found around 40% higher in case of organic wheat. Weighted mean average for price of organic wheat was Rs 3926 per quintal.*

**Keywords:** *Organic wheat, Economic analysis, Problems, Organic farming*

**JEL classification:** *Q12, Q16*

### **Introduction**

India after independence was self-insufficient in terms of food grains. There was food shortage in the country. There was a need to make India self-sufficient in terms of food-consumption. Around 1960s, policies were made which promoted introduction of seed developed by Borlaug, "miracle seeds". All these efforts led to Green revolution in India in 1960s (Sharma 2010). The new seeds introduced had capability to produce high yield only when inputs like chemicals fertilizers and irrigation were used. Hence, green revolution had wiped-off varieties

which use to give more than one usage of plant biomass. HYV seeds were able to respond only under higher irrigation and higher chemical inputs.

Sustainable agriculture growth is need of the hour. Organic farming promotes and improves agro-ecosystem health, including biological diversity, biological cycle and soil organism activity. It prefers the use of management practices rather than off-farm inputs, keeping in mind that the local conditions require a system which is locally adapted. As per definition by United States Department of Agriculture, "Organic farming is a system which avoids or largely excludes

the use of synthetic inputs (such as chemical fertilizers, pesticides, hormones, feed additives etc.) and to the maximum extent rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection". India has 1.49 million hectares of organic land and 8,35,000 farmers which are engaged in organic farming (Willer and Lernoud 2018). The world's largest organic producers are in India. In 2016-17 certified organic produce in India was 11.80 lakh tonnes (Dutt 2018). Aulakh and Ravisankar (2017) studied that many farmers in Punjab have realized that chemical-intensive; water guzzler paddy is no longer sustainable. Some of the progressive farmers have started shifting towards organic farming. Most organic producers are adopting organic farming mainly due to the assumption that organic farming will improve the environment conditions and human health. Soil health improvement is the reason for the farmers to adopt organic farming. Attention has been paid for promoting organic farming, but still it has not been adopted by large number of farmers in Punjab. Farmers are unable to adopt due to high agricultural expenses and due to risks involved in initial period of organic farming. Recently, Punjab state farmers are attracted towards production through organic farming and becoming popular. Singh and Grover (2011) studied that in Punjab, on a one-acre basis, total variable cost of organic wheat was found less than inorganic wheat. For wheat growers the net returns over variable cost was found higher for organic (Rs. 21895/acre) than inorganic (Rs. 16700/acre). The higher prices for organic wheat in market had compensated for low yield in organic wheat i.e., 6.7q/acre. More labour hours had to be spent in operations of organic wheat cultivation. A study by Lampkin and Padel (1994) found out that under organic

farming in case of Cotton (in states of Punjab and Gujarat) and Sugarcane (in states of Maharashtra and U.P.) unit cost of production was less but cost of production per acre was lower in conventional farming in case of Wheat and Paddy crops in states of U.P. and Punjab. Therefore, current study has been prepared for comparison for the productivity and profitability of organic and inorganic wheat cultivation so that barriers in the promotion of organic wheat in the state can be understood and suggest policies.

### **Data Sources and Methodology**

To draw sample of organic wheat growers, the list of organic wheat growers was obtained from institutions like School of organic farming in PAU, PAU organic farmers club, Nabha Foundation etc. From the list, more number of organic wheat growers was found in Ferozepur, Moga, Patiala and Sangrur districts. To accomplish various objectives primary data were collected. A random sample of 70 organic wheat growers was selected from list, spreading over 45 villages. Primary data about organic wheat were collected from 70 organic wheat growers and primary data about inorganic wheat were collected from same farmers who also practised inorganic wheat cultivation along with organic wheat, which were 54. Overall, a sample of 70 organic wheat growers comprising of 13 small, 32 medium and 25 large farmers was randomly selected. Besides, amongst these 70 organic wheat growers, 54 farmers which also cultivated inorganic wheat were selected which comprised of 3 small, 30 medium and 21 large farmers. Farmers having operational land holding upto 5 acres was considered as small farmers while who were having operational land holding 5 to 15 acres were considered as medium farmers and farmers having operational land holding more than 15 acres was considered as large farmers.

