

## ECONOMIC ANALYSIS OF COMMERCIAL POTATO CULTIVATION IN KUSADEVI, KAVRE

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### ABSTRACT

*A study was conducted to assess the economic profitability of commercial potato (main season) cultivation among farmers of KusaDevi, Kavre. Potato forms one of the major agriculture enterprises with summer production as major share and other being autumn season. Farmers were selected randomly and were provided with daily farm record format jointly developed by NPDP and MRSMP. Data were filled by farmers and verified by regular supervision from NPDP throughout the crop season for use of inputs and yield whereas information regarding farming, command area, marketing and other relevant information were obtained by focused group discussion. Quantitative data were analyzed using MS Excel and SPSS 16. The total investment per ropany (500m<sup>2</sup>) was found approximately 9530 NRs of which household resources accounted 69% share and remaining being direct cash investment. The b/c ratio was approximately 1.32 and 1.77 and ROI was found 0.32 and 0.77 at the farm-gate price (FGP) at harvesting time and most common selling price respectively. Farmers' product price varied greatly with their retention capacity, storage availability and dealing with traders at local and distant markets such as Kalimati and other wholesale markets of Kathmandu valley. Seed, fertilizer and labor ranked first, second and third respectively by share of investment in potato cultivation. Cost of cultivation particularly seed potato, fertilizer and labor cost in one hand; and the yield and FGP of fresh potato as well as its demand pressure from market on other hand were the major factors determining the net economic return to the farmers.*

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*Key words: benefit/cost ratio; commercial potato; cost of cultivation; farm gate price; Kavre district, net farm income, return on investment, small farmers*

### INTRODUCTION

Potato is an important crop grown all over the country and contributing as non cereal staple food item for the people of mountains and as important vegetable for other parts of the country. Potato ranks fifth in area, second in production and first in productivity when compared to other staple crops in the country. The area, production and yield of this crop in Nepal is 1,85,342 ha, 25,17,696 mt and 13.58 mt/ha, respectively (MoAC, 2010). Potato which was previously used to grow by farmers as summer and winter crop is now being grown up to four seasons a year depending on market availability, comparative advantage, potentiality of locality and degree of commercialization. Potato is also an important crop from food security perspectives since it is grown widely as staple food crop in mountain and selected hill areas of Nepal.

Kavre district located at 85° 24' - 85° 49' east longitude and 27° 20' - 27° 45' north latitude lies in east of Kathmandu valley. The district is well known for commercial production of agricultural commodities. Potato is one of the major commercial crops grown in the district. Kathmandu valley is the major market destination for agricultural production. Potato is cultivated in 5404 ha of land with annual production of 94615 mt and yield 17.58 mt/ha (DADO Kavre, 2009). Potato is cultivated as autumn crops and summer crops of which summer crop forms the major share of production in district. This district ranks eighth, fifth and ninth position in terms of area, production and yield respectively out of 75 districts in Nepal (NPDP, 2010).

Kusadevi lying about 35 Kilometers from Kathmandu and located at west part of Kavre district is one of the potential pockets for potato cultivation. The total area of this VDC is 1977 ha of which 70% accounts rainfed *bariland* whereas 30% is lowland *khet*. Almost all people enjoy agriculture as their major profession. Potato is grown twice a year first at autumn and second at summer. In autumn, potato covers approximately 10% of *khet* and 60% of total *bariland* whereas potato is grown almost in 90% of *khet* and 5-10% of *bariland*

as summer crop. The autumn potato is planted on August and harvested on October/November whereas summer potato is planted on January and harvested on April/May. Autumn season occupies large area than summer season in terms of area coverage. Because of its productivity, summer season production is referred as main season potato. However, yield of summer potato is higher than that of autumn season. The yield of autumn potato is around 12-14 mt/ha whereas it reaches around 20 mt/ha in summer (NPDP, 2011).

