

# Comparative Profitability Analysis of Conventional and Organic Vegetable Farming in Khyber Pakhtunkhwa and Azad Jammu Kahsmir, Pakistan

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## Abstract

Pakistan is blessed with ample diversity in ecological and diverse environmental aspects, due to its varying landscapes provide of opportunity for cultivation of crops, fruits and vegetables throughout the year. Given that, Three vegetable crops as cauliflower, tomato, and Turnip can be grown through both farming system (organically and conventionally ) in different parts of the two provinces of Pakistan (AJK&KPK).The study aims to better understand , how much these three vegetable crops can be economical beneficial for farmers aside with desire of healthy food .Targeted data collected through a semi structured interview and questionnaire survey of 150 KPK 150 AJK sample of vegetable farmers in these Provinces . This study revealed in two parts, first parts highlights to the present condition of organic vegetable farming (OVF) and after that computation of financial behaviour of three major cropped vegetables. In the last, we examined the financial execution of cultivated veggie under three presumed states. That were analyzed in connection with synthetic fertilizers and pesticides price of organic vegetables. The analyzed results showed that organic vegetable farms have employed comparatively marginal fraction of the extents as compare to the conventionally grown vegetables. Financial analysis of the research illustrates that due to low level yield, plantation of organic vegetables has economically less attraction to the consumer than that of conventional which usually has not met the production cost of vegetables. But still farmers are showing their interest to grow organic vegetables on small scale to fulfil their household desires. The findings shown that directly or indirectly exception of subsidies synthetic fertilizers and pesticides, appreciation in the yield and price of organic vegetables can enhance the financial performance of organic vegetable farming. On the basis of these assumptions, this study provides accurate rationalisation that could lead for provision of good opportunity not only for organic vegetable producers but also its users.

**Keywords:** Organic vegetable farming; fertilizer; Average Cost; Net profit; benefit cost ratio

## 1. Introduction

Being agriculture country, Pakistan's economy mostly relies on its agriculture sector. It contributes 21 % to the GDP and engages 43.7 % of the total labour force. It supports about 68 % of the population for their sustenance and 60% to total export earnings (Naqvi et al., 2017). Currently, intensive use of chemicals (fertilizers and pesticides, etc.) is being practiced in Pakistan. Intensive use of chemical fertilizer and pesticides/herbicides are not only causing air and soil pollution, but also reducing soil fertility and hence could be a potential threat to food security (Khan and Damalas, 2015). Alternative solution to produce crops could be organic farming that promise minimum usage of costly pesticides, herbicides and synthetic fertilizers. It avoids nutrient exploitation and improves soil quality. Moreover, produce of organic farming is free of chemical contaminants and therefore considered as healthy. The demand for organic products has been increasing due to health concerns of people using non-organic foods (IFOAM, 2004). Such demands are compelled with high profitability from organic products and organic producer has good opportunity to increasing their income (Donia et al., 2017). Farmers are also provoked gradually and involved to produce organic food due to its high demand for food security. Organic agriculture appears superior to conventional agriculture in terms of environmental impacts as it requires less energy and hence reduces greenhouse gas emission (Liu and Gu, 2016).Organic Agriculture (OA) in Pakistan was introduced in 1996 by Lok Sanjh, non-profit organization, took the initiative step to start working with farmers at grass roots level by making Farmers Field Schools (FFS), to persuade 10,000 farmers were trained to adopt ecological approaches to (Husnain et al., 2017). A separate Directorate of OA was established by the Government of Pakistan in 2008 at the National Agriculture Research Centre (NARC). Organic production methods are assessed according to regulation (EEC NO.2092/91) and USDA-NOP5 standards, while organic farms of Pakistan are certified by Control Union Certifications Zwolle, Netherlands (Ul-Husnain and Khan, 2015). Mainly NARC and Pakistan Agriculture Research Council (PARC) are the prominent institutions involved in promotion of organic farming.