## Results and discussion

### Comparative productivity of organic and inorganic wheat in Punjab

The yield (productivity) gap of main product and by-product which occurring in organic and inorganic wheat is represented in Table 1. Productivity of inorganic wheat was 20.11 quintals/acre and that of organic wheat was 12.25 quintals/acre. This showed decline of 7.86 quintals/acre which is 39 per cent of yield as compared to yield under inorganic wheat farming. Productivity for organic wheat was highest for medium farmer i.e. 12.73 qtls/acre while the lowest for small farmers i.e. 11.35 qtls/acre. The percentage decline was the highest for small farm (43%) and was the lowest for medium farmers (36%). Similar decline was seen in by-product productivity. By-product productivity of inorganic wheat was found to be 13.25 quintals/acre and that of organic wheat was 9.67 quintals/acre. This showed decline of 3.59 quintals/acre which was around 27 per cent yield of inorganic wheat. By-product productivity of organic wheat was highest for large farmer (9.9 quintals/acre) while the lowest was for small farmers (9.19 quintals/acre). Percentage decline was the highest for small farmers (30%) and was the lowest for large farmers (25%).

### Input-use pattern of organic wheat vis-à-vis inorganic wheat cultivation

Input use pattern of organic wheat vis-à-vis inorganic wheat growers is represented in Table 2. The input use pattern for the cultivation of organic wheat revealed that about 85 man hours per acre were required for carrying out the various operations like sowing, manure application, weeding, irrigation, harvesting etc. Machine labour hours required for organic wheat was 13 hours/acre which included sowing, land preparation, spray application through hand-spray/knap-sack spray, harvesting etc. FYM was also used by the sample growers for the organic wheat cultivation (about 3 qtls/acre). Jeev amrit was used as spray on an average about 164 litres/acre. Other fertilizers used were zabrailliac acid, compost, biofertilizers etc. Measures opted for plant protection were khatti lassi and milk, which had 8 per cent of fat content, was used about 5 litres/acre and 0.27 litres/acre respectively. Number of irrigation requirement was not high; only 3 to 4 times in season. The input use pattern for the cultivation of inorganic wheat showed that about 29 man hours per acre were required for carrying out the various operations like sowing, fertilizer application, weedicide and plant protection spray, irrigation, harvesting etc. Extra human labour for manual weeding

**Table 1. Comparison of yield gap between organic and inorganic wheat of sample farmers in Punjab, 2017-18**

Particulars	Main Product				By-Product			
	Small	Medium	Large	Overall	Small	Medium	Large	Overall
Inorganic wheat	20.11	19.8	20.43	20.11	13.23	13.42	13.11	13.25
Organic wheat	11.35	12.73	12.38	12.25	9.19	9.89	9.9	9.67
Decline	8.76	7.07	8.05	7.86	4.04	3.53	3.21	3.59
Percent decline	43.56	35.71	39.40	39.10	30.54	26.30	24.49	27.11

Table 2. Input-use pattern of organic wheat vis-à-vis inorganic wheat cultivation of sample farmers in Punjab, 2017-18

Inputs	Units	Small		Medium		Large		Overall	
		Organic	Inorganic	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic
Human labour	Hours								
Hired		67.32	11.63	71.81	12.37	61.12	13.42	66.63	12.77
Family		18.95	17.11	21.47	16.37	14.96	15.89	18.09	16.22
Machine labor	Hours	10.19	13.73	12.32	14.27	16.14	14.53	13.29	14.12
Seed	Kg/acre	34.07	40.00	35.53	39.82	39.80	38.69	36.78	39.27
Seed treatment	Kg/acre	0.16	0.19	0.29	0.02	0.23	0.02	0.20	0.02
Fertilizers									
FYM	Kg/acre	2341.13	-	2785.32	-	3579.71	-	2986.23	-
Jeev amrit	ltr/acre	169.23	-	153.13	-	176.00	-	164.28	-
Others*	Kg/acre	0.51	-	0.39	-	0.45	-	0.42	-
DAP	Kg/acre	-	55.54	-	60.21	-	59.73	-	57.66
Urea	Kg/acre	-	127.68	-	130.47	-	131.62	-	128.83
MOP	Kg/acre	-	19.00	-	20.73	-	20.11	-	20.20
Sulphur	Kg/acre	-	19.79	-	0.24	-	0.25	-	0.23
Zinc	Kg/acre	-	5.21	-	5.89	-	6.01	-	5.47
Manganese	Kg/acre	-	0.50	-	0.59	-	0.61	-	0.54
Plant protection									
Khatti lassi	ltr/acre	4.92	-	4.66	-	5.40	-	4.99	-
Milk (8 % fat)	ltr/acre	0.38	-	0.31	-	0.16	-	0.27	-
Insecticide	ltr/acre	-	0.56	-	0.66	-	0.73	-	0.67
Weedicide	gm/acre	-	125.25	-	130.70	-	141.41	-	133.39
Irrigation	Number	3.69	3.63	3.72	4.20	4.10	3.81	3.90	3.89