Most of the farmers are small farmers. The average holding of farmer is 0.8 ha in Kavre district. Farmers have been attracted towards potato farming because of its comparative advantage, better market opportunity and higher yield at summer and better market value at winter. Potato is grown intensively at Kusadevi. Farmers switched towards intensive farming some 9-10 years ago replacing wheat crop which used to provide low economic return. The alternate crop for autumn planting is mustard and for summer is wheat. Potato has better economic return despite higher investment on this crop.

Nepalese farmers grow potato mainly for subsistence and commercialization purpose. Almost all farmers lack systematized record of their farming and those who grow potato also lack record of investment and return. There are very limited studies on the economic assessment of potato cultivation especially the commercial one. A study on main season potato for 2009/10 at Kavre by market research and statistics management program (MRSMP) revealed that the cost of production, yield and net profit was found 489 Rs/quintal, 32.16 mt/ha and 151104 Rs/ha respectively (MRSMP, 2010).

Upadhyaya (2004) from the survey of 188 farmers in Kavre reported that average farm size for potato was 0.2 ha with average production of 24mt/ha. Potato farming was profitable enterprise and price of input and output played an important role in the profitability of the enterprise.

However, these studies do not reflect about use of household resources and direct cash investment. There was a need for study on economic aspects of potato cultivation. Farmers lacked confidence for judicious use of resources and the return from their enterprises including potato. A need was felt by national potato development program (NPDP) to conduct study on commercial potato cultivation and assess the economic profitability and resource use efficiency.

This study was targeted at central question of economic assessment of main season commercial potato farming in Kusadevi of Kavre district. Investment pattern cost of production, gross return, net farm income (NFI), benefit cost (B/C) ratio, return on investment, identification of major governing factors for income and pattern of marketing and selling of potato by farmers at Kusadevi were focused in this study.

## RESEARCH METHODOLOGY

Kusadevi, a commercial potato growing pocket was selected purposively where NPDP is providing technical support for commercial seed potato promotion program in collaboration with district agriculture development office (DADO), Kavre. As potato was a major commodity for commercialization by farmers, Kusadevi was selected as study site to identify the level of investment and return at farm level which could provide baseline information and implication to farmers regarding use of resources. Formats were distributed randomly to forty five farmers from the pocket area and data were collected using daily farm record through out the crop season. Altogether 20 farm records were selected out of 28 received formats. The daily farm record format was jointly developed by NPDP and MRSMP considering the objective of research and nature of enterprise.

Simple economic tools were used to identify the benefit cost ratio. Benefit cost ratio includes the gross revenue (GR) including the monetary value of total farm production utilized for household consumption and marketable surplus.

$$\text{NFI} = \text{GR} - \text{TC} \quad \dots\dots\dots (1)$$

$$\text{B/C} = \text{GR}/\text{TC} \quad \dots\dots\dots (2)$$

Where, NFI= Net farm income, GR= Gross revenue, TC= Total cost and B/C= Benefit-Cost ratio

Similarly, another simple and versatile economic tool return on investment (ROI) was determined to evaluate the efficiency of an investment in potato cultivation. This included the net return per unit investment excluding investment.

ROI = (Gain from investment - Cost of investment) / Cost of investment .....(3)

Along with the calculation of B/C and ROI, a very common tool for cost of cultivation was also calculated for the production of commercial potato considering total investment and yield of potato at farm level.

Farmers' investment of resources was categorized as household resources and direct cash investment. Resources which were contributed from farmers own home were considered as household resources and resources that farmers purchased from market and locality as well as other expenses on cash were considered as direct cash investment.

