
**AN ECONOMIC ANALYSIS OF KHARIF CROPS IN HIMACHAL
PRADESH: A CASE STUDY OF CHAMBA DISTRICT**

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ABSTRACT

The Kharif crops in Himachal Pradesh plays significant role to earn income for rural population. The analyses have been done on the production of Kharif season crops which are produce in Kharif season in Himachal Pradesh's Chamba District, employing a meticulous approach with both primary and secondary data sources. Focusing on key crops such as Maize, Paddy, Pulses (Rajma), Tomato. The study utilizes a strategic sampling strategy and applies statistical measures for data analysis. Findings offer detailed insights into cropping patterns, production, and resource utilization, with Wheat emerging as the predominant crop by using cost and intercorrelation Metrix. The research contributes valuable information for decision-making, providing recommendations to optimize resource use pattern. Serving as a resource for policymakers, researchers, and farmers, the study aims to enhance agricultural sustainability and economic outcomes in the Chamba District.

KEYWORDS: Kharif Crops, Production, Productivity, Cost and Returns, Resource used pattern

1. INTRODUCTION

Agriculture encompasses both the artistic and scientific aspects of tending to the soil, growing crops, and rearing livestock. Its purpose is to yield plants and animal products for human consumption and distribution in various markets.¹ Agriculture, along with its related sectors, indisputably stands as the primary source of livelihood in India, particularly in the expansive rural regions. Moreover, it makes a substantial contribution to the Gross Domestic Product (GDP). Sustainable agricultural practices, emphasizing food security, rural employment, and the adoption of environmentally friendly technologies like soil

conservation, sustainable natural resource management, and biodiversity protection, are imperative for comprehensive rural development. The agricultural landscape in India has witnessed transformative phases such as the green revolution, white revolution, yellow revolution, and blue revolution.² Kharif crops, including rice, sorghum, maize, cotton, ragi, pearl millet (*Pennisetum glaucum*), sugarcane, jute, and others, thrive in dry and arid conditions. The soil and its nutrient content play a crucial role in sustainable farming.³ Despite the implementation of modern agricultural techniques, the rapid growth in population leads to insufficient crop yields.⁴ The selection of a particular crop pattern is influenced by various criteria that vary from one region to another.⁵ The agriculture and economic infrastructure sectors are scrutinized at the district level. Utilizing factorial analysis with 23 indicators, the research aims to pinpoint districts that are lagging behind. This assessment serves as the groundwork for devising plans tailored to the diverse physiographic districts of Himachal Pradesh. These plans consider the districts' resource potentials, current developmental statuses, and the overarching goals of socio-economic equity and regional balance.⁶ Agriculture in Himachal Pradesh providing employment for approximately 70% of the rural population and supplying food and non-food grains to millions, agriculture serves as a critical component in the transition process of nations. It generates markets for industrial products, contributes raw materials for industrial processing, and fosters price stability through adequate food supplies. In Himachal Pradesh, where a significant portion of the population depends on agriculture, the level of income derived from farming activities is a key determinant of economic growth. Efficient resource allocation in farming, affected by factors like uncertain rainfall due to limited irrigation facilities in India, further influences the economic development of farming families. Despite its essential role, the share of agriculture in India's GDP has declined over the years, with challenges in productivity attributed to factors like low literacy rates and difficulties in adopting new technologies. This global perspective on agriculture reflects common challenges faced by developing countries, where low agricultural productivity struggles to match the pace of rapidly growing populations, leading to issues such as malnutrition among farmers.⁷

Hypothesis

There is positive correlation between resources which are used in the production of Kharif Crops.

2. METHODOLOGY

2.1. Analysis of Costs

Total Cost

Total cost incurred in the production of food grains and other field crops by parts, i.e., cost A1, A2, B and C which worked out as follows:

Cost A1

This includes the value of hired human labour, value of owned and hired bullock labour, hired machinery changes, value of owned machine labour, the value of seed (both purchased and produced), value of insecticides and pesticides, value of manure (owned and purchased), value of fertilizers, depreciation of implements and farm building, irrigation charges, land revenue, taxes, interest on working capital and miscellaneous expenses (Artisans etc.)

Working Capital

Working capital includes the costs of human labour (hired), bullock labour, manure, fertilizer, seed/seedlings, insecticides & pesticides, and sticks. The interest charged at the rate of 12.5 percent per annum for a period of 3 months on the working capital as a simple interest.

Cost A2

Cost A1 plus rent paid for leased in land.

Cost B

Cost A2 plus imputed rental value at owned land.

Cost C

Cost B plus imputed value of family labour

Imputed value of owned resources has been calculated as given below:

- (i) At the time of sowing, the value of owned seed and farmyard manures was determined using the local market prices.
- (ii) The market rates that are in effect in the research region have been used to evaluate owned bullock labour days.
- (iii) The cost of family human labour has been estimated using the same formula as that for casual labour, considering the higher of the actual wage or the statutory minimum.
- (iv) The rate of interest on working capital has been charged at 12.5 percent,
- (v) The Special Expert Committee on Cost of Production Estimates (1980), Ministry of Agriculture, Government of India, recommended that the rental value of owned land be computed as one-fifth of the value of production net of land revenue.

