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Resource use efficiency on potato farms in Kannauj district of Uttar Pradesh

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Abstract
Hundred sample farms (Marginal, Small and Medium) were interviewed from five villages of "Umarda" block of Kannauj district of Uttar Pradesh. Data were analysed and found that average holding size was 0.49 hectare and cropping intensity was 222.45 percent, potato occupied 13.85 percent of grass cropped area 1.09.It offers a net income of Rs. 70013.40 with an expenditure of Rs. 80533.58 as total cost per hectare. Input-output ratio was found 1:1.87 on overall farms having direct relationship with size of holding potato cultivation in the study was characterized by decreasing return to scale.

Keywords: Potato farms, Kannauj, *Solonum tuberosum* L.

Introduction

Potato (*Solonum tuberosum* L.) belong to the family Solanaceae well known as the king of vegetable has emerged as the most important food crop of India. Potato acclaimed around globes as the power house of energy. It is the world, third most important food crop after wheat and rice with a production of 43.42 million tones fresh weigh produced from 2.16 million hectare area (2015-16). The potato is a crop which has always been the 'poor men' friend. Potato is being cultivated in the country for the last more than 300 years. For vegetable purpose is has become one the most popular crop in this country.

India ranks 2nd in area and production of potato in the world after China with productivity 22.92 million tonnes per hectare. TE-2007, potato was grown on 0.68 per cent of total cropped area and contributed Rs.6095.30 crores (at year 1999 price)with share 1.5 percent of the value of outut from agriculture in country (Joshi at al.2008). It was produced about 28.5 million tonnes from 1.56 million hectare with an average yield of 28.4 tonnes per hectare (Nayak and Lal 2012).

In Uttar Pradesh potato is grown in 5.05 lakh ha with the production of 11.1 million tonnes. It plays an important role in the state economy and well being of the farmers. Although potato productivity in the state ranks 3rd next to Gujrat and West Bengal.

In Kannauj district of Uttar Pradesh potato occupies an area of 52.50 million hectares and its productivity was 224.20 q/ha. The total production was 1177.16 million tonnes (horticulture statistics at a glance 2015-16)

Materials and Methods

1. Selection of Sample Farmers

Purposive and random sampling techniques were used to select the blocks, villages and the respondent. District Kannauj and block 'Umarda' was selected purposively because of nearness and familiarity of investigator with the people and the cultural environment Thereafter, the list of the villages in the block was prepare and five villages were selected randomly. The separate list of the household of each selected village were prepared along with their size of holding and categories in to, three categories i.e.

Marginal	:	Below 1ha.
Small	:	1 to 2ha.
Medium	:	2 to 4ha.

2. Methods of Enquiry

Personal interview method was used to collect the primary information from the respondent. The data were recollected on well structured and pre tested schedule. Several visits were made from time to time in order to collect the information. The study was based mainly on primary data, but secondary data was obtain from Tehsil/Block/Village and District level official records.

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3. Analytical Tools

Tabular analysis was used to compare the different aspect of farm study. Average and percentage of different variable were calculated for this purpose. The simplest and most important measures below –

(a). Weighted mean = $\dfrac{\sum W_i X_i}{\sum W_i}$

(b). Arithmetic mean = $\sum X/N$

For the potato production different type of production were explored, out of them only cob-Douglas production function is used for analysis –

$$Y = a x_1^{b1}, x_2^{b2} \ldots\ldots\ldots\ldots x_n^{bn}$$

Where,
y = dependent variable (output value in Rs./hs)
X_1 = 1th independent variable (input value in Rs./ha).
a = constant
b1 = production elasticity with respect to x1.
The value of the constant (a) and coefficient (b1) in respect of independent variable in the function have been estimated by using the method of least square.

4. Estimation of Marginal Value Productivity

The marginal value product of input was estimated by taking partial derivatives of return with respect to the input $_{concerned}$ at the geometric mean level of inputs.

