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Cost of Cultivation and Production of Various Crops in Punjab

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Abstract

Decreasing farm income and increasing cost of production is creating challenge in Punjab. A study has been conducted on the cost of cultivation, production and returns of various crops such as wheat, paddy, basmati, maize, barley, cotton, potatoes, guar, rapeseed and mustard (R&M) in order to identify the most profitable crops for the farmers in the three agro-climatic zones of Punjab. The result of the study revealed that machine and human labour found to be the major components of the cultivation cost. Potato was with the highest value of variable cost per ha. Returns from basmati and paddy were the highest profitable while; rapeseed and mustard (R&M) and potato are the least profitable crops. Also, the profitability of different crops in different zones shows that wheat, paddy, basmati, and R&M were at the highest level than the two other zones.

Keywords: Crops, Main product, By-product, Returns over variable costs, Cost of cultivation.

JEL Classification: M11, O13, Q15, Q52

Introduction

Agriculture is an art and science that involves nurturing the soil, growing crops, and rearing livestock. It entails preparing plant and animal items for human use and distributing them to marketplaces. The cost of cultivation includes factor cost up to the stage of gathering the harvest and the cost of production includes factor cost up to the stage of marketing of the product. This sector is the backbone of developing-country economies, which provides food and facilitates human life. India is the world's largest food producer, but the Punjab state is recognized as the "Granary" of the country. The central government's policy played a key role in replicating the Green Revolution policy, under which the pattern of agricultural production in Punjab shifted dramatically towards a monoculture of rice and wheat, the food items being critical for the national goal of self-sufficiency in food availability (Singh 2012). With a significant change in the pattern of cultivation over the last 60 years, the area devoted to the main crops increased from 37.9 lakh ha in 1960-61 to 78.3 lakh ha in 2020-21, an increase of over 100 percent. More importantly, the wheat area increased from 13.9 lakh ha to 35.3 lakh ha (an increase of 2.54 times). The rice area increased from 2.3 lakh ha to 31.49 million ha (an increase of 13.7 times) during this period (Gulati *et al* 2017, Anonymous 2021). Although mechanization has historically contributed greatly to the state's agricultural progress, it is currently demonstrating the adverse effects of intensive agricultural practices. The considerable increase in fixed costs threatened the economic viability of agriculture, particularly for small and marginal farmers. While the variable costs of rice and wheat production in the state fell during the 1980s and 1990s, the fixed costs significantly grew (Sidhu *et al* 2005). In recent decades, the production of the principal crops has stagnated, resulting in decreasing farm income of the state. Currently, agriculture in Punjab has reached a point of stagnation where new additions to production are accompanied by higher costs, making it an expensive sector. Rising costs of cultivation, along with a relatively minor increase in MSP, have put pressure on the state's farming profitability (Singh *et al* 2017). Evidently, state agriculture has reached a point of stagnation whereas the cost of cultivation is rising. In order to obtain insight into the appropriateness of different crops in Punjab for long-term societal perspectives, an attempt has been made to evaluate the performance of various crops in the state of Punjab in terms of input resource use valuation. The current study has undertaken the objective: to assess major input use, production, and returns from various crops in Punjab state.

Data Source and Methodology

The current study is based on the data collected under the 'Comprehensive scheme for studying the cost of cultivation of principal crops in Punjab'. It is the most important database on the cost of cultivation of major crops in the state. For

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the present study, the data pertains to the year 2018–19. The plot-wise data were collected from the 300 farmers of 30 villages, from the three agro-climatic zones of the state, representing all the climatic conditions, farmer categories, and crops of Punjab.

To calculate the economics of different crops, the technique of budgetary analysis has been used. The various components in the cost of cultivation of crops under study were estimated in line with the methods provided in the manual of cost of cultivation like farm-produced and purchased seed, fertilizers and manures, plant protection chemicals, human labour used, owned/hired machinery charges, and interest on working capital.

Cost Concepts

Based on the cost concept used; the overall costs included the farmers' paid-out expenses in cash and kind for different items of cost of the cultivation (Rs per ha) taken in the present study. Variable cost include cost of seed, fertilizers and manure, plant protection chemicals, human labour (family + hired), machine labour (owned + hired) and irrigation.

