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

Abstract

In the present paper, an attempt has been made to examine Potato cultivation in different categories of farmers in Kannauj district of Uttar Pradesh.Primary data was collect through personal interview by pre-structured and pre-tested schedule; the data was collect for the agricultural year 2022-23. A sample size of 100 farmers, marginal (61) Small (29) Medium (10) were interviewed form 5 village of Kannauj block in Kannauj district select the farmers by using the proportionate allocation method,with the data analysis, the resultfound that average holding size 0.84, 1.84 and 3.91 ha. in respect of marginal small and medium farm, respectively. In the case of potato,returns to scale of marginal, small and medium size group of farms were 0.8989,0.8525 and0.8280, respectively. Returns to scale in all three categories of the farms were found less than unity. It indicates the production of potato is characterized by decreasing returns to scale on 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 wasnotice at I and II rank by the sample farmers (i.e. Unavailability of machines and tractor and Lack of improved varieties).

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

INTRODUCTION

"Potato (*Solanum tuberosum L.,)*is an annual plant which belongsto the Solanaceaefamily. 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 tone 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"**(Dahia *et al.*, 1995**).

Economical and according to source of energy potatoes are a popular food for human diet.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 Lucien, 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 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 (7.08 million tons) and the Netherlands (6.67million tons), 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 **(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 tones 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 tones/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 Kannaujblock 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 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 2-4 ha and above (Yadav *et al.*, 2024)

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**).

$$\text{Weighted Average} = \frac{\Sigma WiXi}{\Sigma Wi}$$

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**).

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}\ldots\ldots e^{\mu}$$

Where,

Y= Per hectare output (Rs/ha)

X_1=Seed (Rs/ha)

X_2=Irrigation charge (Rs/ha)

X_3=Manure and fertilizers (Rs/ha)

$X_{4=}$ Plant protection charges (Rs/ha)

$X_{5=}$ 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:

$$\text{Log } Y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x3 + b_4 \log x4 + b_5 \log x5 \ldots\ldots\ldots \mu \log e$$

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.

$$MVPxj = \frac{bi\ \bar{y}}{\bar{X}i}$$

bj=Production elasticity with respect to Xj

Y=Geometric mean of the dependent variable (Y)

X=Geometric mean value of Xj, independent variable

MVP, marginal value production J inputj=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 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**).

Percent position = 100*(Rij-0.5)/ Nj

Where,

Rij= Rank given for ith factor by jth individual

Nj= Number of factors ranked by jthindividual.

Results and Discussion:

Average size of holding of sample farms: 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 ha, 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 no. 2 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 four 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, X_1, X_2, X_3, and X_4, stand for seed, hired labour, manure & fertilizer, and irrigation (Rs.) respectively.

Out of four independent variables 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 and0.8280 respectively .Returns to scale in all three categories of the farms were found less than unity. It indicates the production of potato 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. (rank V)constraint reported by the Potato growers was scarcity of labourwhich 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),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 mean score	Rank
1	Unavailability of machines and tractor	67.23	I
2	Lack of improved varieties	65.08	II
3	Lack of irrigation system	62.54	III
4	Unavailability of cold storage	59.39	IV
5	Scarcity of labour	56.67	V
6	Problem of plant protection chemicals and weedicide	55.06	VI

7	Unfavorable weather condition	54.07	VII
8	Attack of pest and disease	48.20	VIII
9	Lack of training facilities& market access.	47.34	IX
10	Irregular electric supply	45.72	X

Conclusion:

The present paper summarizes the scientific importance by using economic tools to compare different sizes of farmers. Besides that, it addresses one of the most important crops in India, which is potato. The salient inferences and conclusions drawn are as follow the sample of 100 farmers of the selected blocks was considered to study and results in the average size of holding as 0.84, 1.84 and 3.91 hectares in respect of marginal, small and medium farms, respectively.

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 and 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-I, rank-II, rank-III, rank-IV, rank-V, it's was 67.23, 65.08, 62.54, 59.39. 56.67 average mean score, respectively.

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