(MVP) b1 = $\dfrac{b_i \bar{y}}{\bar{X}_i}$

Where,
bi = Production elasticity with respect to Xi
$\bar{y}$ = Geometric mean of y (output values in Rs./ha.)
$\bar{X}_i$ = Geometric mean of Xi (input values in Rs./ha.)

Result and Discussion
Farm Structure

This section includes the component of size of farms, cropping pattern, cropping intensity, and per farm investment.

Size of Holding

The study covers of a sample of 100 farmers, which are divided in three size group namely marginal (below 1hac), small (1-2ha) and medium (2-4ha) with respect to the holding size. The average size of on various group of sample farms are presented in table 1. It is evident form of the table that the average size of holding in study area was 0.28, 1.59 and 2.28 hectare in marginal, small and medium size group of farms respectively. Whereas, overall average holding size was 0.49 hectare.

Cropping Intensity

Cropping intensity is an index of intensity of land use determined by the number of crops grown in a particular field, during a year. It has been worked out by using the following formula. Cropping intensity as a ratio between gross cropped area and net shown area expressed in percentage in presented in table 1 the maximum cropping intensity on overall farm was observed to 200.00 in case of medium farms, followed by small, marginal farms corresponding to 216.98 and 235.71 percentage respectively with an overall of 222.45percent.

Table 1: Average size of holding and cropping intensity on sample farms.

S. No.	Size group of farm	No. of sample farm	Total cultivated area	Average size of holding	Gross cropped area(ha)	Cropping intensity
1.	Marginal (below 1ha)	86	24.27(100)	0.28	0.66	235.71
2.	Small (1-2ha)	11	17.50(100)	1.59	3.45	216.98
3.	Medium (2-4ha)	03	6.84(100)	2.28	4.56	200.00
	Total	100	49.07(100)	0.49	1.09	222.45

Cropping intensity = $\dfrac{\text{Total cropped area}}{\text{Total cropped area}}$ x 100 = $\dfrac{1.09}{0.49}$ x 100 = 22.45

Cropping Pattern

A cropping pattern is the proportion of area under different crops at a point of time. In thus differ from a crop rotation in the sense that it does not denote succession of crop in a field over time as rotation dose.
The area allocated to different crops under various season are presented in table 2. It is depicted from the table that among the cereals rice, wheat and maize have substantial area and became a major cereals crops. As it cover 23.87,23.92 and 18.52percent of the total cropped area. Other important crops included in the cropping pattern were in mustard in rabi (1.47%). In zaid maize, chari, urd and vegetable were given much important by the sample farmers, as it were allotted 13.85% each of the gross cropped area on over all farms.
Potato was found most important crop of the study area as it was allotted 18.34 percent of total cropped area.
It may be concluded that paddy, wheat, potato and maize were considered as main food crop having 1st and 2nd place in cropping pattern.

Table 2: Cropping Pattern on Different Size of Sample (Area in ha and %)

S. No.	Crop grown under different season	Size group of farms			
		Marginal	Small	Medium	Overall average
1.	Kharif	0.25(37.88)	1.59(46.08)	2.27(49.78)	0.46(42.39)
a.	Paddy	0.13(19.70)	1.00(28.98)	1.23(26.97)	0.26(23.87)
b.	Maize	0.12(18.18)	0.59(17.10)	1.04(22.81)	0.20(18.52)
2.	Rabi	0.27(40.91)	1.59(46.09)	2.27(49.79)	0.47(43.73)
a.	Wheat	0.13(19.70)	1.03(29.85)	1.14(27.00)	0.26(23.92)
b.	Mustard	0.01(1.51)	0.04(1.16)	0.10(2.21)	0.02(1.47)
c.	Potato	0.13(19.70)	0.51(14.78)	1.03(22.58)	0.19(18.34)
3.	Zaid	0.14(21.21)	0.27(7.82)	-	0.16(13.85)
a.	Maize	0.07(10.60)	0.19(5.51)	-	0.08(7.48)

b.	Chari	-	0.19(0.58)	-	0.01(0.20)
c.	Urd	0.05(7.60)	0.05(1.45)	-	0.05(4.47)
d.	Vegetable	0.02(3.03)	0.01(0.29)	-	0.02(1.70)
	Gross cropped area	0.66(100)	3.45(100)	4.54(100)	1.09(100)

