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Economics of production and marketing of banana in Chitwan district, Nepal

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Article Info	ABSTRACT
  	The study was conducted in several place of Chitwan, Nepal from where 90 representative farmers and 20 traders were selected randomly as sample. The farmers were categorized into small, medium and large farm based on land holding size. The finding showed average productivity was maximum in medium size farm. Total cost of banana cultivation per bigha (1.5 bigha = 1 hector) was NRs. 239031 (106 NRs. = $1) excluding land rent. The share of planting material was 12.66%, manure 13.55%, fertilizer 16.49%, micro-nutrient 2.59%, pesticides 10.54%, labor 19.48%, animal/ machine 19.23%, marketing & transport cost 2%, and miscellaneous 3.46%. The average return rate found to be highest in large farm and lowest in small farm. The average profit of banana cultivation found to be NRs. 131902.3 per bigha. The average benefit cost ratio was 1.55 in the study area. Producer–Collector–Wholesaler–Retailer–Consumer was the most prevalent marketing channel, through which 94.74% volume was traded. Disease and pest infestation was the major production problem and fluctuation in price for marketing. The average share of banana on annual income for farmers found to be 41.34 %, indicating commercial cultivation in study area.

INTRODUCTION

B anana is a relatively short duration crop and, therefore, most of the farmers can afford to grow it. It is one of the cheaper and most nourishing fruit. It contains nearly all the essential nutrients including minerals and vitamins and has several medicinal properties (Bose 1990). And, Chitwan is considered as one of the most potential district for banana farming. The cultivation of banana in Chitwan was started as early as 1940 (Shrestha 1994). Total of 690 ha area is under the banana cultivation with the productive area of 680 ha and 12,104 MT (metric ton) of production. Initially, farmers used to allocate small patch of land to grow banana by rural people but the area under its cultivation is expanding and so, is the contribution of banana farming on national AGDP (Agriculture gross domestic product) (ICIMOD 2015). This fruit possess immense potential for the improving farmers' economic status as well providing strength to poverty

reduction. Thus, realizing the importance of banana cultivation, this study was carried to dig out the economics of production and marketing of banana along with its problems in Chitwan district.

MATERIALS AND METHODS

Study Area

The study was conducted in Chitwan district, which lies in the central part of Nepal. Thimura, Ramnagar, Padampur, Ratnagar and Jagatpur were the main site of study. The reason behind selecting those areas was to obtain as fair data as possible and to avoid biasness in the result. And other than that large number of banana grower were situated in those areas.

Selection of banana producers, collectors and retailers

Ninety banana producers were selected from the list of the farmers, by applying simple random sampling technique. Banana growers were divided in three different categories i.e. farmers cultivating in area less than 0.5 *bigha* (1.5 *bigha* = 1 ha) were small category and farmers cultivating 0.5-2 *bigha* were medium category and the farmers cultivating above 2 *bigha* were large category. The count of the small farms were 7, medium farm 48 and large farms and large farms 35. To understand about market and marketing structure and channel of

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banana in Chitwan, twenty traders were selected including ten collectors and ten retailers.

Source of information

The pre-tested systematic semi structured questionnaire was used to obtain the primary data from the randomly selected farmers. These data were obtained through face to face interview and key informant interview. Secondary information was obtained through reviewing different publications published by government agencies, Banana Producers Associations, different NGOs and INGOs concerning banana production.

Survey design and data collection

Interview schedule design

For the collection of primary data two sets of interview schedule were prepared, one set to collect the information from farmers regarding production and marketing of banana and another set to collect the information from traders. Different variables were identified and interview schedules were prepared accordingly.

Field survey

The field survey was conducted in December, 2015. The respondents were interviewed using face to face method by visiting their homes during day time. Regular checking and validation of the information were done after filling the interview schedule to avoid haphazard data. The traders and key informants were interview in the same manner.

Methods and techniques of data analysis

Both the primary and secondary information collected from the field survey and other means were coded, tabulated and analyzed by using Microsoft Excel and Statistical Package for Social Sciences (SPSS).

Cost of production

Mainly the cost of land preparation, manure, fertilizer, plant protection, labor, planting materials etc. was focused on determining cost of production while excluding land rent, since all of those farmers were cultivation on their own land.