\*Includes Zabrailic acid, Compost, Biofertilize

**Table 3. Operational cost of cultivation of organic wheat vis-à-vis inorganic wheat cultivation of sample farmers in Punjab, 2017-18****(Rs/acre)**

Cost component	Small		Medium		Large		Overall	
	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic
<b>Human labour</b>								
Hired	4189 (35.57)	482 (4.23)	4491 (35.84)	497 (4.14)	3825 (30.45)	531 (4.41)	4003 (32.93)	499 (4.26)
Family	711 (6.03)	708 (6.20)	805 (6.43)	669 (5.58)	561 (4.47)	653 (5.42)	679 (5.58)	678 (5.79)
Machine labour	3761 (31.93)	4180 (36.62)	4241 (33.85)	4245 (35.43)	4444 (35.37)	4293 (35.64)	4107 (33.78)	4233 (36.17)
Seed	1533 (13.02)	1800 (15.77)	1599 (12.76)	1792 (14.96)	1791 (14.26)	1741 (14.45)	1655 (13.62)	1767 (15.10)
Seed treatment	27 (0.23)	179 (1.57)	43 (0.35)	162 (1.35)	31 (0.25)	162 (1.34)	36 (0.29)	168 (1.43)
<b>Fertilizers</b>								
FYM	535 (4.54)	-	652 (5.21)	-	817 (6.51)	-	689 (5.67)	-
Jeev amrit	338(2.87)	-	294(2.34)	-	352(2.80)	-	323(2.66)	-
Others*	56 (0.47)	-	41 (0.33)	-	47 (0.38)	-	44 (0.36)	-
DAP	-	1201 (10.52)	-	1421 (11.86)	-	1351 (11.21)	-	1294 (11.06)
Urea	-	802 (7.03)	-	959 (8.00)	-	959 (7.96)	-	819 (7.00)
MOP	-	215 (1.88)	-	222 (1.86)	-	219 (1.82)	-	220 (1.88)
Sulphur	-	19 (0.17)	-	24 (0.20)	-	25 (0.21)	-	23 (0.20)
Zinc	-	371 (3.25)	-	378 (3.16)	-	422 (3.50)	-	403 (3.44)
Manganese	-	42 (0.37)	-	55 (0.46)	-	59 (0.49)	-	47 (0.40)
<b>Plant protection</b>								
Khatti lassi	235 (2.00)	-	159 (1.27)	-	264 (2.10)	-	211 (1.73)	-
Milk (8 % fat)	19 (0.16)	-	16 (0.12)	-	8 (0.06)	-	14 (0.11)	-
Insecticide	-	679 (5.95)	-	753 (6.29)	-	790 (6.56)	-	753 (6.44)
Weedicide	-	371 (3.25)	-	388 (3.23)	-	443 (3.68)	-	403 (3.44)
Irrigation	171 (1.45)	170 (1.49)	173 (1.38)	210 (1.76)	206 (1.64)	188 (1.56)	187 (1.54)	193 (1.65)
Total variable cost	11777 (100)	11415 (100)	12529 (100)	11981 (100)	12563 (100)	12045 (100)	12157 (100)	11702 (100)

\*Includes Zabrailic acid, Compost, Biofertilizers

was not required in inorganic wheat because chemical weedicide was used machine labour hours required for inorganic wheat were 14 hours/acre; which was nearly similar to organic wheat cultivation. Application of urea per acre was found to increase as farm size increased i.e. large farmers used more amount of urea. Same case was true in case of application of sulphur, manganese, zinc etc. DAP application per acre was more in medium and large farmers than in small farmers. Insecticides and pesticides were used in less amount but they were effective in less amount i.e. 0.67 ltr/acre and 133 g/acre respectively.