The current study was planned to assess the financial inclination of organic vegetables under existing and some supposed situations. Beginning with an appraisal of the recent situation of organic vegetable farming in the specified areas come after financially viability of three major vegetables that were yield under present and supposed conditions, this meditation reflects that several measures including support prices and subsidies are required for financial soundness of organic farmers.

## 2. Methodology

The locale of the study consists of two provinces of Pakistan viz. Khyber Pakhtunkhwa (KP) and Azad Jammu and Kashmir (AJK), which has an area of 13,297 Km<sup>2</sup> and 74,521 km<sup>2</sup> respectively. Khyber Pakhtunkhwa is divided into 26 administrative districts included five Provincially Administered Tribal Area (PATA) districts. AJK is divided into 10 administrative districts. Among other crops in KPK wheat, rice, barley, maize, sugarcane, tobacco, mustard, groundnut, pulses, vegetables and fruits are most cultivated crops. These crops are being cultivated on ninety percent of the total cropped area and play an important role in sustaining the living of the rural population. (Tareen et al., 2015). Khyber Pakhtunkhwa ranks third among Pakistani provinces by GDP, while Azad Kashmir ranks fifth among Pakistani provinces by GDP (Economic Survey of Pakistan 2016-17). More than 80% of households in AJK has agricultural land and almost 40% of its economy depends on growing crops and livestock. Mainly fruits and vegetables are grown here include apples, pears, apricots, potatoes, turnips, cauliflower, tomato, and spinach while main crops include maize and wheat. The sale of milk, meat and eggs from the livestock also contributes to boost income. Despite of all these agricultural contributions, it is still underproductive, although officially announcements claim that productivity can improve, few steps have been taken to address these issue. Majority of the farmers in both of the study areas hold small lands with low economic returns.

## 3. Data collection

The facts & figures with regards to this analysis was compiled through a home based survey. A semi-structured questionnaire was developed and used to interview the organic peasant and conventionally growing vegetables peasants in the defined area. The respondents was asked questions about type of farming (organic or conventional), area, input costs (expenses of seed, fertilizer cost (organic/synthetic), tunnel cost, seasonal irrigation cost and miscellaneous costs), yield and price of produce. Primary information regarding details of organic farmers was obtained from the NARC. Three hundred farmers from each province (150 organic farmers; 150 conventional farmers) were included in the survey. Survey directed that peasants in the selected regions were producing enormous organic veggie such as spinach, cauliflower, cabbage, celery, eggplant, cucumber, lady finger, turnip, tomato etc. However, cauliflower, turnip and tomato were found the most cultivated vegetables in these regions. Thus, these three vegetables were selected in current study for further information.

### 3.1 Data Processing and Analysis

The raw collected data was processed to calculate Net Income (Rs./Kanal), Average Cost (Rs./Kg) (eq. 2) and Net Profit (Rs./Kg). Benefit cost ratio (BCR) were calculated for each farm. The data were analysed by t- test (unequal mans) to compare conventional and organic farming systems of two regions separately (Ruxton, 2006). The following formulae were applied to do above calculations.

- Gross income (Rs./Kanal) = Yield (Kg) × price per Kg
- Average income (Rs. /Kg) = Gross income (Rs./Kanal)/ Yield (Kg/ kanal)
- Average cost (Rs./ Kg) = Total cost per kanal / yield per kanal
- Net Profit (Rs. /Kg) = Average Income – Average Cost
- BCR = Net income / Average cost

The total cost was calculated from various input expenses like seed price/kanal, seed expenses, synthetic fertilizer/kanal, organic fertilizer price/kanal, pesticides expense/kanal, tunnel cost/kanal, seasonal irrigation cost/kanal, miscellaneous costs/kanal. Farm production was calculated as total yield kg/kanal.

