

Resource Use Efficiency and Constraints faced by Potato Growers in Kannauj District of Uttar Pradesh

Abstract

In the present paper, an attempt has been made to examine various Potato Cultivation in different categories of the farmers in Kannauj district of Uttar Pradesh. Hundred Sample farmers (marginal 61, Small 29, & medium 10) were interviewed from 5 village Kannauj block of Kannauj district. Data was analysed and found that Average holding Size 1.41 ha. Varying from 0.80 to 3.91 ha. Returns to scale in case of marginal, and small and medium size group of farms were 0.8989, 0.8525 and 0.8280 respectively. Returns to scale in all three categories of the farms were found less than unity. It indicates the production of cauliflower is characterized by decreasing returns to scale on the each farm situation. Another factor of production i.e. manure and fertilizer was found significantly associated with dependent variable at 1% level probability in all farm situation. The problem related with hired human labour and technical knowledge were noticed at 1st and 2nd rank by the sample farmers.

Keywords:-Return to scale, Resource Use Efficiency and Constraints etc.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is an annual plant which belongs to Solanaceae family. It is regarded as the most significant food crop in India. The potato is revered as a source of power worldwide, with a 54.23 million tonne fresh weight production from 2.25 million hectares, it is the third-most significant food crop in the world after rice and wheat (2020–2021). A crop that has traditionally been "the poor man's friend" is the potato. Over 300 years have passed since the cultivation of potatoes began in our nation. It has become one of the most widely grown crops in this nation for vegetables.

Economical and a source of energy for the human diet, potatoes are a popular food. Starch, vitamins, particularly C and B, and minerals are abundant in potatoes. Its composition is 20.6% carbohydrates, 2.1% protein, 0.3% fat, 1.1% crude fiber, and 0.9% ash. The important amino acids Leucine, tryptophan, isoleucine, etc. are also present in good amounts in potatoes. (Agricultural statistics at a Glance 2021).

The potato produces significantly more edible energy protein and dry matter per unit area and time than many other crops due to its high protein calories ratio (17 gm protein:1000 kcal) and short vegetable cycle. In recent decades, there has been a tremendous rise in both area and productivity. The lack of the necessary infrastructure for storage, transportation, marketing, and utilisation is the fundamental reason why the nation is still unable to absorb the excess output of potatoes.

India is the world's second-largest country in terms of area and potato output, behind China and the Indian Federation. When compared to Poland (7.08mt) and the Netherlands (6.67mt), India's production of potatoes (54.23 million tonnes) is high and relatively extremely low, respectively. This might be because there are significant differences in the agro ecological environments in the various regions of the nation (**global potato statistics latest FAO data2021**). Several industrial processes involve potatoes, including the manufacturing of starch and alcohol. Farina, a potato starch, is used in laundries and textile mills to size yarn.

The production of potatoes in Uttar Pradesh totals 15811.31 tonnes and is farmed on an area of 620.44 hectares. The state's economy and the farmers' well-being are both significantly impacted by it. There is still a significant difference between the actual (21-27 t/ha) and potential yields (40–45 t/ha), even though the state's productivity in producing potatoes is third only behind Gujrat and West Bengal. (**Agricultural statistics at a Glance 2021**)

The potato crop covers 39779 hectares in the Kannauj district of Uttar Pradesh, and its production was 254.28 q/ha. 293.71 q/ha was the total production. (Meaning and number division Kannauj, 2020–21). With this background the study was conducted with the following **objectives**.

1. To examine the resource use efficiency of potato on different size of sample farms.
2. To find out the constraints in potato production faced by the farmers suggest suitable measures to overcome them.

Materials and Methods

1. **Sampling design:** Multi-stage stratified cum purposive random sampling design was used to select district, block, village and cultivators in the ultimate stage of study.

2. **Selection of the district:** The study was purposively undertaken in kannauj district in order to avoid operational inconvenience of the investigator.
3. **Selection of block:** Kannauj block was randomly chosen for the study out of the district's 8 blocks.
4. **Selection of villages:** A list of all the villages falling under kannauj block were prepared and arranged in ascending order to the area covered under crop hence forth. Out of the which 5 villages were selected randomly from this list
5. **Selection of farmers:** A Separate list of Potato growers of selected villages was prepared along with their size of holding and further it was grouped into three categories i.e.

1. Marginal farmer below 1 ha
2. Small farmer 1-2 ha and
3. Medium farmer 2 ha and above

From these lists a sample of 100 respondents were drawn following the proportionate allocation to the different categories.

