INNOVARE JOURNAL OF AGRICULTURAL SCIENCE

Vol 9, Issue 5, 2021

ISSN- 2321-6832

Research Article

PRODUCTION ECONOMICS AND MARKETING OF POTATO IN OKHALDHUNGA, NEPAL

BIBEK PHULARA[1], BIBEK ACHARYA[1,*], SUSMITA ADHIKARI[1], BHAWANA OJHA[2], UDIT PRAKASH SIGDEL[2]

[1]Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal. [2]Department of Chemistry, Tribhuvan University, Kirtipur, Nepal. [3]Department of Agricultural Extension and Rural Sociology, Agriculture and Forestry University, Rampur, Chitwan. Email: bibekacharya0305@gmail.com

Received: 28 July 2021, Revised and Accepted: 16 August 2021

ABSTRACT

Potato is a major staple food crops in the hilly region of Nepal. To assess the production economics and marketing of potato, a study was conducted at Siddicharan municipality and Molung rural municipality of Okhaldhunga, Nepal in 2019. Altogether 60 samples, 30 from each location were selected randomly. Economic analysis was performed through cost benefit analysis and Cobb Douglas Production function. Among the different variety used by the farmers, Kufri Jyoti was the most preferred variety. The main constraints in potato production were shortage of irrigational structure followed by low information on use of chemical fertilizer, lack of labor at the time of harvesting, insufficient quantity of manure, prevalence of middle man, high cost of transportation, and unavailability of improved seed. The mean difference between the farm gate price and market price of Siddicharan and Molung was 7.33 and 5.96, respectively, which were statistically significant at $p<0.1$. The overall average benefit cost ratio was found to be 1.23 in which Siddicharan and Molung had BC ratio of 1.55 and 0.99, respectively, which was significant at $p<0.01$ which indicated that farming in Molung was not profitable. Overall the seed cost, labor cost, FYM cost, and bullocks cost should be increased by 900%, 186.95%, 101.88%, and 626.31%, respectively, and chemical cost, machinery cost, and transportation cost should be decreased by 99.98%, 73.11%, and 99.57%, respectively. Return to scale was found to be 0.227 which implies that it was increasing at decreasing rate of return.

Keywords: Productivity, Benefit cost ratio, Kufri Jyoti, Economic.

 DOI: http://dx.doi.org/10.22159/ijags.2021v9i3.40833. Journal homepage: https://innovareacademics.in/journals/index.php/ijags

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important crops in Nepal. It is grown all over the country in tropical climate of terai to temperate climate of high hills from 65 to 000 masl. Potato serves as staple food particularly for hilly people whereas it is used either as sole or mixed with other vegetables almost in every meal of Nepalese people. Potato is a cool weather crop or temperate plant. The optimum temperature for germination ranges from 18 to 25°C. Tuber production is retarded at soil temperature above 20°C and growth is completely inhibited at 29°C [3]. Similarly, it has high moisture requirement. The optimum soil moisture regime for better growth and development of tubers ranges from 70 to 80% of the field capacity during flowering and tuber formation and 60 to 65% during starch deposition in the tubers.

Well drained sandy loam and loam soils rich in humus are most suitable for potato. The optimum soil pH for potatoes is 4.8–5.4 from the view point of both yield and scab retardation [3].