Benefit cost analysis

For benefit cost analysis, total cost of production of banana and total gross return from produce were used. For calculating gross return, income from produce sale was accounted. So the B/C ratio was calculated using the following formula:

B/C ratio = Gross Return/Total Cost

Profit analysis

The profit is the difference between total revenue and total cost incurred. Thus, net profit for any farm business can be written as:

$$\Pi = TR - TC$$

Where,

Π = net profit, TR = total revenue, TC = total cost

Marketing margin and producer's share

Marketing margin is the difference between farm gate price received by the farmers and the price paid by the consumer (Tomek 1984). It was calculated by subtracting the farm gate price from the retailer's price.

Marketing Margin (MM) = Retailer Price (P_r) – Farm Gate Price (P_f)

Similarly, producer's share is the price received by the farmer expressed as a %age of the retail price, which is the price paid by the consumers. It was calculated using following formula;

$$\text{Producer's Share (Ps)} = \frac{\text{Farm gate price (Pf)}}{\text{Retailer price (Pr)}} \times 100$$

Factors affecting banana production

In order to estimate the factors affecting banana production multivariate regression model was applied. Production (in bunch) was accounted as the dependent variable while cost incurred on the planting material, fertilizer, manure, micro nutrient, pesticide, labor, animal/machine, and area under banana cultivation (in *bigha*) considered as the explanatory variables.

Linear relationship was assumed to exist between these variables. The regression model was expressed as;

Quantity banana produced by farmer = f (Expense on planting material, fertilizer, manure, micro nutrient, pesticide, labor, animal/machine, area under banana cultivation)

The mathematical specification is,

$$Y = \alpha_0 + \beta_1\,Pm + \beta_2\,FMM + \beta_3\,P + \beta_4\,L + \beta_5\,A/M + \beta_6\,MM$$

Y = Banana yield (bunch)

Pm= Expense on Planting material

FMM = Expense on fertilizer, manure and micronutrient (NRs.)

P = Expense on pesticide (NRs.)

L = Expense on Labor (NRs.)

A/M = Expense on animal power or machine (NRs.)

A = Area under banana cultivation (in *bigha*)

α_0, β_1.......β_6= Coefficient to be estimated

Contribution of banana production to household economy

The contribution of banana to household income will be analyzed by keeping the annual share of this enterprise to the total annual income of farmers.

Total Household income = *f* (on farm income, off farm income)

Indexing / Scaling

For finding the importance of different production and marketing problems five point scale was used based on the farmer's perception about them. It comprises very high importance, high importance, normal importance, less importance and the least importance to the different problems

using numeric value 1, 2, 3, 4 and 5 respectively. The index of importance was conducted by using the following formula;

$$I_{imp}= \sum (S_i \, f_i)/N$$

Where,

I_{imp}= Index of importance

S_i = Scale value

f_i= Frequency of importance given by the respondents

N = Total number of respondents

RESULTS AND DISCUSSIONS

General overview

Both tropical and sub-tropical climate is present in the district. Mean temperature during summer is 27-30^{0}C and mean temperature during winter is 10-15^{0}C in tropical region while in sub-tropical region mean temperature during summer is 20-25^{0}C. The mean annual rainfall is about 2000 mm (DADO 2014).

Land holding and utilization

The result showed that average land holding size of the overall sampled household was 2.95 *bigha*. The average land under banana cultivation in the study area was 2.16 *bigha*. The land use under banana cultivation varied from 0.35 *bigha* to 5.5 *bigha* with standard deviation 1.18. The details of land use for banana cultivation are presented in Table 1.

Economics of banana production

Cost of banana cultivation

In comparison to other field crops banana production requires higher amount of inputs. It is a capital intensive enterprise. Total cost of banana cultivation per *bigha* was NRs. 239031 (106 NRs. = 1 USD) excluding land rent which found to be almost double as per reported in Pakistan (Memon, Wagan & Noonari, 2016). Labor cost contributes to the highest share (19.48%) of total production cost, which is supported by Kamal et al. (2015) and Guledgudda et al. (2002). Details of cost and share of different factors of banana cultivation are presented in Table 2.

Cost of cultivation, return and profit of banana (NRs. per *bigha*)

The average return of banana found to be NRs. 370216.6 per *bigha* with average profit of NRs.