(vi) Gross farm income is defined as gross value of output including by products priced at farm harvest rates, and

(vii) After deducting farm expenditures (cost of cultivation) from gross farm revenue, net farm income is the amount paid to the farmer for their management.

2.2. Analysis of Revenue

Gross returns

The gross return was computed by deducting any costs, commissions, or other charges from the overall rate of return on investment in agricultural inputs.

Net returns

The average cost per hectare was deducted from the gross returns per hectare to obtain the net returns per hectare for each crop.

Intercorrelation Matrix

A square matrix that displays the correlation coefficients between two variables is called a correlation matrix. The strength and direction of a linear relationship between two variables are measured by correlation coefficients. Frequently used in multivariate analysis and statistics, a correlation matrix looks at the relationships between several variables.

The Product Moment Correlation or Simple Correlation Coefficient are other names for Karl Pearson's Coefficient of Correlation. The most generally used and well-liked technique for calculating the coefficient of correlation.

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n(\sum X^2) - (\sum X)^2][n(\sum Y^2) - (\sum Y)^2]}}$$

Where:

r = Pearson's correlation coefficient

n = number of paired scores

X = score of the first variable

Y = score of the second variable

XY = the product of the two paired scores

or

$$r = \frac{\text{covariance of variable A and B}}{\sqrt{(\text{variance of variable A}) \times (\text{variance of variable B})}}$$

Significant Testing of Pearson's Correlation Coefficient

If the coefficient is considerably different from zero, statistical analysis must be done to establish whether the estimated r is relevant to the population from which the sample was collected.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Where:

r = Pearson's product-moment correlation coefficient

n = sample size of paired scores

A high correlation coefficient (near -1 or 1) may not be significant if the sample size is small. On the other hand, a large sample might have a r that is statistically significant but not clinically significant. The magnitude of the correlation coefficient, the significance of the t -test, and the context of the research issue should all be considered as a result.

3. RESULTS AND DISCUSSIONS

3.1. Cropping Pattern of Kharif Crops

Table and Figure 1 presents the cropping pattern of Kharif crops among sample farms. The table is categorized based on the size of land holdings, specifically marginal, small, and medium holdings, along with an aggregate for all holdings. Four major crops are considered in the analysis: Maize, Paddy (Rice), Pulses (Rajma), and Tomato. For Maize, the largest Kharif crop in terms of area across all types of holdings, marginal holdings contribute 30.09 hectares, accounting for 97.41 % of their total area. Small holdings allocate 12.41 hectares (92.34 %), while medium holdings dedicate 11.71 hectares (94.66 %). Collectively, Maize occupies 54.21 hectares, making up 95.61 % of the total area among all holdings.

Table 1: Cropping Pattern of Kharif Crops among Sample Farms

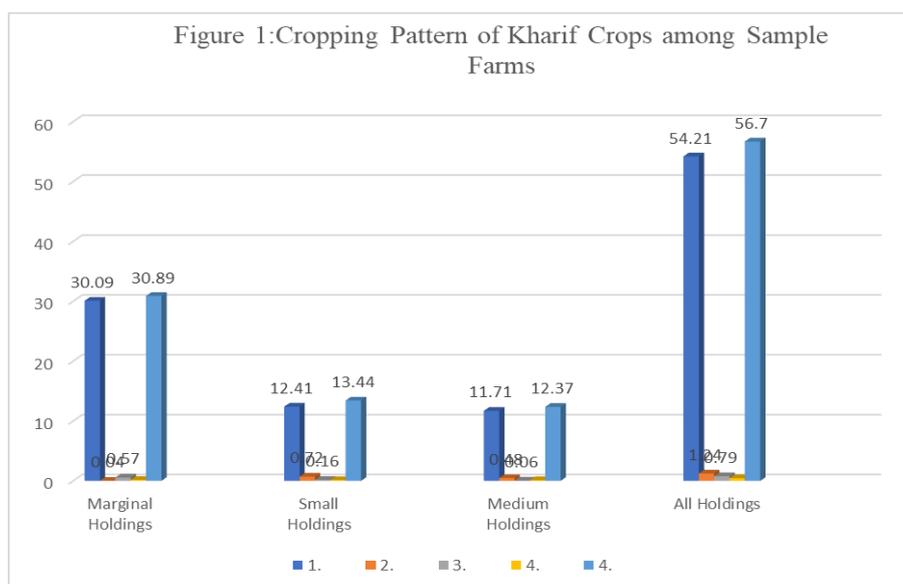
(Area in Hectares)