6. **Period of Study:** The data was collected for the agricultural year 2021-2022.
7. **Method of enquiry:** For the interpretation of data the following analytical tools were used:

(i) **Analysis of data:** Both the tabular and functional analysis was used. Weighted Average was worked out for interpretation of data with the help of following formula. (Kushwaha *et al.*, 2019; Kumar *et al.*, 2022 and Yadav *et al.*, 2024).

$$\text{Weighted Average} = \frac{\sum W_i X_i}{\sum W_i}$$

Where,

X-variable

W=Weights of variable.

(ii) Multiple regression analysis of Cobb-Douglas production function

The mathematical form of Cobb Douglas production functions: (Yadav *et al.*, 2021).

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} \dots e^{\mu}$$

Where,

Y= Per hectare output (Rs/ha)

X₁=Seed (Rs/ha)

X₂=Irrigation charge (Rs/ha)

X₃=Manure and fertilizers (Rs/ha)

X₄= Plant protection charges (Rs/ha)

X₅= Human labour Charge (Rs/ha)

B_i (i=1, 2, 3, 4, 5) =Elasticity coefficient of the respective

Input variables

e=Error term or disturbance term

μ=Random variables

(iii) Cobb-Douglas Production functions in log form:

$$\text{Log } Y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + \mu \log e$$

This form was used for estimating the parameters of the function based on sample data.

(iv) Estimation of Marginal Value Productivity (MVP):

The marginal value product of inputs was estimated by following formula.

$$\text{MVP}_{x_j} = \frac{b_j \bar{y}}{\bar{X}_j}$$

b_j=Production elasticity with respect to X_j

Y=Geometric mean of the dependent variable (Y)

X=Geometric mean value of X_j, independent variable

MVP, marginal value production J input j=1, 2, 3, 4, 5, variable

Constraints faced by farmers in production of Potato in the study area:

Constraints faced by farmers have been analyzed through survey based on demographic profile of the farmers like age groups and educational level of the farmers. Garret ranking technique (Henry Garrett) has been used to analyze the constraint faced by the farmers, wholesalers, retailers involve in plant marketing. Constraints faced by farmers in plants value chain is the most important aspects of research for suggestion to government policy. The

respondent has been asked to rank the constraints and these converted in to score (**Gautam et al., 2022**).

$$\text{Percent position} = 100 \cdot (R_{ij} - 0.5) / N_j$$

Where,

R_{ij} = Rank given for i th factor by j th individual

N_j = Number of factors ranked by j th individual.

Results and Discussion:

Average size of holding of sample farms: The study covers a sample of 100 farmers, which are divided in three size groups, namely marginal (below-1ha), small (1-2ha) and medium (2-4ha). It is clear from the Table 1 that net cultivated area of sample farms (34.54) per cent, (37.75) per cent, and (27.71) per cent at the gross cropped area marginal, small, and medium farms, respectively. The average size of holding of marginal, small and medium farms comes to 0.80, 1.84 and 3.91 hectare, respectively. On an overall, average size of holding was estimated 1.41 hectares.

Table No. 1: Average size of holding on sample farms under different size group of farms in the study area (ha)

S.No.	Size group of farms	No. of sample farm	total cultivated area	average size of holding
1	Marginal	61	48.00 (34.54)	0.80
2	small	29	53.3 (37.75)	1.84
3	Medium	10	39.80 (27.71)	3.91
Total		100	141.10 (100)	1.41

Resource use efficiency and Marginal Value Productivity:

Resource use efficiency: The production function analysis was carried out to determine the efficiency of various resources (seed, labour, manure & fertilizer, and irrigation) used in the

production of Potato. Cobb-Douglas production function was found best fit to the data, and applied for the analysis.

Elasticity of production:

The estimated value of elasticity of production, standard error, co-efficient of multiple determinations (R^2) and returns to scale for Potato production by different size group of farms are given in Table-2. It is evident from the Table that co efficient of multiple determinations (R^2) of marginal, small and medium size groups farms were 0.87, 0.88 and 0.92 respectively. The above co-efficient of multiple determination of marginal, small and medium size group of farms **was of all six independent** variables viz. seed, labour, manure & fertilizer, and irrigation, thus it is clear that all input variable contributed 0.89 percent, 0.87 and 0.81 per cent under marginal and small and medium group of farms.

Table 2: Production Elasticity of Potato on different size group of farms in the study area

Size group of sample farms (ha)	Production Elasticity				Returns to scale	R^2
	X1	X2	X3	X4		
Marginal	0.2411	0.1518	0.2121	0.2939	0.8989	0.87
Small	0.2662	0.2624	0.1789	0.1650	0.8725	0.88
Medium	0.1890	0.1989	0.2937	0.1364	0.8180	0.92

** Significant at 5% significant level

*Significant at 1% significant level

Where, X₁, X₂, X₃, and X₄, stand for seed, , hired labour, manure & fertilizer , and irrigation (Rs.) respectively.