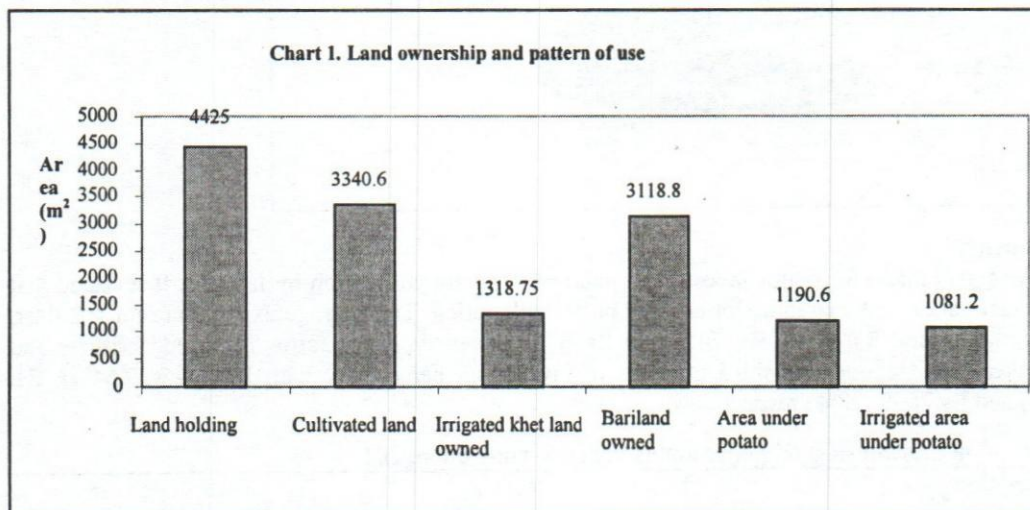
**Data collection and analysis**

Data on input and output of commercial potato were filled by farmers from land preparation to harvesting and verified by regular supervision of NPDP throughout the crop season whereas information regarding area and coverage, command area, marketing of potato and other relevant information were generated through focus group discussion. The study was carried out from January-June 2011. The formats were collected and final verification of data was made with farmers before subjecting for computer analysis. Data were analyzed using statistical package for social science (SPSS 16.0) and MS Excel program. Simple descriptive statistics such as minimum (min), maximum (max), mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) were employed to analyze the data. The confidence interval (CI) for mean was also calculated fixing at 95% level. Limited inferential statistics were also used for analyzing key relationship between production and return and farming scale.

**RESULT AND DISCUSSION**

**Socioeconomic characteristics of farm household**

Potato grower farmers in Kusadevi are small farmers with average land holdings of 4425 m<sup>2</sup> (0.44 ha). Farmers cultivated about 3/4 of their land. The minimum and maximum area allocated for potato was found 250 m<sup>2</sup> to 4000 m<sup>2</sup> of land with average of 1190 m<sup>2</sup>. Farmers have utilized most of their irrigated land for potato cultivation in the summer season.



**Table 1. Farmers' categorization based on scale of potato farm, 2011**

Categorization	Frequency	Percent	Cumulative Percent
Cultivating less than 1 ropany (500 m <sup>2</sup> )	4	20.0	20.0
Cultivating 1-3 ropanies of land (500-1500 m <sup>2</sup> )	10	50.0	70.0
Cultivating more than 3 ropanies (1500 m <sup>2</sup> ) of land	6	30.0	100.0
Total	20	100.0	

### Household expenses and direct cash investment

The study revealed that farmers' household resources accounted 72.4% of total resources in terms of monetary value with weighted mean of 69.1% in general. Farmers' household resources ranged 62 to 91% in terms of investment. It was clear that farmers' household resources had a considerable share on potato production. Farmers' investment ranged from Rs 3425 to 94770 with average of 24392 Rs/farm. The average cost per ropany was found Rs 9530 including household cost and direct cash investment.

**Table 2.** Share of household resources in percent by farmers on potato cultivation, 2011

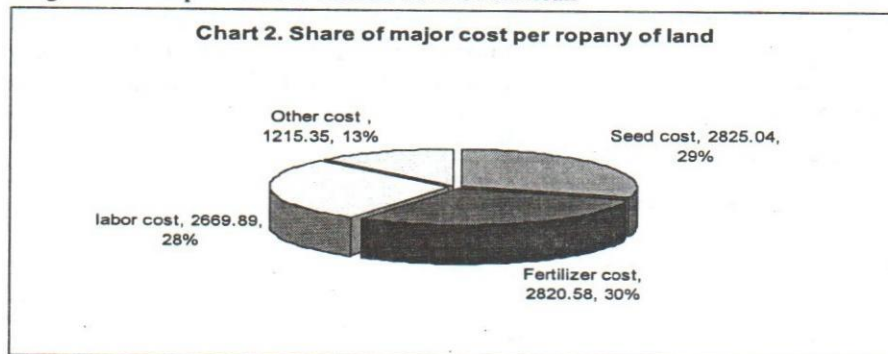
Min	Max	$\bar{x}$	Weighted $\bar{x}$	$\sigma$
62.22	91.34	72.43	69.1	7.43