Cost of Cultivation

This covers the cost of crop production, including operational costs, and material costs. The cost of hiring human labour, and machine labour charges was calculated on the basis of prevailing rates at that particular time within a concerned research area with regard to operating costs. In addition, the estimated actual value for family labour was calculated by reference to a baseline rate of pay in the study area. For machinery charges like fuel, repairs, and maintenance were calculated for those who did not own them (Bansal and Grover 2020).

Different expenses associated with the cultivating of various crops under consideration have been estimated as per the manual of cost of cultivation (Singh 2022). The component-wise evaluation method adopted is as own-produced and purchased seed from market has been valued on the basis of its actual purchase price. While the expenses of seed produced by the farmers on their farms has been valued at the prevailing local market price. The purchase price of chemical fertilizers was considered for evaluation. The manure produced at own farm has been valued at the price prevailing in the village. While the actual purchase price has been considered for the purchased manure. The costing of herbicides, insecticides and pesticides has been done based on their actual purchase price. For the family labour the value has been imputed on the basis of prevailing labour rate in the market or the statutory wage rate, whichever was higher. For the hired labour, the actual payment made for hiring the labour has been used. The cost of owned machine has been estimated based on the amount spent on fuel, power and other expenses spent on running the machine. For the hired machines the actual payment made for hiring has been included in the cost. The working capital interest has been calculated at the annual rate of 10% for half of the crop growing duration.

Returns over Variable Cost

The average estimates of various crop yields for each zone were calculated by pooling data from the sample holdings in that zone and the pooled data of the state. The process for calculating the average yield from each crop has been worked out in terms of the value of the total output per ha. The total output included the value of the main product as well as the value of the by-product realized throughout the particular year at post-harvest prices (Chand *et al* 2022, Raju *et al* 2015, Srivastava 2017, Sachdeva and Sing 2017). The average productivity for zone-wise and overall Punjab was calculated in the following way:

$$\mathbf{GRc} = \sum_{i=1}^{n} * \sum_{j=1}^{m} (MP_{ij} * PMP_{ij}) + (BP_{ij} * PBP_{ij}) \Big/ \sum_{i=1}^{n} * \sum_{j=1}^{m} A_{ij}$$

$$\mathbf{VCc} = \sum_{i=1}^{n} * \sum_{j=1}^{m} * \sum_{k=1}^{t} (I_{ijk} * PI_{ijk}) \Big/ \sum_{k=1}^{n} * \sum_{j=1}^{m} A_{ij}$$

$$ROVC_c = GR_c - VC_c$$

Where:

GR_c = Gross returns from c^{th} crop (Rs. /ha), VC_c = Variable cost of c^{th} crop (Rs. /ha), $ROVC_c$ = Returns over variable costs from c^{th} crop (Rs./ha), MP_{ij} = Quantity of main products from j^{th} plot of i^{th} farmers (Qt/ha), BP_{ij} = Quantity of by-products from j^{th} plot of i^{th} farmers (Qt/ha), MPP_{ij} = Price of main product realized by the i^{th} farmers for the produce of j^{th} plot (Rs. /Qt)., BPP_{ij} = Price of by-product realized by the i^{th} farmers for the produce of j^{th} plot (Rs. /Qt), A_{ij} = Area of j^{th} plot of i^{th} farmers put under c^{th} crop, c = Selected crop (1, 2 and 3)

The gross returns are the results of the quantity of the main product plus by-product multiply the current market price of main product and by-product. Returns over variable cost can be calculated as gross return (value of main product + value of by-products) minus variable cost

In the State, crop production is generally carried out in three seasons: (i) monsoon, also called *kharif* season (starts from July to October), (ii) winter, also called *rabi* season (starts from November to March), and (iii) summer (starts from March to June). Paddy, cotton, and maize are the major crops grown during the *kharif* season while other crops like arhar, guar, moong, groundnut, etc. have been cultivated in the smaller cultivation area as well. During the *rabi* growing season, the major crops like wheat, potato, and mustard whereas some of the traditional crops that lose their area in the country are gram, sunflower, lentils, and barley. In the summer, which is known as zaid season, moong will also grow within a short period of 50 to 70 days.