Sr. No.	Crops	Marginal Holdings		Small Holdings		Medium Holdings		All Holdings	
		Area	% of Total	Area	% of Total	Area	% of Total	Area	% of Total
1.	Maize	30.09	97.41	12.41	92.34	11.71	94.66	54.21	95.61
2.	Paddy	0.04	0.13	0.72	5.36	0.48	3.88	1.24	2.19
3.	Pulses (Rajma)	0.57	1.85	0.16	1.19	0.06	0.49	0.79	1.39
4.	Tomato	0.19	0.62	0.15	1.12	0.12	0.97	0.46	0.81
	Total	30.89	100.00	13.44	100.00	12.37	100.00	56.7	100.00
	Mean	7.72	25.00	3.36	25.00	3.09	25.00	14.18	25.00
	Standard	7.45	24.14	3.02	22.47	2.87	23.23	13.35	23.54

Error									
Median	0.38	1.24	0.44	3.28	0.30	2.43	1.02	1.79	
Standard Deviation	14.91	48.28	6.04	44.94	5.75	46.46	26.69	47.08	
Sample Variance	222.41	2330.68	36.47	2019.19	33.04	2158.92	712.46	2216.22	
Kurtosis	3.99	4.00	3.96	3.96	3.98	3.98	4.00	4.00	
Skewness	1.99	2.00	1.99	1.99	1.99	1.99	2.00	2.00	
Range	30.05	97.28	12.26	91.22	11.65	94.17	53.75	94.80	

Source: Field Survey

Paddy cultivation shows variations across different land holdings. Marginal holdings have a minimal contribution of 0.04 hectares (0.13 %), while small holdings allocate a more substantial 0.72 hectares (5.36 %). Medium holdings fall in between, with 0.48 hectares (3.88 %). The overall Paddy cultivation area is 1.24 hectares, representing 2.19 % of the total area among all holdings. Pulses (Rajma) exhibit a similar trend. Marginal holdings dedicate 0.57 hectares (1.85 %), small holdings contribute 0.16 hectares (1.19 %), and medium holdings allocate 0.06 hectares (0.49 %). Combined, Pulses cover 0.79 hectares, representing 1.39 % of the total area. Tomato cultivation follows a comparable pattern. Marginal holdings have 0.19 hectares (0.62 %), small holdings contribute 0.15 hectares (1.12 %), and medium holdings allocate 0.12 hectares (0.97 %). Together, Tomato cultivation covers 0.46 hectares, making up 0.81 % of the total area. In summary, the table provides a comprehensive breakdown of Kharif crop cultivation patterns across different sizes of land holdings, shedding light on the distribution and contribution of each crop in the sampled farms.



3.2. Production of Kharif Crops

Table and Figure 2 provides a clear depiction of the production of Kharif crops within the sample farms, revealing distinct characteristics among different crops and land holdings. The average land area allocated to maize cultivation is 54.21 hectares, followed by paddy with 1.24 hectares, pulses with 0.79 hectares, and tomato with 0.46 hectares. The overall average land area across all crops is 56.70 hectares.

Table 2: Production of Kharif Crops among Sample Farms

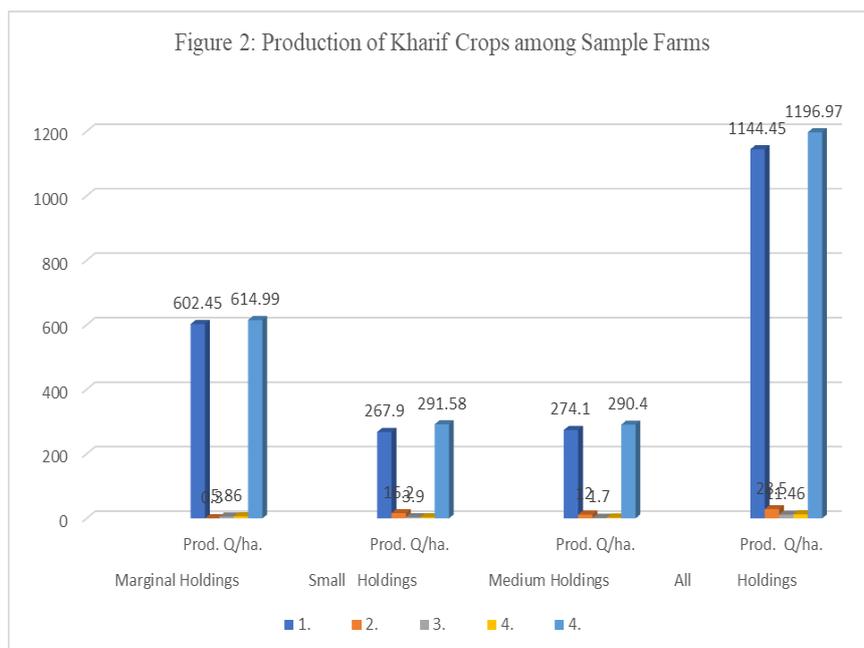
(Area in Hectares) (Production / hectares in quintiles)