## 4. Results:

### 4.1 Current Status of Organic Vegetable Farming

Tomato, cauliflower and Turnip were the most growing vegetables by the farmers. Organic fertilizer as farm yard manure (FYM) was used in organic farming systems. Synthetic fertilizers, organic fertilizer and pesticides expense varied from region to region due to soil fertility and type of vegetable that were grown as well. The data depicts that no significant variation was found regarding use of organic fertilizers among both regions under study (i.e. AJK and KP). However significant variation was found between two farming systems i.e. organic and conventional (Table 1)

The average amount spent on cauliflower of KP and AJK was Rs. 20.60/Kg and Rs. 20.83/Kg respectively by organic farmers, while Rs.16.01/Kg and Rs. 16.05/Kg respectively by conventional farmers (Table 1). Statistical analysis showed significant difference between the amount spent by organic farmers as compared to conventional farmers. Moreover, the findings showed that organic and conventional farmers earn profit (per Kg) with slight differences in term of cauliflower in both regions.

Production cost of Tomato is comparatively less than cauliflower. In KP region, the average cost of production was Rs.18.36/Kg and Rs.14.73/Kg in organic and conventional farming systems respectively. The net profit earned by organic farmers was Rs. 42.30/kg, while conventional farmers earned Rs 30.63/Kg. Similarly,

average cost of production in AJK was Rs.17.70/Kg and Rs.14.97/Kg on organic and conventional farming systems respectively. The net profit of Rs. 42.49/Kg and Rs. 29.55/Kg was earned by organic and conventional farmers of AJK respectively. Average cost to produce organic and conventional turnip in KP was Rs. 23.74/Kg and Rs. 15.82 /Kg respectively. The cost was significantly higher in organic farming as compared to conventional farming. Net profit earned by organic farmers was Rs. 48.88 /kg, while conventional farmers got Rs.56.80/Kg in KP. Similar situation prevailed in AJK where organic and conventional farmers bore average cost of Rs.23.70/Kg and 15.86 respectively, while net profit was Rs.49/kg and Rs.56.90/kg in both farming systems respectively.

#### 4.2 *Benefit Cost Ratio (BCR) of OVF under Current Scenario*

The BCR obtained from organic tomatoes was 2.38, while 3.13 in conventional tomatoes in KP. Similarly, the BCR obtained from organic and conventionally grown tomatoes was 2.41 and 3.04 in AJK respectively. The BCR obtained from organically produce cauliflower was 1.57, while in conventional way its BCR was 2.31 in KP. Similarly in AJK the BCR obtained from organic cauliflower was 1.56 Rs, while in conventional way its BCR was 2.32. The BCR obtained from organically produce turnip was 2.06, while in conventional way its BCR was 3.59 in KP. Similarly in AJK the BCR obtained from organic turnip was 2.07 Rs, while in conventional way its BCR was 3.59.

#### 4.3 *Profitability under assumed scenarios:*

Results revealed that organic vegetable farming is financially less attractive. Organic farming could not be made attractive until current situation prevails. Thus, alternative situations were assumed and analysed to examine the possible improvements in profitability of organic farming (Table 2).

**Condition I: Augmentation in the cost of semisynthetic fertilizers and pesticides (25% and 100% respectively)**

#### 4.4 *Cauliflower:*

Farming systems (organic and conventional) were compared for profitability and cost under assumed scenario where cost of synthetic fertilizers and pesticides increased by 25% and 100% respectively, while prices of farm produce remained constant. The average predicted amount spent on cauliflower production would be Rs. 20.60/Kg and Rs. 16.30/Kg by organic and conventional farmers respectively. Similarly, the average amount spent on cauliflower in AJK is predicted to be Rs. 20.83/Kg and Rs. 16.34/Kg by organic and conventional farmers respectively (Table 2). After Statistical analysis, significant difference showed between the amount spent by organic farmers as compared to conventional farmers. Moreover, the projected net profit in option-A would be Rs.32.39/kg and Rs 36.69/kg by organic and conventional farmers of KP respectively, while Rs.32.43/kg and Rs 36.92/kg by organic and conventional farmers of AJK. The BCR results of assumed option-A reflects that organic farming is not as much profitable as conventional farming systems even under assumed situation. Significant variation was found regarding use of organic fertilizers among both regions under study (i.e. AJK and KP).