Investment of Farm Assets
It was recorded as Rs 152873.00, Rs 313010.50 and Rs 405800.70 against marginal, small and medium size group of farms. Total per farm value on far assets were found to Rs.377288.40, Rs.722821.00 and Rs.1025234.00 on marginal, small and medium farmers respectively.

The investment on farm assets such as far building, implement & machinery and livestock on marginal, small and medium farms and average overall farms are displayed in Table 3.

Table 3: per hectare investment on different size group of farms (RS.)

S. No.	Particulars	Marginal(below-1ha)	Small(1-2ha)	Medium(2-4ha)	Overall average
1.	Building	199568.70(52.89)	355335.10(49.16)	503000.10(49.06)	225805.90(51.94)
2.	Livestock	24846.73(6.58)	54475.44(7.54)	116433.30(11.36)	30853.49(7.09)
3.	Implements & machineries	152873(40.52)	313010.50(43.30)	405800.70(39.58)	178076.00(40.97)
	Average grand total	377288.40(100)	722821.00(100)	1025234.40(100)	434735.40(100)

Cost and Return
(A). Cost: Per hectare cost return from the cultivation of Potato crop on different categories of farms have been presented in Table 4 It is obious from the table that, on a overall average per hectare cost of Potato crop to Rs. 80533.58 per ha. Which was maximum to Rs. 79997.53 on marginal farms followed by small and medium farms corresponding to Rs. 83221.65 and Rs. 86043.91, respectively. The cost of cultivation was maximum on marginal sample due to more expenditure occurred on human labour and tractor charges as compared to other categories of farms. It was also observed from the table that cost of cultivation showed positive relationship with the size group farms.

Table 4: Per hectare cost and income of potato cultivation

S. No.	Particulars	Marginal		Small		Medium		Overall average	
A.	Cost expenditure	Rs.	%	Rs.	%	Rs.	%	Rs.	%
1.	Seed and showing	14843.43	18.55	15952.41	19.17	17333.34	20.14	15040.12	18.67
2.	Manures& fertilizer	14234.40	17.80	16454.43	19.77	17267.09	20.06	14569.58	18.09
3.	Chemical (plant protection)	1247.82	1.56	1432.89	1.72	1465.89	1.70	1274.72	1.58
4.	Irrigation	8750.20	10.94	8867.07	10.65	8445.43	9.81	8753.91	10.87
5.	Family labours	13485.70	16.86	5766.60	6.93	5477.55	6.36	12396.35	15.39
6.	Hired labours	7440.34	9.30	13415.43	16.12	13832.54	16.07	8289.37	10.29
7.	Total human labours	20926.04	26.16	19182.03	23.05	19310.09	22.44	20685.72	25.68
8.	Machinery power	5155.58	6.44	5565.4	6.68	5876.72	6.83	5222.29	6.48
9.	Total working capital	51671.77	64.60	61687.64	74.12	64221.01	74.63	53149.99	65.99
10	Return value of owned land	5000.00	6.25	5000.00	6.0	5000.00	5.81	5000.00	6.21
11.	Interest on working capital	2066.87	2.58	2467.50	2.96	2568.84	2.98	2126.00	2.64
12.	Interest of fixed capital	500.69	0.62	734.30	0.88	854.34	1.11	539.99	0.67
13.	Sub total	72725.03	90.91	75656.05	90.91	78221.74	90.91	73212.34	90.91
14.	Managerial cost @10% of subtotal	7272.50	9.09	7565.61	9.09	7822.17	9.09	7321.23	9.09
15.	Grand total	79997.53	100	83221.65	100	86043.91	100	80533.58	100

