



Economics of fodder production for dairying in selected areas of Bangladesh

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Abstract

Dairy farming along with fodder production is a highly profitable enterprise. Considering these views, the study was aimed to estimate profitability of fodder production, to determine the income coefficient of fodder farm households and to assess the contribution and impact of fodder production on livelihood change. In this regard, six study areas were selected from six districts viz: Dinajpur, Jessore, Kurigram, Rangpur, Pabna and Sirajgonj considering the concentration of fodder production and dairy farming systems. A purposive sampling technique was followed for collecting primary data from the field. Two categories of sample farmers were selected namely: i) Fodder Producer cum Seller; ii) Fodder Producer cum Dairy owner having 1-2 dairy cows as small, 3-4 dairy cows as medium and 5 and above dairy cows as large farmer. A total of 220 fodder farmers were interviewed. Field survey method and focus group discussions were followed to collect necessary data and information. Descriptive statistics and Cobb Douglas type revenue function were applied to get the meaningful results. The production cost of fodder for producer was estimated Tk. 1,82,415/ha and for producer cum seller Tk. 1,79,748/ha. On average, total cost was estimated Tk. 1,81,081/ha/year irrespective of fodder producer. Bio-mass yield was found 207ton/ha/year and per ton fodder price was estimated Tk. 1,714. On the contrary, annual net return from fodder production was estimated Tk. 1,67,823/ha/year and Tk. 1,81,489/ha/year for producer and producer cum seller, respectively. The BCR was 1.92 for producer and 2.01 for producer cum seller. Functional analysis revealed that fodder sale and livestock rearing and fodder business significantly contributed to the household income of the fodder farmers. The dairy farmers having 1-2, 3-4 and 4-5 cross-bred dairy cattle earned Tk. 1,20,227, Tk. 1,91,728 and Tk. 4,17,287, respectively, whereas local cattle earned Tk. 33,658, Tk. 51,601 and Tk. 1,13,558, respectively from milk sell annually. For addressing the impact on livelihood status of the dairy farmers with fodder production, it was found improved human capital component over time acquiring knowledge and education, better health condition, easy and more entrance to information, etc. Cultivable land, using open water resources and forests were indicated to determine the changes situation in the natural capital aspects. In case of financial capital, cash in hand, savings and liquid assets had increased notably over the periods. Physical assets had also observed positive trends in the study regions. Thus, dairy owner cum fodder farmers' overall livelihood status had shown a positive trend.

Key words: fodder production, income coefficient, cost, return and livelihood

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Introduction

Bangladesh is agricultural country and nearly three-fourth population depends on agriculture for livelihood. Major parts of population live in rural areas. Livestock sub-sector plays an important role in developing the rural economy of the country providing balanced and cheap nutritional food in the form of milk and other animal products. Livestock is also an important asset for the farm families. Therefore, rapid growth of livestock sector is most desirable not only to retain steady agricultural growth but also to lessen rural poverty. The share of agriculture

sector in national GDP is 18.70 and the share of livestock sub-sector is 2.45 and it provides employment for about 25 per cent of the total labour force (BER, 2013). Livestock also creates opportunities to exploit common grazing lands, supports collateral and savings, and diversify income (Faruque, 2003). One of the main reasons for the low productivity of our livestock is malnutrition, under-nutrition or both, beside the low genetic potential of the animals. Fodder plays an important role in case of dairy production. The country is highly deficient in respect of availability of green fodder, dry fodder and concentrates. Fodder deficient can mainly be attributed to our

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limitations in increasing the area under fodder crops, limited availability of high yielding variety fodder, lack of quality seeds of improved varieties, poor quality of dry fodder, changing cropping pattern in favour of cash crops etc. Besides, low priority efforts to invest in fodder production, lack of post-harvest management for surplus fodder, poor management of pasture lands and inadequate research, extension and manpower support also augmented the deficit situation of fodders.

The steady availability of fodder is a pre-requisite to make livestock production cost efficient especially of milk. Feed and fodder cost constitute about 60-70% of cost of milk production (Grover, et al., 2012). Without ensuring an adequate supply of quality fodder, the achievement of desired growth of livestock sub-sector in the coming years looks almost impossible. The study conducted by (Sayeed et al., 2008) showed that the average acreage under fodder cultivation was increasing; it is a matter of good hope for our livestock sub-sector. A farmer in Palashbari Upazila under Gaibandha district become cropper through fodder production was a glaring example (Alokito Bangladesh, 7th December 2014). Fodder contains a major protein of daily ration of milch animals and therefore, cultivation of nutritious and high yielding variety fodder is inevitable. The authors also revealed that the highest amount of income was observed from harvested fodder based cropping pattern. Profitable livestock farming depends mainly on adequate availability of fodder with reasonable price. In Bangladesh, fodder production and its preservation practice is a very new chapter. Despite various impediments, the farmers are very much eager to produce fodder for their livestock as nutritious feed. But research work is very much scanty in this arena.