#### 4.5 *Tomatoes*

The average predicted amount spent on tomatoes production would be Rs. 18.36/kg and Rs Rs.15.01/kg by organic and conventional farmers respectively. Similarly, the average amount spent on tomatoes in AJK is predicted to be 17.70/Kg and Rs Rs. 15.24/Kg by organic and conventional farmers respectively (Table 1). Statistical analysis showed significant difference between the amount spent by organic farmers as compared to conventional farmers. Moreover, the projected net profit in option-A would be Rs.42.30 /kg and Rs.42.49/kg by organic and conventional farmers of KP respectively, while Rs.32.43/kg and Rs 36.92/kg by organic and conventional farmers of AJK. The BCR results of assumed option-A would reflect that organic farming is not as much profitable as conventional farming systems even under assumed situation. So the result under assumed scenario depicted that availability of the of synthetic fertilizers and pesticides on high prices will encourage conventional tomato farmers to produce tomatoes organically. which would be economically viable for the. Because organic farmers would enjoy high net profit /kg than conventional farming in Both regions as KP and AJK. BCR results also reflecting that Organic farming would be much ideal and profitable as conventional farming systems even under assumed situation of both regions i-e KP and AJK. While under this assumed condition.

#### 4.6 *Turnip*

The comparative analysis would be regarded as both regions under study (i.e. AJK and KP), average amount spent on organic turnip production was Rs. 23.74/kg while its conventionally production cost would be Rs.16.08/kg in KP. Similarly, the average amount spent on turnip of AJK was Rs. 23.70/Kg and Rs. 16.11/Kg

respectively by organic farmers, and conventional farmers (Table 1) respectively. Results in the table 'showed that organic farmers spent significantly high amount on turnip productions than conventional farmers in both regions. Moreover, the findings showed that in KP regions organic farmers would earn net profit Rs.48.88 /kg while in conventional farmers earned comparatively high profit that was Rs 56.54/kg. Similarly, in AJK organic farmers would earn net profit Rs.49.06/kg while farmers would earn comparatively high profit from conventional way that was Rs 56.64/kg. So that the result under assumed scenario depicted that this assumed condition could not convince the conventional farmers of both regions as KP and AJK on transition to organic.

**Table 1 Profitability Analysis of Vegetable farming**

Vegetable	Region	Net Profit (Rs. /Kg)		Average Cost (Rs. /kg)		BCR	
		Organic	Conventional	Organic	Conventional	Organic	Conventional
Cauliflower	KP	32.40	36.99	20.60	16.01	1.57	2.31
	AJK	32.44	37.21	20.83	16.06	1.56	2.32
Tomatoes	KP	42.31	30.63	18.36	14.74	2.31	3.13
	AJK	42.50	29.56	17.70	14.97	2.41	3.04
TURNIP	KP	48.89	56.80	23.74	15.83	2.06	3.59
	AJK	49.06	56.90	23.70	15.87	2.08	3.59

**Condition II: Increase of organic vegetables price by 10%**

*4.7 Cauliflower*

This assumptions depicted that the increased price (100% ) of organic vegetable would not be economically viable option than conventional farming system .As Net Profit from organic Vegetables would still be significantly less than the net profit from conventional, which is Rs.32.39/kg and Rs.36.98/kg respectively in KP while Net Profit/kg from organic cauliflower would also significantly minor than the net profit/kg from conventional , which is Rs.32.43/kg and Rs.37.21/kg respectively in AJK. And the average to produce cauliflower organically would be Rs.20.60 /kg in KP. while only Rs.16.01 /kg would spend on its conventional production. which would higher cost than conventional farmers. Same situation was also faced in AJK, The table reflected that organic farming would also costly even under assumed increased price of organic cauliflower. So it would be concluded that organic vegetables would still not be financially attractive.