Results and Discussion

Dynamics of Cropping Pattern in Punjab

Cropping pattern refers to the proportionate area under different crops during a crop year. The cropping pattern in the state is shown in Table 1, the total area cultivated in 1960-61 was 4723 thousand ha, and in 2020-2021 it increased to 7818 thousand ha, a rise of 3095 thousand ha during the period of 61 years. In 1960-61, paddy and wheat together occupied 1663 thousand ha (35.21 per cent) of the total planted area, compared to 3,060 thousand ha (64.79 per cent) under all other crops combined. The area cultivated in rice and wheat increased with the advent of the green revolution, and according to the most recent data available for 2020-21, paddy and wheat together occupied 6679 thousand ha (85.43 per cent), whereas the area occupied by all other crops has drastically decreased to 11.39 thousand ha (14.57 per cent). The amount of area cultivated under wheat has increased from 1436 thousand ha (30.40 per cent) in 1960-1961 to 3530 thousand ha (45.15 per cent) in 2020-21. The area under paddy has dramatically increased from 227 thousand ha (4.81 per cent) in 1960-61 to 3149 thousand ha (40.28 per cent) in 2020-21. The area under potatoes, maize, Rape Seed & Mustard, and barley decreased from 0.28, 8.07, 2.27, and 3.45 per cent in 1960-61 to 1.38, 1.38, 0.40, and 0.07 per cent, respectively in 2020-21. Thus, the expansion of the area under paddy cultivation has been mainly at the cost of maize, and cotton while the wheat gained from the area under barley, R&M. The main factors responsible for the increase in area under paddy crops are high and stable yield compared to other *kharif* crops, assured minimum support price, and public procurement. Since the net returns to the farmers from paddy crops are high vis-à-vis other competing *kharif* crops. So, paddy replaced *kharif* pulses and oilseeds on a large scale in the last decades. The increasing area under wheat has also replaced *rabi* pulses and oilseed crops. This crop has a high and stable yield, assured price, and public procurement as compared to other *rabi* crops. It is also a staple food of Punjab. Wheat bhusa, the by-product of wheat is used on a very large scale by farmers to feed dairy animals (Singh *et al* 2017).

Table 1. Area under various crops in Punjab, 1960-61 to 2020-21 **('000 Rs/ha)**

Crop/Year	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11	2018-19	2019-20	2020-21
Wheat	1436 (30.40)	2336 (41.14)	2812 (41.58)	3273 (43.63)	3408 (42.92)	3510 (44.53)	3520 (44.90)	3521 (45.0)	3530 (45.15)
Paddy*	227 (4.81)	390 (6.87)	1183 (17.49)	2015 (26.86)	2612 (32.89)	2826 (35.85)	3102 (39.57)	3142 (40.16)	3149 (40.28)
Cotton	447 (9.46)	450 (7.93)	649 (9.60)	701 (9.34)	474 (5.97)	483 (6.13)	268 (3.42)	248 (3.17)	252 (3.22)
Maize	381 (8.07)	327 (5.76)	382 (5.65)	188 (2.51)	165 (2.08)	138 (1.75)	115 (1.47)	115 (1.47)	108 (1.38)
All oil seeds	195 (4.13)	319 (5.62)	238 (3.52)	104 (1.39)	87.4 (1.10)	56 (0.71)	41 (0.52)	40 (0.51)	38 (0.49)
All pulses	903 (19.12)	414 (7.29)	341 (5.04)	143 (1.91)	59 (0.74)	20 (0.25)	30 (0.38)	33 (0.42)	32 (0.41)
Potato	13 (0.28)	17 (0.30)	40 (2.01)	23.3 (0.31)	60 (0.75)	83.6 (1.06)	103.1 (1.31)	106.1 (1.36)	107.1 (1.38)
Barley	163 (3.45)	57 (1.00)	65 (0.96)	37 (0.49)	32 (0.4)	12 (0.15)	6 (0.08)	6.2 (0.08)	5.9 (0.07)
Other crops**	851 (18.02)	1240 (21.8)	917 (13.6)	948.7 (12.6)	988.6 (12.4)	721.4 (9.15)	623.6 (7.96)	581.7 (7.43)	564.4 (7.22)
GCA	4723 (100)	5678 (100)	6763 (100)	7502 (100)	7941 (100)	7882 (100)	7839 (100)	7824 (100)	7818 (100)
Cropping intensity (%)	126	140	161	178	187	190	190	190	191