It is one of the important food crops of Nepal and is staple crop in hills of Nepal [3]. Out of total agricultural land, potato cultivation is known to occupy about 6.47% which is about 199.971 ha [6]. Total production is about of 2,591,686 tons with average productivity of 13.94 t ha^{-1} in 2016/2017 in Nepal (Agriculture Statistical Year Book, 2017). Nepal is one of top twenty countries where potato contributes significantly for human diet [4]. Potato is now second most important staple crop after rice and per capita consumption of potato is 51 Kg/Year [9]. Kavre, Dadeldhura, Kailali, and Nuwakot are major potato producing districts of Nepal [7]. Potato is an important vegetable crop in kitchen gardens and also cash crop for smallholder farmers in high hills of Nepal [15]. Potato provides nutrients such as dietary fiber, carbohydrates, vitamins, minerals (potassium, magnesium and iron), beta-carotenes, and polyphenols. Color potatoes play an important role in defense system by providing antioxidants [16]. The share of potato to Gross Domestic Product (GDP) and Agriculture GDP is 2.17% and 6.57%, respectively [1]. Thus, there is great scope for potato growing farmers to earn huge amount of income. Although concerted efforts have been made on development of crops like potato; still there exit several constraints, such as lack of production and marketing research on major crops, and hindering the rapid expansion of production on sustainable basis. In case of potato, the efficiency of marketing is crucial in determining the profits from the products. It is, therefore, necessary to identify different constraints of production to boost-up the production. Nepal's excellent topographical variation provides vast opportunities for growing and exporting a variety of cash crops. However, the government has been focusing to invest on a few cereal crops, such as rice, maize, wheat, and legumes [12]. Regarding potato, farmers are facing various productions as well as marketing problems. The annual productivity of potato in Nepal is 14.76 Mt ha^{-1}. The annual productivity of potato in Okhaldhunga is 10.54 Mt/ha and it is the fourth important cash crop of Nepal after rice, maize, and wheat [7]. Hill farmers plant very small seed potatoes (10–15) gm in size. Sometimes they may plant 2 or 3 small tubers together. Farmer's seed rate is lower than the recommended National Pulses Development Project seed rate [10]. Farmers tends to use inferior quality seeds, attack of insects, pest, and diseases are common, limited application of improved practices for potato production is prevalent among the hill farmers. Among the constraints of low yield, inferior quality seed used by the farmers is the most important [8]. The major problem in Okhaldhunga for the production and marketing of the potato were lack of infrastructures for production and marketing of potato, prevalence of middle man which affects small holder farmers, irregularity of resource availability, and accessibility, people were not aware about scientific production and marketing practices, and lifestyle of potato growing farmer was not satisfactory.

Shrestha *et al.* [13] explained that production efficiency of vegetable farming could be increased with a greater access to improved seed, agricultural credit, training, and extension services in eastern high hills of Nepal. Mahatha [5] stated seed, irrigation, plant protection

chemicals, potash, and Di-ammonium phosphate were underused resources. Thus, farmers could improve economic efficiency and productivity if they use more of these resources. As potato is a major staple food in the hills of Nepal, it might be good option for contributing food security in the district. Moreover, income from potato could be used for buying necessary food as it more profitable than other crops. In this connection, this study was designed to find out the production and marketing potentiality of potato for ensuring livelihood of farmers in Okhaldhunga. Okhaldhunga has favorable physical, chemical and edaphic factors for potato cultivation. It has more than 500 ha of land for commercial potato cultivation and this study is helpful in understanding the existing scenario of the potato growers, the methods and inputs they use for potato production, productivity and profitability of potato production in the study area. This study is useful in assessing the economics of production, integration of potato markets and enlisting the problems faced by the farmers during cultivation and marketing of produce. The results of this study are useful for planners, administrators, policy makers, farmers, and other input agencies involved in promotion of potato cultivation and formulation of policies and strategies to boost the production of potato. This would also enable the marketing institutions to orient their efforts toward efficient production and marketing.

MATERIALS AND METHODS

Study site

Okhaldhunga is one of the potential districts of province 1 of Nepal for the production of Potato. Its unique geographical and topographical feature makes it possible for potato cultivation, mostly summer season or kharif. Site of study was Siddicharan municipality (Ward No 6 and 7) and Molung rural municipality (Ward No. 6) of Okhaldhunga district which was selected purposefully.

Population, sampling frame, and sample

Sampling frame from the two studied sites was selected with purposive sampling technique. The purpose of the sampling was to include the farmers directly linked with PMAMP zone Okhaldhunga district of Nepal which included total of 130 farmers within the sampling frame. From the sampling frame, sample size of 30 each from Siddicharan and Molung was taken randomly according to Slovin's formula given as:

$$n = N/(1+Ne^2)$$

Where n= number of sample (sample size) N= population size (130)
e= margin of error or level of significance which was 0.1 (10% level of significance).

Pre survey activities

Pre-survey field visits were conducted to gather preliminary information regarding the demographic, socio-cultural, and topographical knowledge about the site. This information was used in preparing interview schedule and designing a sampling framework. Different key informants, members of service centers, teachers, etc., were consulted during the visit.

Sources of data

Primary data were collected through interview schedule. These data were supplemented and verified by the data collected through Focus Group Discussion (FGD), Key Informant Interview (KII). Source of secondary data were DADO annual reports, newsletters, bulletins and relevant articles, libraries and information office, Department of Agriculture, Ministry of Agriculture, and Livestock Development (MoALD). Population census was other important sources of secondary information. Both the published and unpublished official records available in the district were considered.