*4.8 Tomatoes*

Net Profit from organic tomatoes would still be significantly higher than the net profit from conventional which is Rs.102.97/kg and Rs.30.63/kg respectively in KP regions. similarly, Net Profit/kg from organic Vegetables were also significantly higher than the net profit/kg from conventional which is Rs.102.69/kg and Rs. 29.55/kg respectively in AJK regions. And the average cost consumed by organic farmers to produce tomatoes was Rs.18.36 /kg in KP region. while convention farmers spend only Rs.14.73 /kg. which is less costly than organic farmers. Same situation was also faced in AJK region, the table depicted that organic farming would also costly even under assumed increased price of organic cauliflower. So as a result organic tomatoes would be high significantly profitable business for organic famers under this assumption.

*4.9 Turnip*

Net profitability from organic turnip would still be significantly lower than the net profit from conventional, which is Rs.18.55/kg and Rs.26.46/kg respectively in KP regions. Similarly, net profit/kg from organic Vegetables were also significantly lower than the net profit/kg from conventional, which is Rs18.66 /kg and Rs.26.49/kg respectively in AJK regions. And the average cost consumed by organic farmers to produce turnip was Rs.23.74 /kg in KP region . while convention farmers spend only Rs.15.82 /kg. which is less costly than organic farmers. Same situation was also faced in AJK region, the table depicted that organic farming would also costly even under assumed increased price of organic turnip. So as a result organic turnip would be no charming under this assumption.

**Condition III: Increase of 25% yield in organic vegetables**

*4.10 Cauliflower*

The profitability of OVF was analysed by assuming a condition that prices of organic vegetables increase by 25 %. The analysis showed that net profit/Kg of organic cauliflower would still be significantly lower from conventional, which is Rs.42.69/Kg and Rs.50.23/Kg respectively in KP regions. Similarly, net profit/Kg from organic vegetables were also significantly lower than the net profit/kg from conventional ,that is Rs.42.85/kg and Rs50.52/kg respectively in AJK regions (Table2). And the average cost consumed by organic farmers to produce cauliflower was Rs.10.30 /kg in KP region. while convention farmers spend Rs.16.01/Kg. which is higher cost than organic farmers. Same situation was also faced in AJK region, the table(2) depicted that organic

farming would also spend less than conventional farmers ,even under assumed increased yield of cauliflower . But under this situation both farming systems are individually economical viable because their cost is significantly lesser than their profits but comparatively organic vegetables still not get attraction financially as conventional farming systems under this assumed scenario.

#### 4.11 Tomatoes

Organic tomatoes net profitability /kg would still be significantly lower from conventional, which is Rs.57.59/kg and Rs.61.09//kg respectively in KP regions. Similarly Net Profit/kg from organic tomatoes were also significantly less than the net profit/kg from conventionally produce which is Rs.57.54/kg and Rs63.07/kg respectively in AJK regions. And the average cost consumed by organinc farmers to produce tomatoes was Rs.18.36 /kg in KP region . while conventional farmers spend Rs.14.73 /kg. which is comparatively less costly than organic tomato farming. Same situation was also faced in AJK region , (Table 2) depicted that organic farming would bear comparatively higher cost than conventional farmers ,even under assumed increased yield of tomatoes . But under this scenario both farming systems are individually economical viable because their cost is significantly lesser than their profits but comparatively organic vegetables will still not be financially beneficial than conventional farming systems under this assumed scenario.