Table 3 depicts the pattern of investment on potato by farmers. It was found that average household, direct cash and total investment per farmer was Rs. 16864, Rs. 7541 and Rs. 24392 respectively. The average investment per ropany was found Rs. 9530.

**Table 3.** Pattern of investment (Rs) on potato cultivation by farmers, 2011

Description	Min	Max	$\bar{x}$	$\sigma$
Household investment	2425.00	61350.00	16864.75 ( $\pm 7721.25$ )	16497.14
Direct cash investment	455.00	33920.00	7541.25 ( $\pm 4042.80$ )	8638.17
Total investment	3425.00	94770.00	24392.50 ( $\pm 11680.25$ )	24957.03
Investment per ropany	5231.25	13100.0	9530.86 ( $\pm 1122.54$ )	2398.49
Cash investment per ropany	800	4266.67	2624.22 ( $\pm 479.79$ )	1025.17

\* Figures within parentheses include 95% CI of mean



### Major investments

The analysis was also made for major investment incurred in potato cultivation by farmers. It revealed that fertilizer, seed and labor cost shared major cost for potato cultivation. The average expenditure for fertilizer, seed and labor was found Rs. 7098, Rs. 7055 and Rs. 6976 respectively per farm. The seed, fertilizer and labor cost ranked first, second and third in terms of investment per ropany with Rs 2825(29.64%), Rs. 2820(29.59%) and Rs.2669 (28%) respectively.

**Table 4.** Level of investment (Rs) on major inputs in potato cultivation, 2011

Description	Min	Max	$\bar{x}$	$\sigma$
Fertilizer cost/household	750.00	25880.00	7098.75 ( $\pm 3438.03$ )	7345.97
Cost of seed/household	800.00	28800.00	7055.50 ( $\pm 3323.8$ )	7101.91
Labor cost/household	925.00	26250.00	6976.25 ( $\pm 3689.30$ )	7882.85
Fertilizer cost/ropany	1500.00	4490.00	2820.58 ( $\pm 377.14$ )	805.82
Seed cost/ropany	1000.00	5226.67	2825.04 ( $\pm 466.86$ )	997.53
Labor cost/ropany (household +hired)	625.00	4487.50	2669.89 ( $\pm 514.99$ )	1100.36

\* Figures within parentheses include 95% CI of mean.

### Pattern of use of major resources

An analysis was made for use of major inputs on potato cultivation especially for seed, labor and fertilizer. Farmers used slightly higher seed rate because of closer spacing. However, the use of fertilizer far exceeded than the recommended dose.

**Table 5.** Use of resources per ropani of potato cultivation, 2011

Description	Min	Max	$\bar{x}$	$\sigma$
Seed (Kgs)	42.50	126	83.50 ( $\pm 10.46$ )	22.34
Fertilizer (Kgs)	10	50	25.25 ( $\pm 5.33$ )	11.39
Compost (Quintals)	4.38	25.0	14.32 ( $\pm 2.23$ )	4.75
Labour (mandays)	6	30	14.52 ( $\pm 2.83$ )	4.75