Figures in parentheses are percentages to respective totals
**Include Basmati paddy which started from 2000-01 to 2020-21*
***Other crops include other minor crops that are not present in the table*
Source: Statistical Abstract of Punjab, various issues

Due to release of high-yield varieties, new technology as well as the policy of the government subsidies especially the increase in electricity subsidy the production of paddy and wheat increased significantly. On the other hand the growth in production of oilseeds and pulses was significantly negative. The decline in the growth rate of the production could be attributed to the decreased growth rate of the area, wheat and paddy monoculture and irrigation subsidy. Increasing production of oilseeds and pulses will increase the chance of Punjab's edible oil and pulses self-sufficiency. Although, production of crops is less than paddy and wheat, but in terms of saving valuable groundwater, these can fit well with cropping patterns in specific regions of the state, hence helping crop diversification and improve soil fertility.

Production structure of various crops cultivated in Punjab: The production of various crop cultivation in three Zones as well as overall of Punjab has been shown in Table 2. It was per ha total production including the main product (MP) and by-product (BP) of various crop cultivation. As compared to zone-wise and overall each crop individually. Wheat, paddy, basmati, and R&M in Zone-III per ha produced 54, 72.6, 48.55, and 21 qts, respectively the highest level of production than other Zones. Other crops used in the respective zones are declared in this table. In the overall Punjab production paddy, wheat basmati and R&M were 69.4, 50.06, 41.13, and 14.61 qts per ha, respectively. The reason for higher productivity in Zone III, particularly in terms of main crops such as basmati, paddy and wheat contributes of favorable climate which is experiencing a warm climate with adequate sunlight and water availability, irrigation facilities like canals and tube wells, soil fertility from alluvial soil deposits brought by revers making it nutrient-rich and conducive to crop cultivation, modern agricultural practices like the use of high yielding crop varieties; balanced fertilization and pest management, government support like agricultural policies and subsidies, extension services, crop rotation, and farm mechanization (Kaur *et al* 2019 and Anonymous 2022).

Costs and return Structure of various crops cultivated in Punjab: The costs and returns of various crop cultivation during 2018-19 are presented in Table 3. It shows that per ha, the total variable cost of various crop cultivation in Punjab potato was the highest level at Rs. 1.25 lakh followed by cotton, basmati, paddy, maize, barley, wheat, R&M, and guar. The examination of various components of variable cost revealed that agricultural machinery was used for sowing, spraying, and harvesting. The next major component in the cost of cultivation was human labour at the different levels was the highest price wage level than another component like expenditure on manure and fertilizers seed used for sowing "some of them were more than the recommended dose per ha (Prakash 2022)", plant protection chemicals, interest on working capital, irrigation through electric or submersible pump-sets, and hiring charges of implements, applied to one-ha. Similarly, the main yield or product, and the by-product per ha was different in the case of using, and the gross returns from various crop cultivation per ha displayed in the mentioned table shows that the value of the main product and by-product taken together again potato was the highest level at Rs. 1.54 lakh which followed by cotton, basmati, paddy, wheat, maize, guar, R&M, and barley. The returns over variable cost of basmati were the highest level at Rs. 81099. Followed by paddy, cotton wheat, guar, maize, and potato in the Punjab state. The higher returns of basmati can be attributed to factors like its premium quality varieties, international demand, higher market prices, and suitable climate of the state and soil condition for this crop (Singh *et al* 2011).