Out of four independent variables s seed, labour, manure & fertilizer, and irrigation, three variable i.e. plant protection, machinery charges and irrigation were found statistically significant at 1% level of probability in case of marginal, small and medium size group of farms respectively. In case of small and medium size group of farms manure & fertilizer and hired labour had significant relationship at 5% level of probability and rest variable were not associated significantly with the yield.

Returns to scale in case of marginal, and small and medium size group of farms were 0.8989, 0.8525 and 0.8280 respectively .Returns to scale in all three categories of the farms were found less than unity. It indicates the production of cauliflower is characterized by decreasing returns to

scale on the each farm situation. It is therefore inferred that increasing all the factors by 1% simultaneously results in increase of the return by less than one per cent.

Marginal Value Productivity:The marginal value productivity of different input factors are also presented in Table-3. It is depicted from the table that in case of all the three categories of farms, for all the four independent variable i.e. seed, labour, manure & fertilizer, and irrigation is the marginal value of productivity to factor cost were found positive, indicating that there is future scope for increasing the investment on all these factor in each farm situation to realize more return than the existing use of input.

Table 3: Marginal Value Productivity (MVP) of included factors in production of Potato crop in the study area

Size group of farms	Marginal value productivity (MVP) on different size group farms.			
	X1	X2	X3	X4
Marginal	2.46	0.92	1.46	0.74
Small	3.44	1.26	2.34	3.61
Medium	3.36	2.06	1.49	2.28

Where, x1, x2, x3, and x4 stand for seed, hired labour, manure & fertilizer, and irrigation (Rs.) respectively.

Constraints in Production of Potato: The Potato growers faced various types of cost of cultivation problems in the study area. It is presented in Table 4. shows the major constraints faced by the Potato growers in the study area were unavailability of machines and tractor of 67.23 (rank I) followed by, lack of improved varieties overall Garrett score 65.08(rank II), lack of irrigation system has mean Garrett score value of 62.54 (rank III), Unavailability of cold storage which got rank IV with a Garrett score of 59.48. **Fifth major constraint reported by the Potato growers was scarcity of labour** which resulted in decrease of farmer's share in consumer's rupee overall Garrett score 56.67 (rank V), problem of plant protection chemicals and weedicide was also one of the major constraints which got VI rank with overall Garrett score of 55.06. In addition to the above problems, unfavorable weather condition (rank VII), **cheating**, by attack of pest and disease (rank VIII), lack of training facilities & market access (rank IX), Existence of intermediaries between farmers and irregular electric supply(rank X), in the study area.

Table 4. Major constraints faced by the Potato growers in the study area

S. No	Potato Production Constraints	Average score	Rank
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1	Lack of training facilities& market access.	47.34	IX
2	Lack of improved varieties	65.08	II
3	Scarcity of labour	56.67	V
4	Unfavorable weather condition	54.07	VII
5	Lack of irrigation system	62.54	III
6	Irregular electric supply	45.72	X
7	Attack of pest and disease	48.20	VIII
8	Problem of plant protection chemicals and weedicide	55.06	VI
9	Unavailability of cold storage	59.39	IV
10	Unavailability of machines and tractor	67.23	I

Conclusion: Under marginal and small farms, the elasticity of production concerning plant protection and seeds was statistically significant. Under medium farms, irrigation, and plant protection were found statistically significant.

In the case of potato, returns, to scale marginal, small and medium, size of sample farms are characterized by decreasing returns to scale. Out of the total variation in dependent variables explained by independent variables which were found significant, labour, seed, manure and fertilizers, and irrigation were found significant at 5 per cent, and 1 per cent level of significance.

The potato crop R^2 was found to be 0.87,0.88, meaning that 0.92 per cent of the variation in the yield was explained by independent variables which were found significant in terms of marginal farms.

MVP value of various inputs used in potato crops grown in Kannauj block revealed that in the case of potato, only manure and fertilizer showed MVP less than unit which means that these resources were overused, so their use should be reduced. Other than manure and fertilizer, all the resources showed MVP more than a unit which stated that these resources were still under use and their use can be increased to raise the profit.

Under constraints analysis of potato, Unavailability of machines and tractors, Lack of improved varieties, Lack of irrigation system, Unavailability of cold storage and Scarcity of labour were rank-1, rank-II, rank-III, rank-IV, rank-V, it's was 67.23, 65.08, 62.54, 59.39. 56.67 per cent. Respectively.

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