131902.3 per *bigha* which found to be almost double as per reported in Pakistan (Memon, Wagan and Noonari 2016). The detail of cost, return and profit of banana cultivation is given in Table 3.

On categorical basis, the average return found to be highest in large farmers category and lowest in small farm category, which is supported by Kathirvel (2007) and Mishra (2000). The reason being this may be due to the bargaining power of the farmer and efficient application of inputs. The average cost of cultivation found to be maximum in large farm category and minimum in small farm category. The reason behind this may be the commercialized and intensive type of cultivation in large scale farming while more of a subsistence nature's cultivation in small scale farming. The profit found to be highest in large farm category and lowest in small scale category. The reason behind this may be the efficient application and use of resources along with high bargaining power of farmers in large scale farming. The details of cost, return & profit of banana production by farm category is presented in Table 4.

But the productivity was observed highest in medium farm category because of efficient use of labor and nutrient and proper management and protection action and lowest in small farm category due to the poor management and negligence of farmers. The average price per bunch (banana stem) found to be highest in large farm category due to the high bargaining power and lowest in small farm category. The average banana cultivation area, average productivity along with average price per bunch is presented in Table 5.

Benefit – cost ratio analysis

Benefit cost ratio simply gives an idea about the recovery of expenditure incurred during the production by return from the product. The benefit cost analysis of banana produced in the study area is presented in Table 6.

The benefit cost analysis showed that the overall B/C ratio is greater than unity (1.55), which is supported by Adhikari and Regmi (2011) but very low compared to the result of Rane and Bagade (2006). The B/C ratio found to be highest Large farm category and lowest in small farm category mainly due to the high bargaining power of large farm and more commercialized and efficient cultivation unlike subsistence nature's farming in small farm.

Table 1. Land use (*bigha*) for banana cultivation by sampled household

Description	Minimum	Maximum	Sum	Mean	SD
Total area	0.5	8	265.35	2.95	1.61
Banana cultivation Area	0.35	5.5	194.15	2.16	1.18
Irrigated area	0	5	126.4	1.41	1.22
Un-irrigated area	0	4	78.75	0.875	1.30

Table 2.Cost of cultivation of banana (per *bigha*) in the study area (NRs. 106 = $1)

Particulars	Cost (NRs.)	% share
Planting material	30266.67	12.66
Manure	32376.67	13.55
Fertilizer	39411.11	16.49
Micro-nutrient	6193.89	2.59
Pesticides	25186.44	10.54
Labor	46568.44	19.48
Animal/Machine	45961.67	19.23
Marketing & transport cost	4783.89	2.00
Others	8282.22	3.46
Total	239031	100

Table 3. Cost of cultivation, return and profit of banana in the study area

Description	Minimum	Maximum	Average
Return	228000	510000	370216.6
Cost	167000	308500	239031
Profit	15900	279500	131902.3

Marketing system of banana

Marketing system in the study area

The banana producers and the village level collectors were the main person involved in the marketing. Mainly buying, assembling, transportation etc are done by the collectors, while producers involved in selling activities only. The marketing system is described as below;

Marketing channels and marketing margin of banana

It is the way through which produce is transferred from point of production to point of consumption. Marketing is a key factor for commercialization of agriculture. So the development of agriculture sector is dependent on its market assurance. In marketing system, producers, collectors, wholesalers and consumers are the main actor involved in the production and consumption chain. Altogether, three marketing channels that had been operating for banana marketing in the study area were identified. Those marketing channels are as follows;

Channel-1: Producer – Village level collector – Wholesaler – Retailer – Consumer

Channel-2: Producer – Collection center – Traders – Consumer

Channel-3: Producer – Retailer - Consumer

Among the three channels the most prevalent was channel-1. Through this channel about 94.74

% volume of banana was traded, which is supported by Poudel (2011). Contradictory of that Shivanand (2002) only reported two market channel for banana. The details of marketing channels and volume of transaction is given in Table 7.

Marketing margin and producer's share

Producers' share found to be about 44%, and similar result presented by Adhikari and Regmi (2011). Marketing margin found to be >100% of the producer share, similar to the result of Kalule and Kyanjo (2013). The details of marketing margin and producer's share are given in Table 8.