Methods of data collection

KII, informal group discussion, and household survey using pre-tested semi structured interview schedule were used to collect data. KII was used to get the preliminary information for designing sampling unit and sampling frame. FGD, KII was conducted to triangulate data obtained from survey.

The detailed information was especially collected from personal interviews of potato growers. Marketing information was collected through commission agents, wholesalers, and retailers. The data were collected with help of specially designed schedule to gather information on cost of cultivation, marketing, and other related aspects of potato.

Method of data analysis

The collected data were compiled and analyzed with a tabular method of analysis, simple statistical tools such as arithmetical averages and percentages were worked out for the purpose of interpretation of results. Different software such as MS excel and SPSS was used for the analyses of the data.

Estimation of production cost

The collected data were analyzed by applying the usual cost concepts used in farm business analysis. For this, simple tabular analysis was done to workout costs, gross returns and input-output ratios. The cost concepts used are as follows.

Cost "A": It is also called as paid out cost; this cost approximates the expenditure incurred by the farmer in cash and kind in the cultivation of crop and includes hired human labor, seed, manure, fertilizers, machinery charges, etc.

Cost "B": It includes cost "A" plus imputed rental value of owned land and interest on fixed capital.

Cost "C": It includes cost "B" plus imputed value of family human labor. The cost "C" represents the total cost of cultivation. The standard cost concepts mentioned above provide different measures of returns to the cultivator. The difference between gross return and cost "A" represents the farm business income. The difference between gross return and cost "C" represents net profit or loss to the cultivator.

Evaluation of output

The main potato produce was evaluated at the selling prices prevailing at the time of harvest in the nearby market where the harvested produce is sold.

Cobb Douglas production function

Estimation of efficiency ratios using Cobb-Douglas production function

The empirical evidence from the previous studies suggested that among the many mathematical functions Cobb-Douglas type of production function is the appropriate one for the studies of resource productivities because it gives specific diminishing, increasing, or constant returns. The data will be, therefore, subjected to functional analysis using the following form of Cobb-Douglas type of production function.

$$Y= aX1b1X2b2…eu.$$

In this functional form "Y" is dependent variable "Xi"s are independent variables, "a" is constant representing intercept of the production function, and "bi"s are the regression coefficients of the respective variables. The regress co-efficient obtained from this function indicates elasticity's of production which remain constant throughout the relevant ranges of inputs. The sum of regression coefficients, that is, Σ "bi" indicates the nature of returns to scale where expressed in logarithmic terms. This function transforms in to a linear function of the following type:

$lnY=lna+b1lnX1+b2lnX2+b3lnX3+b4lnX4+b5lnX5+b6lnX6+u$ Where,
Y=Total income from potato seed production (NRs. per hectare)

X1 = Seed (NRs. per hectare) X2 = FYM (NRs. per hectare)
X3 = Chemical fertilizer (NRs. per hectare) X4 = Labor (NRs. per hectare)
X5 = Machinery cost (NRs. per hectare)

X6 = Bullocks cost (Tillage) (NRs. per hectare)
X7 = Transportation and other cost (NRs. per hectare) u = Error term a = Intercept

ln = Natural logarithm.

The efficiency ratio (r) was computed using the formula r = MVP/MFC.

Where MFC= Marginal factor cost and MVP was estimated using the formula: MVPi=bi×(Y/Xi), where bi = Estimated regression coefficients. Y and X are the geometric mean values.

Decision criteria
r=1 indicate the efficient use of resource r >1 indicate underused of resource

r<1 indicate overused of resource

The relative percentage change in MVP of each resource was estimated as: D = (1−MFC/MVP)×100 Or, D

=(1−1/r)×100

Where, D = Absolute value of percentage change in MVP of each resource.

Return to scale (RTS) analysis
The RTS was calculated as follow: RTS= ∑bi Decision rule:

RTS <1: Increasing RTS; percentage change in output is more than percentage change in input.

RTS=1: Constant RTS; percentage change in output is equal to percentage change in input. RTS>1: Increasing RTS; percentage change in output is more than percentage change in input

Resource use efficiency
The resource use efficiency was judged on the basis of the ratio of marginal value product (MVP) of the resources to its factor cost and it should be greater than, ≤one. MVP of factor taken at their prevailing market prices or opportunity cost indicate the efficiency of resource use.