#### **Operational cost of cultivation of organic wheat vis-à-vis inorganic wheat cultivation**

The comparative operational cost on per acre basis of organic wheat vis-à-vis inorganic wheat cultivation has been shown. In case of organic wheat, total variable cost was found to vary between Rs 11777 for small farmers to Rs 12563 which was due to the fact that large farmers are more mechanized and dependent on machines. On overall basis, the total variable cost on per acre basis was found to be Rs 12157. Machine labour was found to have a little less proportion of cost (33%) as compared to machine labour proportion (36%) in inorganic wheat. Expenses incurred on human labour were higher i.e. 33 per cent in organic wheat cultivation due to hired labour used for manual weeding and hoeing. Among different farm size basis, on per acre basis, small farmers had to incur higher (35%) on hired labour while large farmers had to incur 30 per cent of total variable cost. Seed treatment expenses were minor. Proportion of cost incurred on fertilizers was less in organic wheat cultivation than in inorganic wheat i.e. 8 per cent. With increase in farm size, cost incurred on FYM increased. Expenses on jeev amrit were about 3 per cent of total variable cost. Other organic fertilizers used were minor. Plant protection expenses were about 2 per

cent. Irrigation expenses were about 2 per cent. Irrigation expenses were highest for large farmers and lowest for small farmers.

Total variable cost on per acre basis for inorganic wheat was found to vary between Rs 11415 for small farmers to Rs 12045 which was due to the fact that large farmers are more mechanized and dependent on machines. On overall basis, the total variable cost on per acre basis was found to be Rs 11702. The proportion of Machine labour cost was found to be 36 per cent. Inorganic wheat cultivation do not require manual weeding so hired labour incurred in inorganic wheat cultivation was very less (only 4%) as compared to organic wheat cultivation. Amongst different farm size categories, on per acre basis, small farmers had to incur higher expenses on hired labour. Seed treatment expenses were minor. Proportion of cost incurred on fertilizers was much higher in inorganic wheat cultivation than in organic wheat. The proportion of cost incurred on fertilizers was found to be 23 per cent. The highest cost was incurred on urea i.e. 11 per cent followed by cost incurred on DAP i.e. 7 per cent. Medium and large farmers were found to spend more on fertilizers as they can bare more expenses on fertilizers. Cost incurred on plant protection accounted about 10 per cent. Large and medium farmers spent more on plant protection i.e. 10 per cent as compared to small farmers who spent about 9 per cent. Irrigation expenses were almost equal to irrigation applied to organic wheat i.e. 2 per cent.

#### **Economics of organic wheat vis-à-vis inorganic wheat cultivation**

The productivity of main product of organic wheat was 12.25 quintals/acre whereas of inorganic wheat was 20.11 quintals/acre (Table 4). Weighted average price counted for organic wheat was 3926 Rs/quintals and MSP of inorganic wheat was 1735 Rs/quintals.

**Table 4. Economics of organic wheat vis-à-vis inorganic wheat cultivation of sample farmers in Punjab, 2017-18** (Rs/acre)

Particulars	Small		Medium		Large		Overall	
	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic	Organic	Inorganic
<b>Main product</b>								
Yield(Qtls/acre)	11.35	20.11	12.73	19.8	12.38	20.43	12.25	20.11
Price(Rs/qtls)	4309	1735	3688	1735	3781	1735	3926	1735
Gross Returns (Rs.)	48912	34891	46942	34353	46810	35446	48098	34891
<b>By-product</b>								
Yield(Qtls/acre)	9.19	13.23	9.89	13.42	9.9	13.11	9.67	13.25
Price(Rs/qtls)	352	400	390	357	370	376	372	379
Gross returns (Rs.)	3230	5295	3859	4787	3665	4924	3601	5026
Gross returns (main product +by product) (Rs.)	52142	40186	50801	39140	50475	40370	51700	39917
Total variable cost (Rs)	11778	11415	12529	11981	12563	12045	12157	11702
Returns over variable cost (Rs.)	40365	28771	38272	27159	37912	28325	39543	28215

Hence gross return from main product of organic wheat was much higher from organic wheat. By-product yield was less for organic wheat (9.67 quintals/acre) than inorganic wheat (13.25 quintals/acre). Price for by-product of both types of wheat cultivation was almost equal therefore returns from by-product were higher in case of inorganic wheat cultivation. When gross returns (main product+by product) were calculated, returns from organic wheat were much higher than inorganic wheat. Gross returns from organic wheat were Rs 51700 per acre and from inorganic wheat were Rs 39917 per care. Returns over variable cost of organic wheat were 39543 Rs/acre and from inorganic wheat were Rs 28215 per acre.

On per area basis, the highest returns from

main product of organic wheat were Rs 48912 for small farmers and from inorganic wheat were Rs 35446 for large farmers. The highest returns from by-product of organic wheat were Rs 3859 for medium farmers and from inorganic wheat were Rs 5295 for small farmers. The highest returns over variable cost from organic wheat were Rs 40365 for medium farmers and from inorganic wheat were Rs 28771 for small farmers.