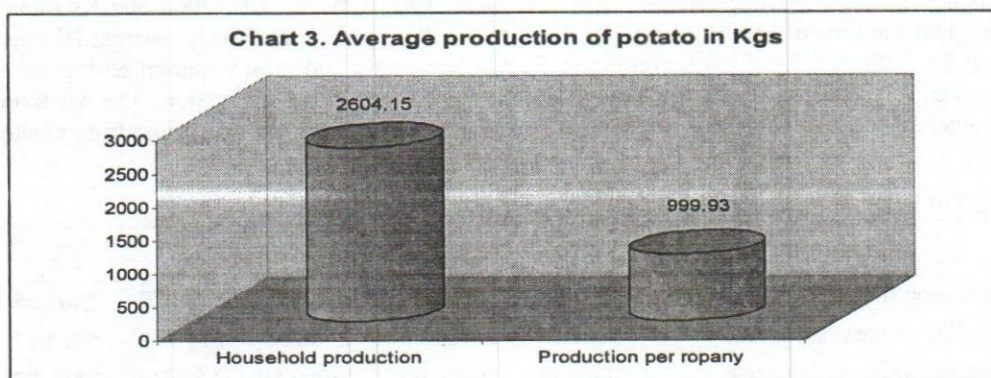
### Production of potato

The trend of potato production revealed that farmers produced on an average of 2604 Kgs of potato with minimum 245 Kgs and maximum of 12 mt. The average yield of potato was found 999.93 kgs/ropani of land (approximately 20 mt/ha). This yield is about 47% higher than the national average productivity of 13.58 mt/ha. It was also found from focus group discussion that productivity of autumn potato in the same locality is around 12-14 mt/ha.

**Table 6.** Potato production (kgs) by farmers, 2011

Description	Min	Max	$\bar{x}$	$\sigma$
Production per household	245.00	12118.00	2604.15 ( $\pm 1381.04$ )	2950.84
Production per ropany	300.00	2500.00	999.93 ( $\pm 230.41$ )	492.30

\* Figures within parentheses include 95% CI of mean.



### Cost of production

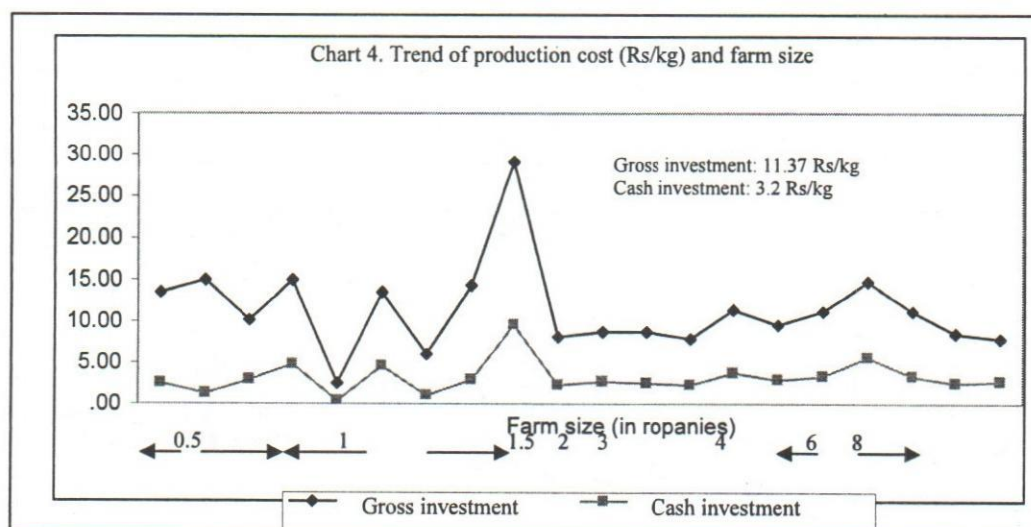
Cost of production was estimated per unit of output considering total investment and direct cash investment. The average cost of production per kg of potato was found Rs 11.37 where as direct cash investment was 3.20 Rs of potato.

**Table 7.** Cost of cultivation of potato per unit of output (Rs/kg)

Description	Min	Max	$\bar{x}$	$\Sigma$
Cost including household resources	2.47	29.2	11.37 ( $\pm 2.67$ )	5.34
Direct cash investment	0.32	9.6	3.2 ( $\pm 0.91$ )	1.93

\* Figures within parentheses include 95% CI of mean.