MVP
This represents a change in Total Value Product (TVP) due to an additional unit of inputs (X). Thus, MVP

= ΔTVP/ΔX

In linear multiple regression, MVP = biPy Where, bi = Regression coefficient

Py = Price of output

In Cob-Douglas Production function, MVP = bix Y/X x Py Where, bi = Regress coefficient of ith variable

Y = Geometric mean of yield

X = Geometric mean of independent variable Py = Price of output.

Ranking of problems and perception
Index score was calculated using following formula:

$$\text{Score} = \frac{\sum \text{Sifi}}{\text{N}}$$

Where,
Si – score obtained fi – frequency
N – Total number of observations

Value of score ranged from 0 to 1. The option with highest score had highest rank and lowest score had lowest rank.

RESULT AND DISCUSSION

Varietal preference of potato
Study revealed that Kufri Jyoti was most preferred variety overall followed by Khumal Rato, Khumal Seto, and local variety (73.3%, 45%, 43.3%, and 4%), respectively. By location, Siddicharan followed same rank as above but in Molung, the rank was Kufri Jyoti, followed by Khumal Rato, Khumal Seto, and local variety. The fact of using Kufri Jyoti, Khumal Rato, and Khumal Seto more than local variety was due

Table 1: Comparison of different varieties of potato cultivated by farmers across study area

Variety	Overall	Siddhicharan	Molung	χ^2 value
	Frequency (%)	Frequency (%)	Frequency (%)	
	n=60	n=60	n=60	
Kufri Jyoti	44 (73.3)	19 (63.3)	25 (83.3)	3.068*
Khumal Rato	27 (45.0)	14 (46.7)	13 (43.3)	0.067
Khumal Seto	26 (43.3)	11 (36.7)	15 (50.0)	1.086
Local variety	24 (40)	11 (36.7)	13 (43.3)	0.278

Figures in parentheses indicate percentage. * indicates Chi-square value is significant at 10% level of significance

Table 2: Status of inter cropping across study area

	Siddhicharan	Molung	χ^2 value
Yes	23 (76.7)	30 (100)	7.925***
No	7 (23.3)	0 (0)	

Figures in parentheses indicate percentage. *** indicates very highly significant at 1% level of significance.

Table 3: Different varieties intercropped with potato and comparison across study area

Crops	Siddhicharan	Molung	χ^2 value
Maize	21 (70)	21 (70)	11.455**
Other than maize	2 (6.7)	9 (30)	
None	7 (23.3)	0 (0)	

Figures in parentheses indicate percentage. * Significant at 5% level of significance

Table 4: Price spread in farm gate and market price (NRs.) across study area

Study area	Farm gate price	Market price	Price spread
Siddicharan	37.93	46.37	8.44
Molung	30.6	40.4	9.8

Table 5: Comparison of farm gate and market price (NRs.) across different study area

Price	Location		Mean Difference	t value
	Siddhicharan	Molung		
Farm gate price	37.93	30.60	7.33	4.57***
Market price	46.36	40.40	5.96	3.99***

*** indicates significant at 1% level of significance

Table 6: Production constraints

	Score	Rank	Overall score
Constraint			
Unavailability of improved seed	0.82	I	
Seed			
Timely unavailability of seed	0.64	II	0.66
High cost of seed	0.53	III	
Insufficient quantity	0.83	I	
Manure			
Costly	0.74	II	0.66
Quality	0.43	III	
Shortage of irrigation infrastructure	0.867	I	
Inadequate water	0.721	II	0.623
Irrigation			
Fluctuation	0.596	III	
Quality of water	0.308	IV	
Chemical Fertilizers			
No information on use	0.84	I	
Costly	0.62	II	0.67
Timely unavailability	0.54	III	
Lack of labor	0.833	I	
Harvest			
Unfavorable climate	0.711	II	0.67
Lack of maturity	0.456	III	

Table 7: Marketing constraints

Constraint	Score	Rank	Overall score
Transportation			
High cost	0.76	I	
Unavailability of vehicle in time	0.78	II	0.67
High transportation loss	0.46	III	
Market			
More middleman	0.842	I	
No market information	0.653	II	
Prices are not assured	0.622	III	
Malpractice in weighing	0.508	IV	0.58
Malpractice in trade	0.464	V	
Delay in payment	0.408	VI	

to distribution of seed by DADO, Okhaldhunga some years ago (AKC, Okhaldhunga). Chi-square test was done for Kufre Jyoti across 2 study area and it was significant and tabulated as 3.068 at 0.08 P value. This signifies that there is difference between farmers of Molung and Siddicharan as more % of farmers cultivates Kufri Jyoti in Molung. It