The production of high quality fodders is fundamental for rearing improved breeds of cattle. As the number of animal population are increasing over the years, the threat of providing adequate feed and fodder become so acute. Fodder provides to animals not to require nutrient but fills the rumen to satisfy the animals. In financial year 2011-12, the total livestock population were 528.36 lakhs, whereas large animal were 246.38 lakhs (BBS, 2012).

The desired annual growth of agriculture sector can be accomplished only through augmenting overall productivity of livestock sector. We all know that our country is a land resource prone

country and have to produce a lot of crops within this limited resource. This is because; pasture lands are gradually reducing and turn to other crops. As livestock related to life and need feeding. With increase in the pressure on land due to urbanization and industrialization and decrease in the area under fodder and depend on external or purchased inputs has also increased and it is putting pressure especially on the resource poor dairy farmers. Efforts are being made and under way for reducing the gap between the requirement and availability of fodders through technological interventions to increase the yields, bringing more area under fodder crops, conservation and improving the nutritive value of the poor quality fodder.

At present, fodder demand is becoming a challenging issue in most of the developing countries including Bangladesh. The quality feed and fodder supply is vital importance in sustaining the growth of the livestock sub-sector in future. The present study, therefore, was undertaken to estimate profitability of fodder. It is expected that further study on the aspects would add new dimension to the government policy. The specific objectives of the study were as follows:

- i. To estimate the costs and returns associated with the cultivation of fodder crops;
- ii. To determine the income coefficient of fodder farm households; and
- iii. To estimate the contribution and impact of fodder cultivation on their livelihood change.

Materials and Methods

Multi-stage sampling procedure was followed for collecting primary data for this study. In the first stage of sampling, six fodder growing districts, namely Rangpur, Dinajpur, Kurigram, Jessore, Pabna and Sirajgonj were selected purposively. In the second stage, one Upazila was purposively selected from each district as the study location considering the concentration of fodder production and marketing. Dairy farmers and the beef fattening farmers are the prospective buyers of fodder. In this study, Napier fodder (*Pennisetum purpureum*) was considered as the highest growing and demanding fodder in the mentioned location. The selected Upazilas were Badarganj under Rangpur, Chirirbandar under Dinajpur, Kurigram Sadar under

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Kurigram, Jessore Sadar under Jessore, Shahjadpur under Sirajgonj and Sathia under Pabna district. In the third stage, a total of 220 fodder farmers were randomly selected from the selected areas. Fodder farmers were grouped into two categories such as: i) Fodder producer cum seller; and ii) Fodder producer cum dairy owner having 1-2 dairy cows as small, 3-4 dairy cows as medium, and 5 and above dairy cows as large farmer (Table 1).

The primary data were collected by direct interview method with the selected respondents by a structured interview schedule. The interview schedule was pre-designed and pre-tested. After pre-testing, necessary corrections, modifications and adjustments were made and thus, final questionnaire was prepared for data collection. The survey was confined during December 2013-March 2014. All the data, thus, collected were coded, tabulated, summarized and processed using computer SPSS Program. Moreover, four focus group discussions (FGD) were organized to examine the fodder production in the study areas. The analysis was done using descriptive statistics like percentage, frequency distribution, ratio and average. Profit was derived in terms of gross return, gross margin, net return and benefit cost ratio. The formula need for the calculation of financial profitability is discussed below:

$$\Pi = \sum_{i=1}^n (P_{Y_i} \cdot Y_i) - \sum_{i=1}^n (P_{X_i} \cdot X_i) - TFC$$

Where,

Π = Profit;

P_{Y_i} = Price per unit of the i-th produce;

Y_i = Quantity of the i-th produce;

P_{X_i} = Price per unit of the i-th inputs;

X_i = Quantity of the i-th inputs;

TFC = Total fixed costs; and

$i = 1, 2, 3, \dots, n$ (number of items).