Similarly, the cost of cultivation was portrayed in chart which revealed that the cost of production fluctuated up to 1 ropany (500 m<sup>2</sup>) of land but followed uniform pattern above this area.



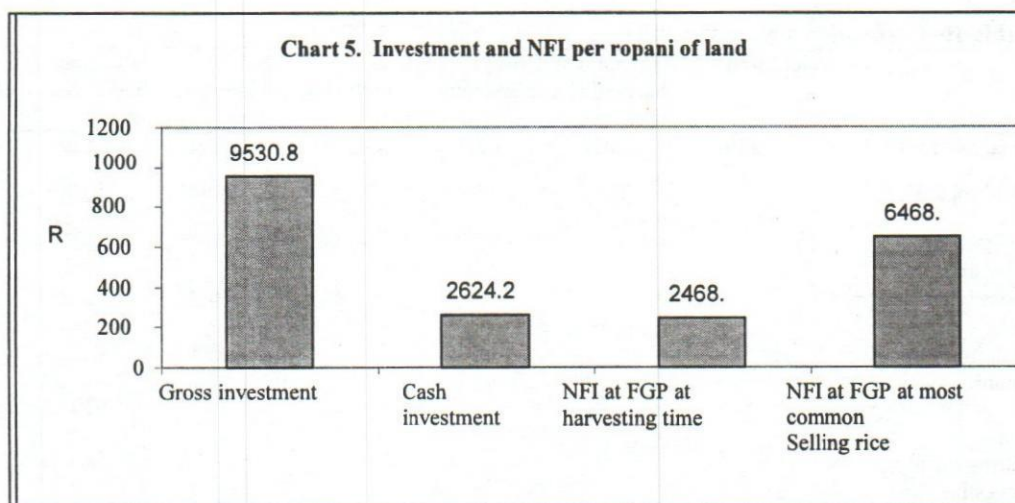
### Return from potato farming

Return from commercial potato was calculated considering the farmers' tendency to sell their product. Majority of the farmers used to sell their product either at harvesting time or wait for some period when they get reasonable price. Very limited farmers used to keep their product for long time till August/September at their home. Limited farmers used to keep some product as source of seed who were engaged in seed potato production. So, analysis was made considering its implication to others who could be involved in commercial farming. The return was calculated in terms of GR, NFI per ropany of land B/C ratio and ROI. The analysis revealed that the average GR per farm was found approximately Rs 12000 and Rs.16000 according to FGP (FGP) at time of harvesting and most common selling price respectively whereas NFI per ropany was found Rs. 2468 and Rs. 6468 according to FGP at harvesting and most common selling price respectively. The FGP at different points was determined through focus group discussion. The net farm return was also found as negative value also which illustrates that some farmers are still at loss from potato cultivation.

**Table 8.** GR and NFI in Rs. at different FGP, 2011

Description	Min	Max	$\bar{x}$	$\sigma$
GR at FGP at harvesting time	3600.00	30000.00	11999.00(±2764.87)	5907.65
NFI per ropany at FGP at harvesting time	-5160.00	23820.00	2468.30(±2819.77)	6024.97
GR at FGP at most common selling price	4800.00	40000.00	15999.00(±3686.49)	7876.87
NFI per ropany at FGP at most common selling price	-3960.00	33820.00	6468.10(±3684.98)	7873.63

\* Figures within parenthesis include 95% CI of mean.



#### Benefit-Cost ratio and return on investment

Similarly, economic analysis was also performed considering B/C ratio and ROI considering the FGP as in case of GR and NFI. It was found that mean B/C ratio was 1.32 and 1.77 according to FGP at harvesting time and most common selling price respectively. Farmers could generate an additional return of 0.32 Rs and 0.77 Rs at given conditions respectively. The analysis further illustrated that the return was found negative also.