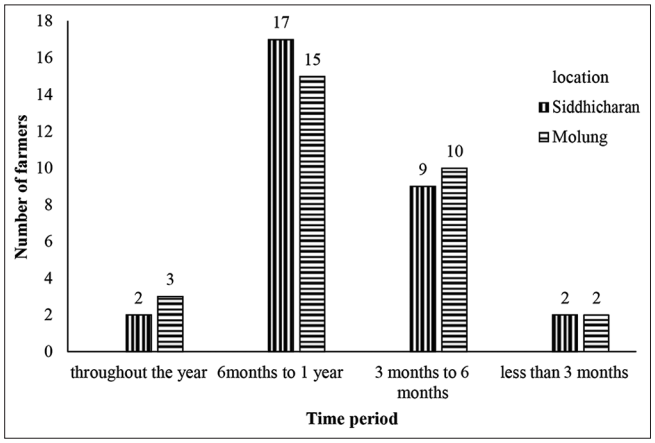

Figure 1: Time of sufficiency of potato as food

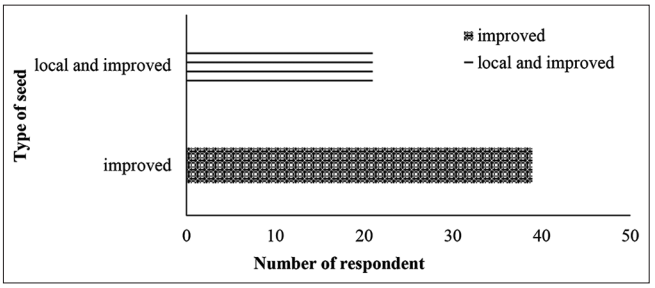

Figure 2: Type of seed used for cultivation by farmers

Table 8: Comparison of potato tuber production cost with respect to study area

Variable	Overall	Siddhicharan (=1)	Molung (=2)	t test
	Mean (SD)	Mean (SD)	Mean (SD)	
	n=60	n=30	n=30	t value
Seed cost	76550±12285.5	73136.84±10699.3	79144±12974	−1.63
Labor cost	63404.76±65586.6	85145.99±89198.3	46881.42±32881.3	1.98
Chemical cost	1711.81±4462.12	3964.21±6175.67	0	3.22***
FYM cost	9459.09±14205.8	13263.15±6568	6568±9660.86	1.575
Machinery cost	33789.86±33161.7	44233.08±44858.1	25853.01±17582.8	1.87*
Bullocks cost (Tillage)	24559.59±16927.4	26623.43±21276.3	22991.07±12959	0.7
Transportation and other cost	3390.15±8965.18	44233.08±44858.1	25853.01±17582.8	0.69
Total cost of production	212865.3–121245	250840.4–158797	184004.2–73596.4	1.86*

All costs of items are in accordance with the market price at the studied sites. Figures in parentheses indicate standard deviation. ***, **, * indicate significant at 1%, 5%, and 10% levels, respectively

Table 9: Estimation of yield and profitability of potato production between two study areas

Variable	Overall	Siddhicharan (=1)	Molung (=2)	t test
	Mean (SD)	Mean (SD)	Mean (SD)	
	n=60	n=30	n=30	t value
Production in household (kg)	2545.5±2828.92	2791.66±3176.2	2299.33±2463.3	0.671
Yield (kg/ha)	8083.76±4718.03	11463.15±5256.55	5515.42±1801.77	5.28***
Returns (NRs./ha)	242513±141541	343894.7±157697	165462.9±54053.3	5.28***
Profit (NRs./ha)	29647.7±164619	93054.33±219596	−18541.3–82367.3	2.34**
BCR	1.23±0.6	1.55±0.69	0.99±0.38	3.3***

Figures in parentheses indicate standard deviation. ***, **, * indicate significant at 1%, 5%, and 10% levels, respectively

Table 10: Estimation of elasticity, MVP, and efficiency ratios using Cobb Douglas Production Function