The benefit cost ratio (BCR) is a relative measure which is used to compare benefit per unit of cost. BCR was estimated as a ratio of gross benefit and

gross costs. The formula of calculating BCR (undiscounted) is shown as below:

$$\text{Benefit cost ratio} = \frac{\text{Gross benefit}}{\text{Gross cost}}$$

Functional analysis

The following Cobb-Douglas type revenue function model was used to determine the income coefficient of the fodder producer.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} e^{u_i} \dots \dots \dots (1)$$

The Cobb-Douglas type revenue function was transformed into following logarithmic form so that it could be estimated by the ordinary least squares (OLS) method. For estimating the income coefficient of fodder producer cum seller, the model was as follows:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + U_i \dots \dots \dots (2)$$

Where,

Y = Total household income (Tk./year)

X_1 = Income from crop production (Tk./year)

X_2 = Income from fisheries (Tk./year)

X_3 = Income from fodder sale (Tk./year)

X_4 = Income from service (Tk./year)

X_5 = Income from business (Tk./year)

X_6 = Income from livestock rearing (Tk./year)

For estimating the income coefficient of fodder producer cum dairy owner, the model was as follows:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + U_i \dots \dots \dots (3)$$

Where,

Y = Total household income (Tk./year)

X_1 = Income from crop production (Tk./year)

X_2 = Income from fisheries (Tk./year)

X_3 = Income from service (Tk./year)

X_4 = Income from business (Tk./year)

X_5 = Income from livestock rearing (Tk./year)

a = Constant/intercept;

b_1, b_2, \dots, b_6 = Coefficients of the respective variables; and

U_i = Error term.

Table 1. Distribution of sample farmers in the study areas

Category	Study Areas						Sample size
	Rangpur	Dinajpur	Kurigram	Jessore	Pabna	Sirajgonj	
Producer cum seller	20	20	20	20	-	-	80
Producer cum dairyowner	20	20	20	20	30	30	140
Total	40	40	40	40	30	30	220

In addition, livelihood framework analysis and SWOT analysis were also performed taking 60 fodder producer cum dairy owners, 30 from Sathia under Pabna district and 30 from Shahjadpur under Sirajgonj district.

Livelihood Framework Analysis

Livelihood includes the capabilities, assets (both material and social) and activities needed for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets and provide sustainable livelihood opportunities for the next generation and which contributes net benefits to other livelihoods at the global and local levels in the long and short term (Chambers and Conway, 1992). Recently, with the increased use of livelihood approaches in development, considerable attention has been given to develop methods for monitoring changes in all aspects of peoples' life which considered not only financial improvement but also socioeconomic impact on livelihoods and social well-being of the target group of people (CARE, 2002). The purpose of the study is to determine the impacts of fodder cultivation along with dairy farming on farmers' income and livelihood pattern.

The livelihood framework identifies five core assets categories or types of capital upon which livelihoods are built. Increasing access which can take the form of ownership or the right to use to these assets is a primary concern for Department for International Development (DFID) in its support of livelihoods and poverty elimination. The sustainable livelihood framework includes the assets pentagon which is composed of five types of capital viz: human capital, social capital, natural capital, physical capital and financial capital (DFID, 2000). A sustainable livelihood is the outcome of inter and intra relationship between the components of the capitals. Changes in the asset position during one year are

discussed as the transformation and improvement of the livelihood of the farmers.

Results and Discussion

Cost of Fodder Production

Costs are the expenses for organizing and carrying out the production process. The cost of production included different variable cost such as land preparation, human labour, fodder cuttings, manure, fertilizer, irrigation etc. Both cash expenditure and imputed value of family supplied inputs were included. Human labour was the major cost items incurred in both producer and producer cum seller. On an average, producer born per hectare human labour cost was Tk. 25,963 whereas producer cum seller Tk. 24,821. Producer incurred slightly more hired labour cost producer cum seller. Total variable cost was found Tk. 1,08,010/ha and Tk. 1,05,627/ha by producer and producer cum seller, respectively. Total cost was found Tk. 1,82,415/ha and Tk. 1,79,748/ha by producer and producer cum seller, respectively. On average, total cost was estimated Tk. 1,81,081/ha/year (Table 2).

Profitability of Fodder Production

Bio-mass yield was found 207.83 t/ha and 206.73 t/ha for producer and producer cum seller, respectively. On average, bio-mass yield was found 207 t/ha/year. The average gross return from fodder production was found Tk. 3,50,238/ha and Tk. 3,61,238/ha for producer and producer cum seller, respectively. Gross margin was found Tk. 2,42,228/ha and Tk. 2,55,610/ha for producer and producer cum seller, respectively. It is also revealed that net return for producer Tk. 1,67,823/ha and Tk. 1,81,489/ha for producer cum seller. The benefit cost ratio was estimated at 1.92 for producer and 2.01 for producer cum seller on full cost basis (Table 3). It indicates that fodder production, dairy cattle rearing and selling of fodder provides more profit.