Table 4. shows the important components of variable cost from various crops in Punjab during the agricultural year 2018-19 where the cotton was the highest level of human labour use with 624 hours per ha with a value of Rs. 26400. Followed by potato, basmati, paddy, maize, R&M, guar,

Table 2. Production structure of various crops cultivated in Punjab, 2018-19

(q per ha)

Crop	Zone-I		Zone-II		Zone-III		Punjab overall	
	MP	BP	MP	BP	MP	BP	MP	BP
Wheat	46.77	33.23	50.14	36.6	54	35.61	50.06	34.93
Paddy	64.98	9.78	72.5	1.9	72.6	0	69.4	4.69
Basmati	39.78	29.08	37.76	32.39	48.55	0	41.13	24.26
Maize	42.28	18.45	-	-	-	-	-	-
R & M	10.98	1.07	15.75	13.44	21	34.71	14.61	12.7
Barley	-	-	38.82	27.06	-	-	-	-
Cotton	-	-	-	-	23.86	67.24	-	-
Potato	261.62	-	-	-	-	-	-	-
Guar	-	-	16.39	33.33	-	-	-	-

MP = main product ; BP = By product

Table 3. Costs and returns from various crops of Punjab, 2018-19

(000' Rs./ha)

Crop	Gross returns	Variable costs	Returns over variable costs
Wheat	103	35	68
Paddy	123	45	78
Basmati	129	48	81
R & M	57	33	24
Maize	76	42	34
Potato	154	125	29
Guar	74	26	48
Barley	69	40	29
Cotton	131	59	72

barley, and wheat. Wheat was the lowest level of human labour 108 hours per ha at the value of 5,500. Similarly, the potato was the highest level of machine labour use at 29 hours using with the value of Rs. 14337 per ha, and guar with 12 hours of use and a value of Rs. 4273 per ha. The higher cost of human labour is influenced by factors like intensive labour of cultivation, harvesting traditional methods, and the shortage of available labour during peak agricultural seasons.

Costs and Return Structure of Crops: Zones wise analysis

The costs and returns of various crop cultivation in Zone-I of Punjab are shown in Table 5. It was per ha total variable cost of various crop cultivation. Whereas, potato was the highest level at Rs. 1.25 lakh followed by basmati, paddy, maize, wheat, R&M, and guar. The examination of various components of variable cost revealed that agricultural machinery and human labour were highest at various crops with different expanses values. Similarly, the main product and the by-product per ha were different and the gross returns over variable costs from various crop cultivation per ha are displayed in Table 6. The estimated values show that the value of the main product and by-product taken together, potato was the highest level at the value of Rs. 1.54 lakh followed by basmati, paddy, wheat, maize, guar, and R & M. The returns over variable cost basmati were the highest level at Rs. 78 thousand. Followed by paddy, wheat, guar, maize, potato, and R & M in the Punjab state.

The costs and returns of various crop cultivation in Zone-II of Punjab are pursued in Table 6. It was per ha total variable cost of various crop cultivation, basmati was the highest level at the value of Rs. 56 thousand. Followed by paddy, R&M, barley, and wheat. The examination of various components of variable cost revealed that agricultural machinery and human labour were the highest expenses value for various crops. Similarly, the main product and the by-product per ha were changes in various crops. The gross returns from various crop cultivation per ha basmati was the highest level at Rs. 1.33 lakh followed by paddy, wheat, barley, and R & M. The returns over variable cost of paddy were the highest level at Rs. 85 thousand. Followed by basmati, wheat, barley, and R&M in the Punjab state.