S. No.	Particulars	Marginal	Small	Medium	Overall average
B.	Income				
16.	Gross income	150390.00	151392.00	151950.00	150547.00
17	Net income	74572.50	68170.40	65904.10	70013.00
18	Family income	91150.70	81502.60	79205.80	89731.00
19	Farm business income	96651.40	87236.90	85160.20	95271.00
20.	Farm investment income	80073.30	73904.70	71860.40	75553.40
21.	Cost of production Rs./q	302.00	32900	339.00	306.08
22.	Yield q/h	250.65	252.32	253.25	250.91
23.	Input –output ratio	1:1.88	1:1.81	1:1.76	1:1.87

(B). Return: It is observed from the table that per hectare gross income was maximum to be Rs. 150390.00 on marginal farms followed by small and medium farms corresponding to Rs. 151392.00 and 151950.00 respectively in respect of all farms. Average gross income come to Rs. 150547.00 however, other income measure like Net Income Rs. 70013.00Farm Business Income Rs. 95271.00, Family labour Income Rs.89731.00 and Farm Investment Income 75553.40 were also assessed and trend was showing positive relationship in the contest of various measures of income with size of farms.

Cost of production per quintal of Potato was computed to Rs. 306.08 on overall farms, which varied Rs.339.00,Rs. 329.00, and Rs. 302.00 on medium, small and marginal size group of farms. Cost of production per quintal had the negative relation with size of farms. Output-input ratio on marginal, small and medium farms was 1.88, 1.81 and 1.76 on cost C_3.

Table 5: Elasticity of production and marginal value of productivity on different size group of farms.

S. No.	Size group of sample farms (ha)	Production of elaitystic					Sum of elasticity	MVP					
		X_1	X_2	X_3	X_4	X_5		R^2	X_1	X_2	X_3	X_4	X_5
1.	Marginal	0.185131** (0.038346)	0.336596** (0.025271)	0.97813** (0.033578)	0.57045 (0.108658)	0.134871** (0.024186)	0.811455	0.795862	3.097056	33.47258	1.191056	0.416775	2.682427
2.	Small & Medium	0.249535 (0.11753)	0.273899** (0.062173)	0.095247 (0.110122)	0.06654 (0.155321)	0.168068 (0.058885)	0.853288	0.818635	4.00587	1.66799	1.124283	0.484558	3.097258

** Significant at 1 percent level of probability
*Significant at 5 percent level of probability

It is the revealed from the table that co efficient of multiple determinations (R^2) of marginal, small and medium size group farms were 0.79586 and 0.81864 respectively.

It is also revealed from the table that was statistically significant at 1 percent level of probability in all size groups of farms.

Conclusion

Overall average size of holding in the study area was 0.28, 1.59 and 2.28 hectare in marginal, small and medium size of farms respectively. Whereas overall average of holding size was 0.49 hectares. The cropping pattern shown that potato was 1st important crop which covered maximum area wheat 23.92 percent followed by Paddy 23.87%, Maize 18.52%, Potato 18.34%, Urd 4.47%, vegetable 1.70%, mustard 1.47% and Chari 0.20% to gross cropped area (kharif,rabi and zaid)respectively. Cropping intensity was 222.47 per cent overall average, cropping intensity decreased with the increase in the size of holding. The maximum total cost was recorded on marginal farms (Rs.79997.53) due to heavy expenditure on human labour, irrigation and income & fertilizer the per quintal cost of production of potato overall farms are Rs.306.08 whereas cost of production Rs.302.00, Rs.329.00 and 339.00 of marginal, small and medium farms respectively. Input-output ratio on the basis of overall 1:1.88, 1:1.81and 1:1.76 respectively. The cultivation of potato was characterized by decreasing return to scale on each farm situation.

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