Sr. No.	Crops	Marginal Holdings		Small Holdings		Medium Holdings		All Holdings	
		Area	Prod. Q/ha.	Area	Prod. Q/ha.	Area	Prod. Q/ha.	Area	Prod. Q/ha.
1.	Maize	30.09	602.45	12.41	267.90	11.71	274.10	54.21	1144.45
2.	Paddy	0.04	0.30	0.72	16.20	0.48	12.00	1.24	28.50
3.	Pulses(Rajma)	0.57	5.86	0.16	3.90	0.06	1.70	0.79	11.46
4.	Tomato	0.19	6.38	0.15	3.58	0.12	2.60	0.46	12.56
	Total	30.89	614.99	13.44	291.58	12.37	290.40	56.70	1196.97
	Mean	7.72	153.75	3.36	72.90	3.09	72.60	14.18	299.24
	Standard Error	7.46	149.57	3.02	65.07	2.87	67.21	13.35	281.76
	Median	0.38	6.12	0.44	10.05	0.30	7.30	1.02	20.53
	Standard Deviation	14.91	299.15	6.04	130.14	5.75	134.41	26.69	563.53
	Sample Variance	222.41	89489.32	36.47	16935.38	33.04	18067.14	712.46	317560.95
	Kurtosis	4.00	4.00	3.96	3.96	3.98	3.98	4.00	4.00
	Skewness	2.00	2.00	1.99	1.99	1.99	1.99	2.00	2.00
	Range	30.05	602.15	12.26	264.32	11.65	272.40	53.75	1132.99

Source: Field Survey

The production figures highlight maize as the most prolific crop, recording 1144.45 quintals per hectare, followed by paddy with 28.50 quintals per hectare, tomato with 12.56 quintals per hectare, and pulses with 11.46 quintals per hectare. The distribution of land holdings indicates that marginal holdings cover an average area of 30.89 hectares, followed by small holdings with 13.44 hectares, and medium holdings with 12.37 hectares. The combined average area under all types of holdings is 56.70 hectares. Production results reveal that marginal holdings yield 614.99 quintals per hectare, small holdings produce 291.58 quintals

per hectare, and medium holdings contribute 290.40 quintals per hectare. The overall production under all holdings reaches 1196.97 quintals per hectare. The higher production of maize is attributed to widespread cultivation by farmers on their lands, utilizing high-yield variety seeds and intensively applying NPK fertilizers during the production process. These findings underscore the diverse agricultural outputs and efficiencies in Kharif crop cultivation across different types of land holdings within the sampled farms.



3.3. Productivity of Kharif Crops

Table and Figure 3 provides insights into the productivity of Kharif crops among sample farms, presenting data on both the cultivated area and production per hectare. The major crops considered are Maize, Paddy (Rice), Pulses (Rajma), and Tomato.

Table 3: Productivity of Kharif Crops among Sample Farms.

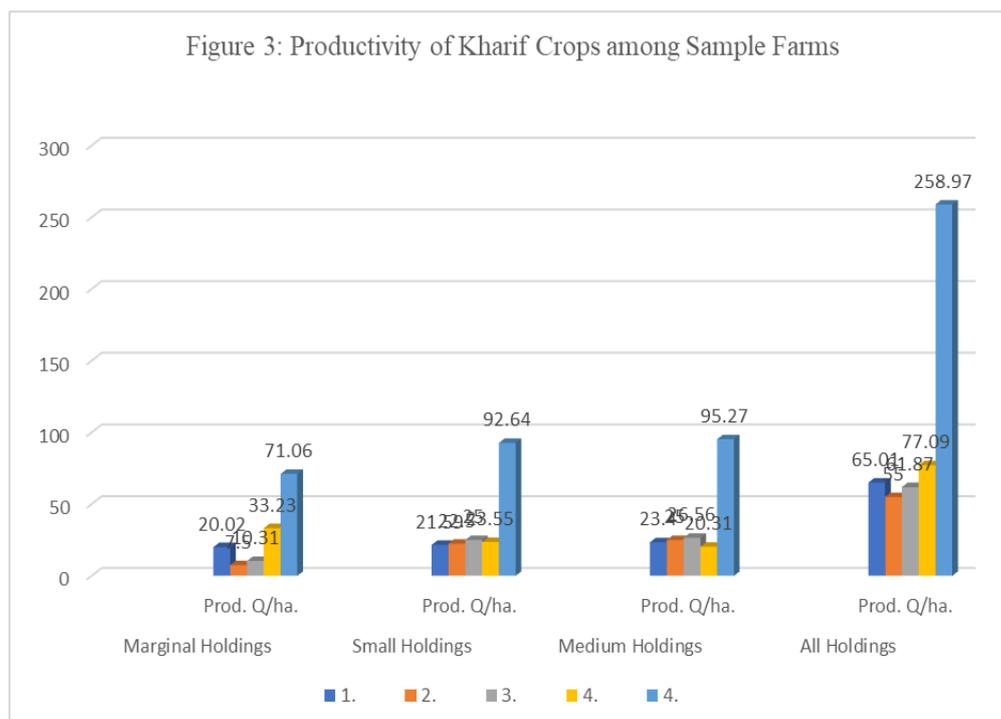
(Area in Hectares) (Production per hectares)