### **Problems faced in organic farming**

Problems faced by farmers in practicing organic wheat cultivation has been highlighted in Table 5. Problem which affected most was the difficulties which farmers had to face during conversion period as production was low, farmers did not know much organic methods and farmers did not know where to

**Table 5. Problems faced in organic farming by sample farmers in Punjab, 2017-18**

Problems faced	(Percent multiple response)			
	Small (n <sub>1</sub> =13)	Medium (n <sub>2</sub> =32)	Large (n <sub>3</sub> =25)	Overall (N=70)
Weed problem	69.23	34.38	44.00	44.29
High manual labour	46.15	40.63	36.00	40.00
Problem of low productivity	23.08	59.38	36.00	44.29
Lack of government support	30.77	40.62	36.00	37.14
Lack of awareness	23.08	25.00	24.00	24.29
Problem in certification process	7.69	3.13	16.00	8.57
Lack of FYM	15.38	3.13	8.00	7.14
Lack plant protection technology	23.08	-	12.00	8.57
Problems faced during initial certification period	46.15	50.00	40.00	45.71

sell his product so that he gets premium prices. Problem of weed and low productivity was told by around 45 per cent of farmers. Weedicide cannot be used in organic wheat and any other method of weed control was not there hence weeds caused serious problem. High human labour also imposed problems in

practicing organic farming as organic farming require manual operations like weeding, rouging etc which was agreed by about 40 per cent of farmer. About 37 per cent farmers told that there was no government support for organic farming. Other problems were lack of awareness, lack of plant protection

**Table 6. Suggestions made by sample farmers in Punjab, 2017-18**

Sr. No. Suggestions made by farmers	(Percent multiple response)			
	Small (n <sub>1</sub> =13)	Medium (n <sub>2</sub> =32)	Large (n <sub>3</sub> =25)	Overall (N=70)
1 Government support and awareness is needed	30.77	46.88	40.00	41.43
2 New organic variety for higher production should be introduced	46.15	62.50	72.00	62.86
3 Separate weedicide recommendations are required	69.23	53.13	44.00	52.86
4 Separate plant protection recommendations are required	30.77	15.63	12.00	17.14



technology, lack of FYM, lack of awareness etc.

### **Suggestions made by sample farmers**

The perusal of suggestions made by farmers for solving problems faced in practicing organic wheat cultivation is suggested in Table 6. As productivity was lower in organic farming so most of the farmers (about 63%) suggested that variety should be introduced which performs well under organic conditions and gives higher yield. Organic farming did not allow use any synthetic chemicals for weed control hence farmers urgently need separate weed control method for organic farming. This was suggested by 52 per cent farmers. All the above suggestions cannot be filled without government support whether it was MSP, assured marketing, varieties introduction etc all required government support at some level. Around 40 per cent farmers suggested that government should support in organic farming. Organic method did not allow use of chemicals so it was suggested that separate plant protection recommendations were required (17%).

### **Conclusion and Policy Implications**

The study revealed that productivity of main product of organic wheat was about 12.25 quintals/acre (40% less) whereas in case of inorganic wheat it was 20.11 quintals/acre. By-product yield of organic wheat was 9.67 quintals/acre (27% less) while in case of inorganic wheat was 13.25 quintals/acre. Decline was more in initial period of adoption of organic farming. Man hours requirement of organic wheat was much higher in case of organic wheat because organic wheat do not allow use of synthetic chemicals for plant protection so weeding has to be done manually. Fertilizers were replaced by on-farm inputs like FYM, Jeev Amrit (cow dung+cow urine+gur+besan). Natural materials like

khatti lassi and milk (8% fat) was used for plant protection. Operational cost of cultivation was higher in case organic wheat due to labour charges incurred on weeding. Fertilizer cost in organic wheat cultivation was cut down about 16 per cent as only on-farm inputs were used.

Operational cost of organic wheat was Rs 12157 per acre and for inorganic wheat was Rs 11702 per acre. Returns over variable cost were found around 40 per cent higher in case of organic wheat. Weighted mean average for price of organic wheat was Rs 3926 per quintals. Policies to encourage organic farming have to be made by government. Government have to take initiative to make farmers and consumers aware about benefits of organic farming. Government should advertise advantages of organic farming. Government should start new projects and funds for breeding programmes which can find out special varieties which can yield higher in organic conditions. Separate recommendations for weedicides and plant protection measures should be given to farmers through seminars, lectures etc.

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