Contribution of banana in household income

The finding of the study showed the higher percentage of contribution of banana to household income. The average share of banana on annual income for farmers found to be 41.34 %, such higher share indicated the commercial scale of cultivation in study area. Among all highest % share were found on large farm and lowest in small farm. It might be due to the commercial cultivation of banana in large farm rather than subsistence farming like in small farm. Further detail is shown in Table 9.

Factors affecting banana production

In order to estimate the factors affecting banana production multivariate regression model was applied. Production (in bunch) was accounted

Table 4. Average cost of production, return and profit of banana by farm category (NRs.)

Farm Size Categories	Return	Cost	Profit
Small (<0.5 *bigha*)	349428.57	228300	103128.57
Medium (0.5 – 2 *bigha*)	365322.91	237005	132628.33
Large (>2 *bigha*)	381085.72	243955.71	135015.71
Total	370216.67	239031	131262.33

Table 5. Average banana cultivation area, average productivity along with average price

Farm Size Categories	Productivity	Price (NRs.)	Area (*bigha*)
Small (<0.5 *bigha*)	2228.57	148.57	0.457
Medium (0.5 – 2 *bigha*)	2240.63	161.50	1.4625
Large (>2 *bigha*)	2237.14	169.65	3.46
Total	2238.33	164.38	2.16

Table 6. Benefit cost analysis of banana produced in the study area (NRs. per *bigha*)

Farm Size Categories	Return	Cost	B/C ratio
Small (<0.5 *bigha*)	349428.57	228300.00	1.53
Medium (0.5 – 2 *bigha*)	365322.91	237005.00	1.54
Large (>2 *bigha*)	381085.72	243955.71	1.56
Total	370216.67	239031	1.55

Table 7. Quantity of banana marketed by the sampled household through various channel

S.N.	Marketing channels	Marketed Volume(bunch)	%age
1	Channel-1	190850	94.74
2	Channel-2	6400	3.18
3	Channel-3	4200	2.08
Total		21.1450	100

as the dependent variable while cost incurred on the planting material, fertilizer, manure, micro nutrient, pesticide, labor, animal/machine, and area under banana cultivation (in *bigha*) considered as the explanatory variables.

The value of multiple correlation coefficient (R=0.629) indicated the fair correlation between dependent and independent variables in the analysis. Likewise, the value of coefficient of multiple determination (R^2=0.396) indicated about 39.6% variation explain in dependent variable is by all independent variable combined.

The analysis shown that NRs. 1000 expenses on planting material contributed 2 bunches to total production in the study area. Expenses on planting material were positively contributed, similar to the result of Fleming (1994). Similarly NRs. 1000 expenses on fertilize, manure, pesticides, animal/machine and contributed 10, 9, 1 and 7 bunches respectively to total production. And with 1 *bigha* increase in area of cultivation contributes 6 bunches. Micronutrient shows negative but non-significant relation with the production while expenses on fertilizer, manure and pesticides, area under banana cultivation and expense on labor show positive and significant relation, which is shown in detail in Table 10.

Production problem of banana

One of the reason for banana failing to arise as the commercial and most important crop for the farmers in the Chitwan is its losses during post harvest and losses caused by diseases and insects (DADO 2014). Panama wilt, Bunchy Top, Leaf Spot, Shoot rot, Brown Spot, Bacterial soft rot of rhizome and pseudo-stem, moko disease, heart rot of pseudo-stem and Diamond spot etc are some important diseases of banana causing serious losses. Other than that insects like Nematode, banana stem weevil, red spider, red rust thripes, flower thripes, Florida red scale, grass hoppers, banana aphids, oriental fruit fly etc are the reason of further loss in yield of banana and blockage on the journey of successful production of banana for farmers, which is supported by Thapa (1993).

The result of the study showed that disease and pest infestation was the major production problem due to the fact that they cause huge loss in production and price of produce (Singh 1999). Gunasekaran (2016) also reported that disease pest are the most important production problem of banana but only after the wind. Second most important problem found to be labor and planting materials followed by lack of chemical fertilizer and pesticides, wind and scarcity of irrigation.