#### 4.12 Turnip

Organic turnip net profitability /kg would still be significantly lower from conventional ,which is Rs23.30/kg and Rs.37.04/kg respectively in KP regions. similarly, Net Profit/kg from organic turnip were also significantly lower than the net profit/kg from conventional, which is Rs.23.40/kg and Rs37.09/kg respectively in AJK regions. And the average cost consumed by organic farmers to produce turnip was Rs.18.99 /kg in KP region. while conventional farmers spend Rs.15.82 /kg. which is comparatively less costly than organic turnip farming. Same situation would also faced in AJK, (Table 2) depicted that organic farming would bear comparatively higher cost than conventional farmers, even under assumed increased yield of tomatoes. But under this scenario both farming systems are individually economical viable because their cost is significantly lesser than their profits/kg but comparatively organic vegetables will still not be financially beneficial than conventional farming systems under this assumed scenario.

**Table 2: Profitability Analysis of Vegetable farming under Assumed Scenario**

	Vegetable	Region	Option a		Option b		Option c	
			Organic	Conventional	Organic	Conventional	Organic	Conventional
Net profit/kg	Cauliflower	KP	32.40	36.70	32.39	36.98	42.70	50.24
		AJK	32.44	36.92	32.43	37.21	42.85	50.53
	Tomatoes	KP	42.31	30.36	102.97	30.63	57.59	61.09
		AJK	42.50	29.29	102.70	29.56	57.55	63.08
	Turnip	KP	48.89	56.55	23.74	15.83	23.30	37.04
		AJK	49.06	56.65	23.70	15.87	23.40	37.09
Average cost	Cauliflower	KP	20.60	16.30	20.60	16.01	10.30	16.01
		AJK	20.83	16.34	20.83	16.05	10.42	16.06
	Tomatoes	KP	18.36	15.01	18.36	14.74	18.36	14.74
		AJK	17.70	15.24	17.70	14.97	17.70	14.97
	Turnip	KP	23.74	16.08	18.55	26.47	18.99	15.83
		AJK	23.70	16.12	18.66	26.50	18.96	15.87
Bcr	Cauliflower	KP	1.58	2.26	1.58	2.31	4.16	3.14
		AJK	1.56	2.27	1.56	2.33	4.12	3.16
	Tomatoes	KP	2.32	3.06	5.63	7.28	3.15	4.17
		AJK	2.42	2.97	5.83	7.08	3.27	4.24
	Turnip	KP	2.06	3.52	0.78	1.68	1.23	2.34
		AJK	2.08	3.52	0.79	1.67	1.24	2.34

## 5. Conclusion

Organic farming system is a comprehensive and distinctive production management system that promotes ecological approach of farming by avoiding the application synthetic fertilizers and pesticides. Organic farming improves soil health and microbiota (Hartmann et al., 2015) The produce of organic farming is considered good for human consumption as it is free from hazardous (Gil et al., 2015). Organic farming system has emerged as new attraction in previous decade as it may help to reduce the problems produced by conventional farming system including environmental and health hazards, soil nutrient depletion etc. (Laxmi et al., 2017). Besides that, it improves food quality (Reganold and Wachter, 2016). Pakistan is bestowed with lot of potential to produce all varieties of organic products due to its diverse agro-climatic regions. However, adaptability of every such

farming system depends upon the financial viability. Analysis conducted in the current study were mainly focussed to understand the comparative economic viability of organic and conventional farming with specific reference to vegetables (cauliflower, tomato and turnip).

The results of the analysis shown that substantially low payoffs from OVF (Organic Vegetable Farming) could be regarded as primary cause for its low acceptability. The question then arises that which features could make OVF financially more beneficial. As described in theory, the foremost justification for the less attractiveness of organic vegetable farming was the considerably low production rate (yield) of organic vegetables than conventional vegetables. However, vegetables produced from both farming systems fetch similar prices, hence making OVF more expensive. The reasons of low yield could be the use of substandard organic fertilizer (FYM) and less effective bio-pesticides. Despite of its benefits (i.e. environment friendly and healthy), premium prices have not been set for organic vegetable farming in Pakistan (particularly in the area of current study). This lack of premium prices makes it financially less

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