Table 4. The major components of variable cost from various crops of Punjab, 2018-19

Crop	Human labour (hrs./ha)	Value (Rs. in thousand per ha)	Machine labour (hrs./ha)	Value (Rs. thousand per ha)
Wheat	108	5.5	18	18.6
Paddy	325	16.2	18	13.6
Basmati	442	21.6	18	13.6
R&M	282	12.4	14	12.8
Maize	333	15.0	21	12.2
Potato	535	25.3	29	14.3
Guar	214	8.8	12	4.3
Barley	168	8.2	20	21.5
Cotton	624	26.4	28	14.8

The costs and returns of various crop cultivation in Zone-III of Punjab are shown in Table 7. It was per ha total variable cost of various crop cultivation, cotton was the highest level at Rs. 59 thousand. Followed by basmati, paddy, and wheat. The examination of various components of variable cost revealed that agricultural machinery and human labour were the highest levels of various crops. Similarly, the main product and the by-product per ha was different quantity per ha. The gross returns from various crop cultivation per ha, basmati was the highest level at the value of Rs. 1.42 lakh followed by cotton, paddy, wheat, and R & M. The returns over variable cost of basmati were the highest level at the value of Rs. 95 thousand. Followed by paddy, wheat, cotton, and R & M the in the Zone-III of Punjab, and the farmers of this Zone did not use straw of basmati as the by-product. This is in line with the estimation of (Pushpa *et al* 2017). The higher returns for paddy cultivation in Zone III of the state may be a suitable climate, efficient irrigation, government support, and market infrastructure.

Conclusion and Policy Implications

The cost of cultivation and production of various crops in Punjab state is influenced by a complex interplay of factors. This can be the choice of crops, input costs, labour expenses, adaptation of technology, government policy, market demand, agro-climatic Zones. Mix traditional practice and modern techniques were impacting the overall cost conditions. Some crops need higher human labour use or resource intensive cultivation methods; some others have favorable market demand, or government subsidies. The different cost and returns in different zones fund due to several factors such as soil quality, climate conditions, irrigation availability, crop choice, market access, government policies, crop rotation and pest pressure, technology adaptation, land tenure and farm size. The overall trends for various crops in the state such as wheat and paddy showed a significant positive increase in terms of production from several decades to yet, whereas other crops such as cotton, oilseeds, and pulses indicates

Table 5: Costs and returns from various crops in Zone-I of Punjab, 2018-19

(000' Rs./ha)

Crop	Gross returns	Variable costs	Returns over variable costs
Wheat	99	36	63
Paddy	116	44	72
Basmati	126	48	78
R & M	42	30	12
Maize	76	42	34
Potato	154	125	29
Guar	74	26	47

Table 6: Costs and returns from various crops in Zone-II of Punjab, 2018-19

(Rs. in thousand per ha)

Crop	Gross returns	Variable costs	Returns over variable costs
Wheat	101	34	67
Paddy	128	43	85
Basmati	133	56	77
R & M	69	43	26
Barley	69	40	29

Table 7: Costs and returns from various crops in Zone-III of Punjab, 2018-19

(000' /ha)

Crop	Gross returns	Variable costs	Returns over variable costs
Wheat	108	34.5	73.5
Paddy	128	42	86
Basmati	142	47	95
R & M	79	36	43
Cotton	131	59	72

negative growth. The production of wheat, paddy, and basmati shows positive and significantly increased than other crops which cultivated in the state, other crops such as cotton, barley, maize, potato, guar cultivated in various zones. During the agricultural year 2018-19 returns over variable cost of various crops like wheat, paddy, basmati, and R&M compared zone wise and overall. The result revealed that Zone-III was the highest of production among other zones, particularly in terms of main crops such as wheat and paddy. The total variable cost of various crops potato was the highest value of expense, followed by cotton, basmati, paddy, maize, wheat, barley, R&M, and guar. The gross returns from the above crops were observed, basmati was the highest level and its one of the most exported items to other countries, followed by paddy, wheat, maize, guar, barley, R&M. In terms of percentage, the return over variable cost was found to be the highest form of guar followed by wheat crop, paddy, basmati, cotton, barley, R&M, maize, and the least potato. This comparison is different from the zone-wise. According to studying previous published research; costs of cultivation of major crops in Punjab increased dramatically. So, the result suggests the need for policies aimed to bring down cost cultivation of major crops in the state. There is need to frame policies to increase the returns from various crops like maize and R&M. it will help in crop diversification from the paddy-wheat monoculture. This would be helpful to the farmers in declining their machinery and labour costs as well. The continuous evolution of these factors emphasizes the need for a comprehensive and adaptive approach to optimize costs and ensure sustainable agricultural practices in the state.