Table 8. Marketing margin and producer share of banana in the study area

Farm Size Categories	Farm gate (NRs/finger)	Retail price (NRs/finger)	Marketing margin (NRs/finger)	Producer share (%)
Small	2.64	6.5	3.86	24.62
Medium	2.86	6.5	3.64	44
Large	2.95	6.5	3.55	45.46
Total	2.89	6.5	3.61	44.46

Table 9. Contribution of banana to household income

Farm Size Categories	Average annual income from banana (%)
Small (<0.5 *bigha*)	5.68
Medium (0.5 – 2 *bigha*)	31.89
Large (>2 *bigha*)	55.96
Total	41.34

Table 10. Factors affecting production of banana

Factors	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	882.382	196.971		4.480	0.000
Planting material	0.002	0.004	0.047	0.488	0.627
Manure	0.009	0.004	0.219	2.199	0.031**
Fertilizer	0.010	0.003	0.298	2.935	0.004*
Micro-nutrient	-0.006	0.011	-0.051	-0.510	0.611
Pesticide	0.001	0.003	0.018	0.182	0.856
Labor	0.007	0.004	0.182	1.705	0.092***
Animal/Machine	0.006	0.004	0.173	1.696	0.094***
Area Under banana	7.374	26.752	0.026	0.276	0.784
R=0.629 R^2=0.396 Adjusted R^2=0.337 SE=285.21					

Table 11.Problems of banana production faced by respondents in the study area

S.N.	Problems	Index	Ranking
1	Disease and pest	0.7088	I
2	Lack of Chemicals	0.5911	III
3	Lack of labor and planting material	0.6533	II
4	Wind	0.4356	V
5	Scarcity of Irrigation	0.5822	IV

Table 12.Growers response on marketing problems in the study area

S.N.	Marketing problems	Index	Ranking
1	Fluctuation in price	0.6733	I
2	Large gap in price	0.6067	III
3	Lack of market information	0.6311	II
4	Lack of collection center	0.5178	V
5	Sale on credit	0.5378	IV

Table 13.Traders response on marketing problems in the study area

S.N.	Marketing problems	Index	Ranking
1	Seasonal supply	0.6844	I
2	Lack of storage facility	0.6022	II
3	Lack of market information	0.5400	V
4	Lack of sufficient production	0.5600	III
5	Difficulty in transportation	0.5467	IV

Such problems arising may be due to the poor governance and poor technical knowhow on farmer's side. Contradictory to that Kameswara (2000) reported that lack of irrigation is the most important problem for the production of banana.

The details of production problems facing by banana growers on the surveyed area is presented in Table 11.

Marketing Problem

Marketing problems are also very important factors which can hinder the producers of high value commodity. The details of marketing problems faced by the banana producers are presented in Table 12 and of the traders are presented in Table 13. The major marketing problem faced by the banana producers are

fluctuation in price followed by lack of market information, large gap in consumers price and farm gate price, sale on credit, lack of collection center, similar to what reported by Gunasekaran (2016).

Traders (Collector, wholesaler, and retailer) play the most important role in the marketing and distribution of the produce. During the course of study of the marketing problems as responded by the traders were the lack of storage facility, lack of processing facility, lack of suitable packaging materials, lack of sufficient amount of produce and Nepal's seasonal supply and demand. Among all these problems seasonal supply emerged as the major marketing problem for the traders.

CONCLUSIONS

Based on the findings of the study conducted on economics of production and marketing of banana in Chitwan district of Nepal, following conclusion were drawn. Chitwan is the potential production area of banana due to favorable climatic condition as well as easy market access. Higher benefit cost ratio with higher return indicates that the crops appear to be highly profitable and remunerative enterprise in Chitwan district of Nepal. Banana cultivation was found to be having significant contribution to household income and thus can be a suitable option for uplifting the socio-economic status of the farmers. The marketing system is still need to be more developed. The farmers are still away from reasonable price of their produce. There are several areas for improvement like market information, storage, grading and further processing. Farmers are facing several productions and marketing problems. And DADO needs to gear up for providing proper help and support to farmers to handle those production and marketing problems. For getting adequate benefit, it is better to practice self-marketing or going through producers group or associations since these areas are near to the market and linked with agricultural roads. The farmers should follow better management practices like irrigation, manuring, plant protection, proper harvesting in order to get higher benefit from banana cultivation.

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