Variables	Coefficient	Standard error	t value	MVP	MFC	r	D
Seed cost	0.035	0.325	0.1	0.1	1	0.1	900
Labor cost	−0.27	0.39	−0.71	−1.15	1	−1.15	186.95
Chemical cost	0.12***	0.015	7.75	5926.3	1	5926.3	99.98
FYM cost	−0.011	0.01	−1.07	−53.08	1	−53.08	101.88
Machinery cost	0.36	0.41	0.87	3.72	1	3.72	73.11
Bullocks cost	−0.013	0.028	−0.48	−0.19	1	−0.19	626.31
Transportation and other cost	0.006	0.01	0.5	235.8	1	235.8	99.57
Constant	11.20***	3.64	3.03				
Observations	43						
F value (7,36)	11.63						
Prob>F	0						
R-squared	0.69						
Adjusted R. Squared	0.63						
RTS	0.227						

*** significant at 1% level of significance. r=efficiency ratio D=Absolute value of percentage

Table 11: Annual income from potato versus training taken by farmers

Income	Yes	No	χ^2 value	p value
<60,000	7 (24.1)	10 (32.3)		
60,000–200,000	11 (37.9)	19 (61.3)	8.837**	0.012
>200,000	11 (37.9)	2 (6.5)		

Figures in parentheses indicate percentage. ** indicates Chi-square value highly significant at 5% level of significance

might signify that Kufri Jyoti is well-established in higher hill than mid hill. For other varieties, there was no significant difference.

Food sufficiency

Total field production was not sufficient for annual fulfillment for the entire household. Study revealed that the annual production of potato was sufficient for 6 months–1 year for majority of the household.

Inter-cropping of potato

Study revealed that potato was inter-cropped with many crops. Study revealed that in Molung, all the farmers intercropped other crop with potato. Chi-square test was done and it was found very highly significant at 1% level of significance.

Crop inter cropped with potato

Majority of the farmers (70%) intercropped maize with potato from each study area whereas potato was cultivated as sole crops by 23.3% of the farmers in Siddicharan. Chi-square test was found to be highly significant between status of intercropping and study area at 5% level of significance.

Type of seed used and number of respondents

Study revealed that 38 (63.33%) were found to be using only improved seed and 22 (38.67%) were found to be using both local and improved seed.

Market

Price

Study revealed that farm gate price and market price were higher in Siddicharan than that of Molung. It was due to the quick access of Siddicharan to major market.

Price trend in Okhaldhunga

Price varied significantly of both farm and market taking two study areas into account. Difference between farm gate prices of those two locations was higher than that of the market price. Study revealed that Molung is far away from its nearest market than Siddicharan. So middleman, wholesalers pay relatively less if they directly go to the farm. Market price in its nearest market is low too for Molung. Molung is located in remote area than Siddicharan. It was found that almost all household cultivate potato for household consumption. Furthermore, t value is very highly significant at both farm gate price and market price for both locations.

Production and marketing constraint

Production constraint

???

Transportation constraint

The major problems in transporting potato from farm to the nearby market were high cost followed by unavailability of vehicle in time and high transportation loss with respective index score 0.76, 0.78, and 0.46. The overall score was found to be 0.67.

Market constraint

The major problems in market were more middleman followed by no adequate information about market price, fluctuation in price, malpractice in weighing, malpractices in trade, and delay in payment with respective index score 0.842, 0.653, 0.622, 0.508, 0.464, and 0.408. The overall score was found to be 0.58.

Economic analysis

Comparison of potato tuber production cost with respect to study area

The comparative study was done between the study areas for cost of potato production. Study revealed that the net cost of production is higher in Siddicharan than that of the Molung. T test was significant for chemical cost and machinery cost. Furthermore, total cost was significant too.

Estimation of yield and profitability of potato production between two study sites

Study revealed that there is less potato production in terms of productivity as compared to statistical data of the government. B/C ratio was found to be 1.23 for overall area and it was 1.55 and 0.99 in Siddicharan and Molung, respectively. The reason for good production in Siddicharan was the awareness level of farmer in chemical fertilizers and good source of irrigation. T test was significant for yield, return, profit, and BC ratio.

Estimation of elasticity, MVP, and efficiency ratios using Cobb Douglas production function

Study revealed that 10% increase in seed cost increases the total income by 0.35%, 10% increase in labor cost decreases the income by 2.7%, 10% increase in chemical cost increases the total income by 1.2%, 10% increase in FYM cost decreases the total income by 0.11%, and 10% increase in machinery cost increases the income by 3.6%. 10% increase

in bullock cost decreases the total income by 0.13%, and 10% increase in transportation cost increase the total income by 0.06%. R-squared value was tabulated to be 0.69 and RTS was 0.027. It signifies that 10% increase in cost of production increases the rate of return by 2.27% which is diminishing rate of return.