Sr. No.	Crops	Marginal Holdings		Small Holdings		Medium Holdings		All Holdings	
		Area	Productivity Q/ha.	Area	Productivity Q/ha.	Area	Productivity Q/ha.	Area	Productivity Q/ha.
1.	Maize	30.09	20.02	12.41	21.59	11.71	23.40	54.21	65.01
2.	Paddy	0.04	7.50	0.72	22.5	0.48	25.00	1.24	55.00
3.	Pulses (Rajma)	0.57	10.31	0.16	25.00	0.06	26.56	0.79	61.87

4.	Tomato	0.19	33.23	0.15	23.55	0.12	20.31	0.46	77.09
	Total	30.89	71.06	13.44	92.64	12.37	95.27	56.70	258.97
	Mean	7.7225	17.765	3.36	23.16	3.0925	23.8175	14.175	64.7425
	Standard Error	7.456667	5.810899	3.019605	0.732473	2.873997	1.335305	13.34596	4.616094
	Median	0.38	15.165	0.44	23.025	0.3	24.2	1.015	63.44
	Standard Deviation	14.91333	11.6218	6.039211	1.464946	5.747993	2.67061	26.69191	9.232188
	Sample Variance	222.4076	135.0662	36.47207	2.146067	33.03943	7.132158	712.4583	85.23329
	Kurtosis	3.995495	0.45051	3.959946	-0.65267	3.978757	0.255202	3.997125	1.33035
	Skewness	1.998661	0.940394	1.988457	0.451976	1.993799	-0.73303	1.99914	0.79139
	Range	30.05	25.73	12.26	3.41	11.65	6.25	53.75	22.09

Source: Field Survey

For Maize, the dominant Kharif crop, marginal holdings exhibit an area of 30.09 hectares with a production of 20.02 quintiles per hectare. Similarly, small and medium holdings contribute 12.41 hectares (prod. Q/ha. 21.59) and 11.71 hectares (prod. Q/ha. 23.40), respectively. The overall productivity for Maize among all holdings is 65.01 quintiles per hectare. Paddy cultivation showcases variations, with marginal, small, and medium holdings contributing 0.04 hectares (prod. Q/ha. 7.50), 0.72 hectares (prod. Q/ha. 22.5), and 0.48 hectares (prod. Q/ha. 25.00), respectively. The overall Paddy productivity reaches 55.00 quintiles per hectare. Pulses (Rajma) and Tomato production patterns follow a similar trend, reflecting the distribution of both area and production quintiles across different sizes of land holdings. The comprehensive data in Table 3 facilitates a nuanced understanding of the productivity levels of Kharif crops among the sampled farms, providing valuable information for agricultural planning and management.



3.4. Cost and Returns

The cost and returns analysis for different land holdings during the kharif seasons, emphasizing major crops like Maize, Paddy, Pulses (Rajma), and Tomato in the study area. The detailed crop-wise analysis helps identify input costs, interest, depreciation, land-related expenses, and imputed values of labour and fixed capital. The categorization into Cost A1, Cost A2, Cost B, and Cost C provides a nuanced understanding of expenditure components. This analysis aids farmers in making informed decisions about resource allocation for increased production capacity. Gross and net returns are calculated by deducting total costs from gross returns, with additional metrics such as yield per hectare, sold yield percentage, quantity sold, price per quintal, gross returns per hectare, total cost per hectare, and net returns per hectare providing valuable insights into economic outcomes for each crop. Overall, the study offers a comprehensive economic perspective to guide farmers in optimizing their choices and enhancing overall agricultural efficiency.

3.5. Aggregate Cost of Kharif Crops

Table and Figure 4 presents a comprehensive overview of the aggregate costs associated with cultivating Kharif crops per hectare, utilizing data for four crops: Maize, Paddy, Pulses (Rajma), and Tomato.