**Table 9.** B/C ratio and ROI at different FGP, 2011

Description	Min	Max	$\bar{x}$	$\sigma$
B/C ratio at FGP at harvesting time	.41	4.85	1.3286(±0.42)	.90
ROI at FGP at harvesting time	-.59	3.85	0.3286(±0.62)	.90
B/C ratio at FGP at most common selling price	.55	6.47	1.7715(±0.56)	1.20
ROI at FGP at most common selling price	-.45	5.47	0.7715(±0.56)	1.20

\* Figures within parenthesis include 95% CI of mean.

#### Relationship among variables

Pearson correlation was determined to gauge extent of relationship between production, investment and return of potato cultivation with selected variables. The relationship between variables is presented in following table.

**Table 10.** Correlation among variables

	Yield/ropani	B/C ratio at harvesting time	Gross Investment per kg	Cash investment/ropani	NFI at harvesting time	GR/ropani at harvesting time	Fertilizer cost/ropani
Area under potato	.229	-.022	-.239	.638**	.082	.229	.240
Yield/ropani		.869**	-.736**	-.022	.919**	1.000	.281
B/C ratio at harvesting time			-.677**	-.396	.981**	.869**	-.035
Gross Investment per kg				.144	-.760**	-.736**	-.015
Cash investment/ropani					-.300	-.022	.390
NFI at harvesting time						.919**	-.003
GR/ropany at harvesting time							.281

\*\* Significant at the 0.01 level (2-tailed)

#### Impact of farm size on production, NFI and B/C ratio

Scale of farming is an important indicator of commercial farming. Simple linear regression was employed to find out the impact of potato farm on yield, NFI and B/C ratio. The linear regression is depicted below.

**Table 11.** Simple linear regression showing relationship among variables

Linear regression	R <sup>2</sup>	Significance
Yield ( kg/ropany ) = 870.55 + (3.39 * farm size)	0.053	Non
NFI/ropany at harvesting time (Rs)= 1900.12 + (14.91 * farm size )	0.007	Non
B/C at FGP of harvesting time = 1.35 - (0.00059 * farm size)	0.00	Non
B/C ratio at most common selling price = 1.80 - (0.00078* farm size )	0.00	Non

It showed that though relationships were non-significant; the farming scale of potato has positive impact on yield and NFI whereas B/C ratio decreases with increased scale of potato cultivation.

#### Determinant factors of net farm income

Farmers return from potato enterprise is dependent on number of variables. Most of the farmers sell their product to local vendors, some sell themselves and even some have direct contact with traders at Kalimati and other wholesale markets of Kathmandu valley. One interesting feature is that the price of potato in Kalimati wholesale market of Kathmandu is lowest at beginning of April and then gradually rises till October when autumn season potato comes from hill districts and winter potato from Terai region to Kathmandu. The trend of wholesale price of potato at Kalimati market clearly indicates that the price doubles by July in comparison to price of April. So, farmers having retention capacity for 1-2 months get higher net return from potato farming. Potato is generally harvested from end of April to mid of May in Kusadevi.

However, almost all farmers are selling potato this year right after harvesting because of probability of rotting of fresh potato due to continuous rainfall. Another interesting feature is that farmers are selling fresh potato 10-12 Rs/kg whereas it accounts around 20-25 Rs/kg for autumn production. Though production is higher at this season, farmers get more prices for autumn season and sell immediately after harvest. The price trends of fresh potato at Kalimati vegetable wholesale market reflect its maximum rate at the month of November ([www.kalimatimarket.com](http://www.kalimatimarket.com)).

#### CONCLUSION

Farmers share large portion of their household resources in the potato cultivation. Farmers should be enhanced in the optimization of resources as some farmers have negative return from farming in locality and have higher application rate of fertilizers. The yield and NFI per unit land both increased with increased farm size of potato cultivation despite diminishing b/c ratio. Farmers' income is mainly governed by



production, reduced cost of investment, retention capacity at home and cold storage, farmers' dealing with traders and local and distant markets and level of investment. Farmers have better scope to get increased return by storing potato at their home up to August. Farmers need to be trained on post harvest storage to get more profit since average potato price increase continuously from April to October in Kathmandu valley which is major market destination for farmers' product.

#### **ACKNOWLEDGEMENT**

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