Training

Income from potato versus training

Annual income from potato was categorized into three categories, that is, <60,000, between 60,000 and 200,000 and more than 200,000. Chi-square test was done between the income and training status and it was found highly significant at 0.012 p value.

CONCLUSION

Okhaldhunga has a favorable geographical climate for potato cultivation. The major potato cultivated area lies in mid and high hill. An economic survey was done to find the socio-economic status of household, constraints in production and marketing and to know the production economics of and marketing of potato. It was found that the majority of the household had male as family head. Major decision in production and marketing was of male and there was involvement of both male and female in work. The main constraints in potato production were shortage of irrigational structure followed by low information on use of chemical fertilizer, lack of labor at the time of harvesting, insufficient quantity of manure, and unavailability of improved seed respectively. Similarly, the main constraint in marketing was prevalence of middle man and high cost of transportation. The annual productivity of potato was found to be 8.08 Mt/ha which was lower than national productivity, that is, 14.76 Mt ha^{-1}. Overall benefit-cost ratio was found to be 1.23 which was feasible. RTS was 0.227 which indicated diminishing rate of return.

ACKNOWLEDGMENT

The authors are totally obliged major advisor Udit Prakash Sigdel, Assistant Professor, Department of Agricultural Extension and Rural Sociology, Agriculture and Forestry University, Rampur, Chitwan for his skilled tutelage, constructive suggestions, and intellectual support during accomplishment of the entire work.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

REFERENCES

1. ABPSD. Statistical Information on Nepalese Agriculture 2014/15. Kathmandu, Nepal: ABPSD, Ministry of Agricultural Development, Government of Nepal; 2015.
2. Bajracharya M, Sapkota M. Profitability and productivity of potato (*Solanum tuberosum*) in Baglung district, Nepal. Agric Food Secur 2017;6:47.
3. International Potato Center. CIP in Bangladesh. Lima (Peru). United States: International Potato Center; 2010. p. 4.
4. Gairhe S, Gauchan D, Timilsina K. Adoption of improved potato varieties in Nepal. J Nepal Agric Res Council 2017;3:38-44.
5. Mahatha RK. Economics of Production and Marketing of Potato in Saptari District of Nepal. Master Thesis. Chitwan, Nepal: Institute of Agriculture and Animal Science, Tribhuvan University; 2012.
6. MESD. Statistical Information on Nepalese Agriculture 2072/73 (2015/16). Kathmandu, Nepa: MESD, Government of Nepal, Ministry of Agricultural Development, Agri-statistics section, Singhadurbar; 2017.
7. MoAD. Statistical Information on Nepalese Agriculture. Kathmandu, Nepal: Ministry of Agricultural Development, Government of Nepal; 2015.
8. NPRP. Annual Report. Khumaltar, Lalitpur, Nepal: National Potato Research Programme, NARC, Potatopro; 2018. Available from: http:// www.potatopro.com/nepal/potato-statistics.
9. Rhoades R. Traditional Potato Production and Farmers' Selection of Varieties in Eastern Nepal. Potatoes in Food Systems Research Series, Report No. 2. Lima, Peru: International Potato Centre; 1985.
10. Sapkota M, Bajracharya M. Resource use efficiency analysis for potato production in Nepal. J Nepal Agric Res Council 2018;4:54-9.
11. Sedhain GK, Aryal KP. Corporatization or Commercialization. Kathmandu: Pro-Public; 2002.
12. Shrestha RB, Huang WC, Gautam S, Johnson TG. Efficiency of small scale vegetable farms: Policy implications for the rural poverty reduction in Nepal. Agric Econ Zemed Ekonom 2016;62:181-95.
13. Thapa GB, Poudel D. Dynamics of Vegetables in Nepal; 2003. Available from: http://www.avrdc.org/pdf/dynamics/Nepal.pdf. [Last accessed on 2008 Aug 06].
14. Timsina KP, Kafle K, Sapkota S. Economics of potato production in Taplejung district of Nepal. Agron J Nepal 2011;2:173-81.
15. Zaheer K, Akhtar M. Potato production, usage and nutrition: A review. Crit Rev Food Sci Nutr 2016;56:11-21.