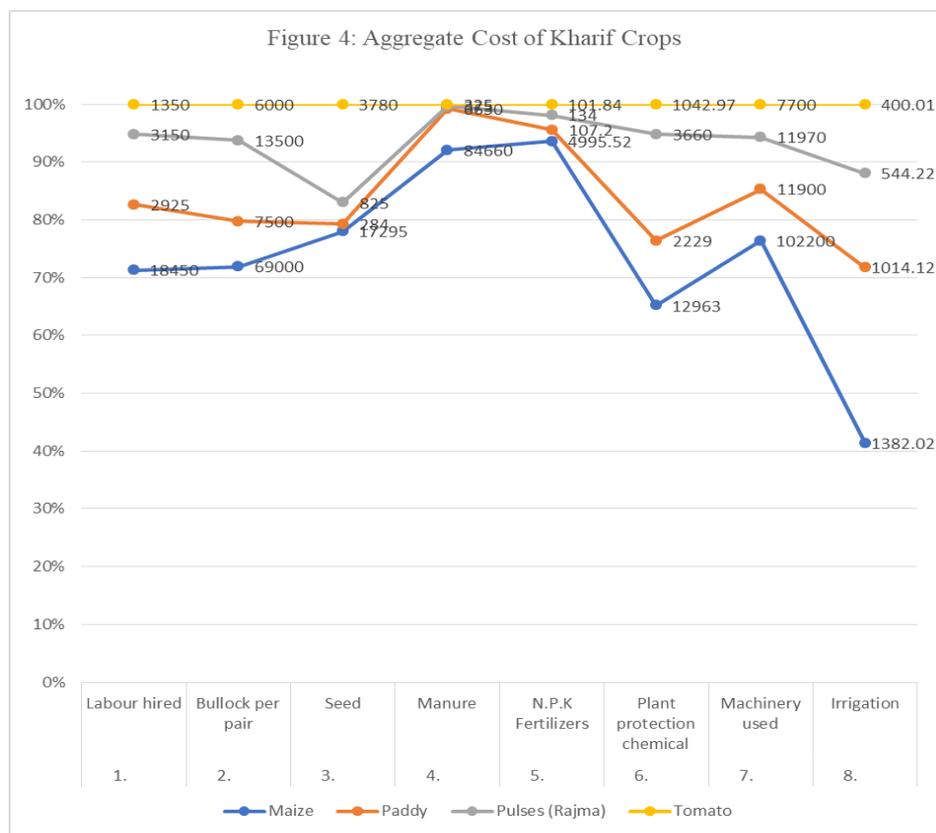
Table 4: Aggregate Cost of Kharif Crops . (Rupees per hectares)

Sr. No.	Particulars	Maize	Paddy	Pulses (Rajma)	Tomato
1.	Labour hired	18450.00	2925.00	3150.00	1350.00
2.	Bullock per pair	69000.00	7500.00	13500.00	6000.00
3.	Seed	17295.00	284.00	825.00	3780.00
4.	Manure	84660.00	6630.00	375.00	325.00
5.	N.P.K Fertilizers	4995.52	107.20	134.00	101.84
6.	Plant protection chemical	12963.00	2229.00	3660.00	1042.97
7.	Machinery used	102200.00	11900.00	11970.00	7700.00
8.	Irrigation	1382.02	1014.12	544.22	400.01
9.	Interest on working capital	37313.46	3910.71	4098.98	2483.98
10.	Depreciation	31094.56	3258.93	3415.82	2069.97
11.	Land revenue	0.00	0.00	0.00	0.00
12.	Taxes	0.00	0.00	0.00	0.00
13.	Miscellaneous cost	178800	0.00	0.00	0.00
	<i>Cost A1</i>	558153.56	39758.96	41673.02	25253.77
14.	Rent on leased-in land	0.00	0.00	0.00	0.00
	<i>Cost A2</i>	558153.56	39758.96	41673.02	25253.77
15.	Rental value of own land	281735.52	9909.90	7207.20	3746.22
16.	Imputed value of fixed capital	5007512.00	63310.00	135524.00	49960.00
	<i>Cost B</i>	5847401.08	112978.86	184404.22	78959.99
17.	Imputed value of family labour	249075.00	7650.00	9225.00	17325.00
	<i>Cost C</i>	6096476.08	120628.86	193629.22	96284.99

Source: Field Survey

The data is expressed in rupees and encompasses various cost components, providing insights into the financial intricacies of agricultural practices. For Maize cultivation, the total cost (Cost C) is 6096476.08 Rupees per hectare. This includes expenditures such as labour hired (558153.56 rupees), bullock per pair (39758.96 rupees), seed (41673.02 rupees), manure (25253.77 rupees), N.P.K fertilizers (39758.96 rupees), plant protection chemicals (41673.02 rupees), machinery used (25253.77 rupees), irrigation (39758.96 rupees), interest on working capital (41673.02 rupees), depreciation (25253.77 rupees), land revenue (0.00 rupees), taxes (0.00 rupees), and miscellaneous costs (178800 rupees). Additional costs, such as the rental value of own land (281735.52 rupees) and the imputed value of fixed capital (5007512.00 rupees), contribute to the overall cost. Similar detailed breakdowns are observed for Paddy, Pulses (Rajma), and Tomato. For Paddy cultivation, the total cost is 120628.86 rupees per hectare, with significant contributions from labour hired, machinery, and inputs. Pulses (Rajma) cultivation incurs a total cost of 193629.22 rupees per hectare, while Tomato cultivation totals 96284.99 rupees per hectare. This comprehensive dataset aids in

understanding the financial dynamics of Kharif crops cultivation, offering valuable insights for farmers, policymakers, and researchers to optimize resource allocation and enhance the economic viability of agricultural practices.