References

Anonymous 2021. *Statistical abstract of Punjab*. Economic Advisor to Government of Punjab, Chandigarh, Pp 124-166.

Anonymous 2022. *Punjab economic survey*. Economical and Statistical Organization, Government of Punjab, Chandigarh, Pp 209-216.

Bansal S and Grover D K 2020. Cost and return structure of wheat crop under tenant farmers in Punjab: A field survey. *Journal of Economics and Development* **16**: 500-503. DOI : 10.35716/ijed/NS20–020

Chand P, Singh J M, Sachdeva J, Singh J, Agarwal P, Jain R, Rao S and Kaur B 2022. Irrigation water policies for sustainable groundwater management in irrigated northwestern plains of India. *Current Science* **123**:1225. DOI: 10.18520/cs/v123/i10/1225-1231

Gulati A, Roy R and Hussain S 2017. *Getting Punjab agriculture back on high growth path: Sources, drivers and policy lessons.* Punjab Agriculture Report, P. 68. Last seeing 24/08/2023 at web https://icrier.org/pdf/Punjab%20Agriculture%20Report.pdf

Kaur S, Kingra P K, Setia R and Singh S P 2019. Comparative analysis of rice productivity of three agroclimatic zones of Punjab. *Agricultural Research Journal* **56**: 49-55. DOI: 10.5958/2395-146X.2019.00012.7

Pushpa, Srivastava S Kand Agarwal P K 2017. Comparative study on cost of cultivation and economic returns from major crops in eastern region of Uttar Pradesh. *International Journal of Agriculture, Environment and Biotechnology* **10**: 387-399. DOI: 10.5958/2230-732X.2017.00047.X

Prakash K 2022. *Punjab tops in use of chemical fertilizers*. The Tribune News Service, 13 December, 2022.

Raju S S, Chand R, Srivastava S K, Kaur A P, Singh J, Jain R, lraj I K, and Kaur P 2015. Comparing performance of various crops in Punjab based on market and economic prices and natural resource accounting. *Agricultural Economics Research Review* **28**: (Conference Number) 2015 pp 189-198. DOI: 10.5958/0974-0279.2015.00034.8

Sachdeva J, Singh J, and Romana G C 2017. Dynamics of Agricultural Productivity, Land Rent and Land Price Relations in Punjab. *Indian Journal of Economics and Development* **13**: 129-134. DOI: 10.5958/2322-0430.2017.00017.8

Sidhu R A, Bhullar A S and Joshi A S 2005. Income, employment and productivity growth in the farming sector of Punjab: Some issues. *Journal of Indian School of Political Economy* - Pune **17**: pp. 59-72. ISSN 0971-0396, ZDB-ID 13405780.

Singh S, Park J and Brown J L 2011. The economic sustainability of cropping systems in Indian Punjab: A farmers' perspective. Paper prepared for presentation at the EAAE 2011 Congress Change and Uncertainty Challenges for Agriculture, *Food and Natural Resources*, Pp. 17. The University of Reading, UK.

Singh P 2012. The role of externally governed economic policies in shaping Punjab's agrarian oriented development pattern. *Journal of Agricultural Development and Policy* **22**: pp 1-18.

Singh R 2022. *Resource use employment and income of farm households in Punjab*. Ph.D. Thesis submitted to Department of Economics & Sociology, Punjab Agricultural University, Ludhiana.

Singh S, Kaur P, Sachdeva J and Bhardwaj S 2017. Profitability analysis of major crops in Punjab: some evidence from cost of cultivation survey data. *Indian Journal of Economics and Development* **13**: 71-78. DOI: 10.5958/2322-0430.2017.00010.5

Srivastava S K, Chand R and Singh J 2017. Changing crop production cost in India: Input prices, substitution and technological effects. *Agricultural Economics Research Review* **30**: (Conference Number) 2017 pp 171-182. DOI: 10.5958/0974-0279.2017.00032.5

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