3.6. Aggregate Returns of Kharif Crops

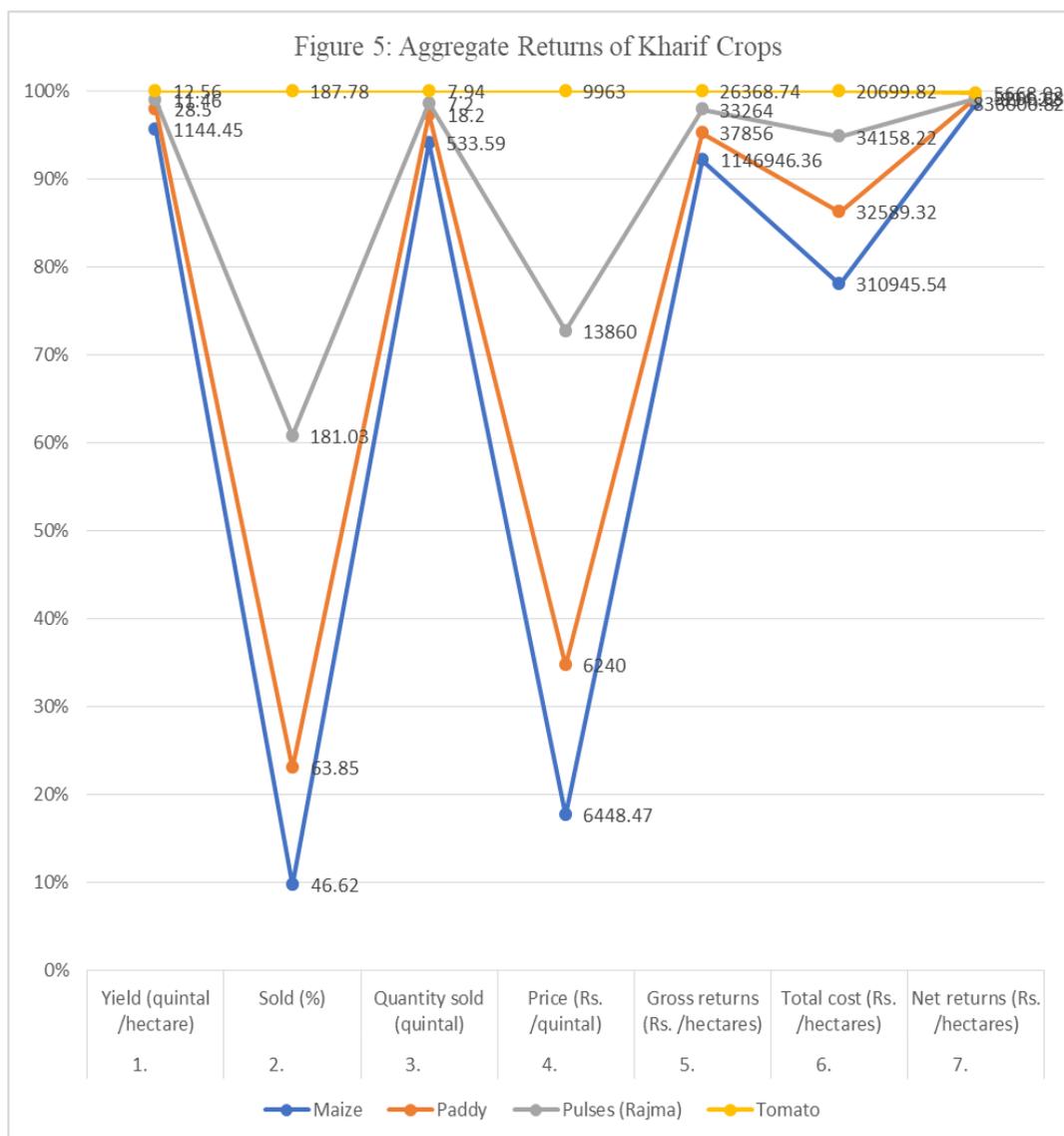
Table and Figure 5 presents a comprehensive assessment of the aggregate returns associated with cultivating Kharif Crops per hectare, with data provided for Maize, Paddy, Pulses (Rajma), and Tomato. The data is expressed in various parameters, offering insights into the financial outcomes of agricultural practices. For Maize cultivation, the yield is 1144.45 quintals per hectare, with 46.62 % of the produce sold.

Table 5: Aggregate Returns of Kharif Crops.

Sr No.	Particulars	Maize	Paddy	Pulses (Rajma)	Tomato
1.	Yield (quintal /hectare)	1144.45	28.50	11.46	12.56
2.	Sold (%)	46.62	63.85	181.03	187.78
3.	Quantity sold (quintal)	533.59	18.20	7.20	7.94
4.	Price (Rs. /quintal)	6448.47	6240.00	13860.00	9963
5.	Gross returns (Rs. /hectares)	1146946.36	37856.00	33264.00	26368.74
6.	Total cost (Rs. /hectares)	310945.54	32589.32	34158.22	20699.82
7.	Net returns (Rs. /hectares)	836000.82	5266.68	-894.22	5668.92

Source: Field Survey

The quantity sold amounts to 533.59 quintals at a price of Rs. 6448.47 per quintal. Consequently, the gross returns for Maize total Rs. 1146946.36 per hectare. After accounting for the total cost of Rs. 310945.54 per hectare, the net returns for Maize cultivation stand at Rs. 836000.82 per hectare. Similar detailed assessments are observed for Paddy, Pulses (Rajma), and Tomato. Paddy cultivation yields 28.50 quintals per hectare, with 63.85 % of the produce sold at a price of Rs. 6240.00 per quintal. The resulting gross returns for Paddy are Rs. 37856.00 per hectare. After considering the total cost of Rs. 32589.32 per hectare, the net returns for Paddy cultivation amount to Rs. 5266.68 per hectare. In the case of Pulses (Rajma), the yield is 11.46 quintals per hectare, but an unusual percentage sold of 181.03% suggests potential discrepancies in the data. The gross returns for Pulses are Rs. 33264.00 per hectare, while the total cost is Rs. 34158.22 per hectare, resulting in negative net returns of Rs. -894.22 per hectare. Tomato cultivation yields 12.56 quintals per hectare, with 187.78% of the produce sold at a price of Rs. 9963 per quintal. The gross returns for Tomato cultivation total Rs. 26368.74 per hectare. After accounting for the total cost of Rs. 20699.82 per hectare, the net returns for Tomato cultivation amount to Rs. 5668.92 per hectare. This detailed dataset provides a comprehensive understanding of the financial returns associated with Kharif crop cultivation, offering valuable insights for farmers, policymakers, and researchers to assess the economic viability and profitability of different crops.



3.7. Inter-Correlation Matrix of Kharif Crops

Table 6 displays an inter-correlation matrix for various factors related to Kharif crops, illustrating the strength and direction of relationships between different variables.

Table 6 Inter-Correlation Matrix of Kharif Crops.

	<i>Labour hired</i>	<i>Bullock per pair</i>	<i>Seed</i>	<i>Manure</i>	<i>N.P.K Fertilisers</i>	<i>Plant protection chemical</i>	<i>Machinery used</i>	<i>Irrigation</i>
<i>Labour hired</i>	1.000							
<i>Bullock per pair</i>	0.997	1.000						
<i>Seed</i>	0.958	0.964	1.000					

Manure	0.995	0.989	0.970	1.000				
N.P.K Fertilisers	0.995	0.995	0.981	0.997	1.000			
Plant protection chemical	0.993	0.995	0.934	0.977	0.981	1.000		
Machinery used	0.998	0.996	0.972	0.998	0.999	0.987	1.000	
Irrigation	0.842	0.800	0.709	0.851	0.811	0.816	0.828	1.000

Significance at 5 percent level and at 1 percent level are 0.576 and 0.714 respectively.

Source: D. Child, Essentials of Factor Analysis, 1970, p. 95.

The correlation coefficients range from -1 to 1, providing insights into how closely linked or inversely related the variables are. Noteworthy correlations include the highly positive relationship between Labour hired and Bullock per pair, with a correlation coefficient of 0.997. Similarly, Labour hired exhibits a strong positive correlation with Seed (0.958), Manure (0.995), N.P.K Fertilisers (0.995), and other factors. Bullock per pair also shows strong positive correlations with Seed (0.964), Manure (0.989), and other variables. The matrix underscores the interconnectedness of various agricultural inputs, with Machinery used demonstrating high positive correlations with Labour hired, Bullock per pair, Seed, and other components. Additionally, the correlation coefficients between Irrigation and the other variables range from 0.709 to 0.851, indicating moderate to strong positive correlations. This inter-correlation matrix serves as a valuable tool for analysing the relationships among different factors in Kharif crop cultivation. It aids in identifying patterns, dependencies, and potential areas of optimization in agricultural practices, providing valuable insights for farmers and researchers.

4. Hypothesis Testing

It is evident from the values of correlation matrix that majority of inputs to produce Kharif Crops are positively and significantly correlated with each other at 1 percent and 5 percent level of significance. Hence the hypothesis in this respect has been accepted keeping in view the values of coefficient of correlation.

5. CONCLUSION

The study encompasses various aspects, including cropping patterns, production, productivity, costs and returns, and resource utilization patterns. The detailed economic analysis includes an aggregate overview of costs and returns for Maize, Paddy, Pulses (Rajma), and Tomato. The breakdown of costs into categories such as Cost A1, Cost A2, Cost B, and Cost C provides a comprehensive understanding of expenditure components, including imputed values and family labour. The aggregate returns analysis offers valuable insights into the financial outcomes of cultivating each crop, aiding farmers, policymakers, and researchers in optimizing choices and enhancing overall agricultural efficiency. Furthermore, the inter-correlation matrix highlights strong positive relationships between various agricultural inputs, emphasizing the interconnectedness of factors such as labour, bullock usage, seed, manure, fertilizers, and irrigation. The matrix serves as a valuable tool for analysing patterns and dependencies in Kharif crop cultivation, providing insights for informed decision-making. Overall, the research paper contributes to the existing knowledge on agricultural practices in the Chamba District and serves as a valuable resource for farmers, policymakers, and researchers. The recommendations provided can guide stakeholders in optimizing resource allocation, enhancing economic outcomes, and promoting sustainable agricultural practices in the region.

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