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Table 2. Cost of Fodder Production

(Taka per hectare)				
Cost Items	Producer	P cum S	Average	Percentage (%)
A. Variable Cost	108010	105627	106818	59
L. preparation	7455	7456	7455	4
Hired labour	25963	24821	25392	14
Fodder cuttings	16379	15807	16093	9
Cutting planting	12237	12370	12303	7
Manure	2317	2774	2545	1
Urea	11956	11762	11859	7
Fertilizer				
TSP	3469	3134	3301	2
MP	2460	2637	2548	1
Irrigation	14198	13547	13872	8
Interest on OC*	11572	11316	11444	6
B. Fixed Cost	74404	74121	74262	41
Family labour	15228	14244	14736	8
Land use	59176	59877	59526	33
Total Cost (A+B)	182415	179748	181081	100

Note: Author's calculation based on field survey, 2014. (OC stands for operating capital).

Table 3. Profitability of fodder production

(Taka per hectare)

Items	Producer	P cum S	Average
Biomass yield (t/ha)	207.83	206.73	207
Price (Tk./ton)	1683	1745	1714
A. Variable cost	108010	105627	106819
B. Fixed cost	74404	74121	74262
C. Gross cost (A+B)	182415	137423	159919
D. Gross return (Tk.)	350238	361238	355738
E. Gross margin (D-A)	242228	255610	248919
F. Net return (D-C)	167823	181489	174656
BCR			
Variable cost basis	3.25	3.41	3
Full cost basis	1.92	2.01	2

Note: Author's calculation based on field survey, 2014.

Contribution of Different Sources to Household's Gross Income

The household gross income of fodder farmers is likely to be influenced by different sources of income. It was evident that the income from fodder sale significantly contributed to the gross household income of fodder farmers in the study areas. Therefore, an attempt was made to estimate the coefficients of various sources of income to gross income of the fodder farmers.

Table 4 showed that the gross income of fodder producer cum seller consisted of various sources of income in the study areas. Among these sources, fishery, fodder sale, business, and livestock rearing significantly contributed to the gross income of the fodder producers' household. The coefficient of fodder sale income was 0.472 which was significant at 1% level of confidence with positive sign. This implies that keeping other things constant, 1% increase in income from fodder sale would lead to an increase in the annual household income by 0.472%. Similarly, 1% increase in income from business would lead to an increase in the annual household income by 0.39%. The value of R² is 0.93 meaning that the explanatory variables included in the model explained 93% of the variation in the total household income of the fodder producer cum seller. Again, the value of 'F' is highly significant at 1% level implying that all the included

explanatory variables are important for explaining the variations in the gross household income of the fodder producer cum seller.

More or less similar sources of income were found for fodder producer cum dairy owner. Respondent dairy farmers used their entire fodder for dairy production. That's why income from fodder sale was completely absent from the gross household income of the fodder producer cum dairy owners. Table 5 revealed that income from fishery, service, business, and livestock rearing significantly contributed to the gross household income of the fodder producer cum dairy owner. The coefficient of fishery income was 0.441 which was significant at 1% level of confidence with positive sign. This implies that keeping other things constant, 1% increase in income from fishery would lead to an increase in the annual household income by 0.441%. Similarly, 1% increase in income from business would lead to an increase in the annual household income by 0.284%. The value of R² is 0.97 meaning that the explanatory variables included in the model explained 97% of the variation in the total household income of the fodder producer cum dairy owner. Again, the value of 'F' is highly significant at 1% level implying that all the included explanatory variables are important for explaining the variations in the gross household income of the fodder producer cum dairy owner.

Table 4. Coefficients of different sources of income for fodder producer cum seller

Explanatory variables	Coefficients	Std. Error	Probability	Sig. Level
Constant	9.774***	0.699	15.778	0.000
Income from crop production (X ₁)	0.040	0.017	0.405	0.687
Income from fishery (X ₂)	0.225**	0.016	2.325	0.023
Income from fodder sale (X ₃)	0.472***	0.045	4.795	0.000
Income from service (X ₄)	0.093	0.020	0.963	0.339
Income from business (X ₅)	0.390***	0.015	3.958	0.000
Income from livestock rearing (X ₆)	0.211**	0.020	2.200	0.031
R ²	0.930	0.043	-	-
F value	7.404***	-	-	0.000

Note: *** and ** represent significant at 1% and 5% level of significant respectively.

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Table 5. Estimation of income coefficient for fodder producer cum dairy owner

Explanatory variables	Coefficients	Std. Error	Probability	Sig. Level
Constant	10.899***	0.522	20.881	0.000
Income from crop production (X ₁)	0.074	0.037	0.863	0.391
Income from fishery (X ₂)	0.441***	0.018	4.923	0.000
Income from service (X ₃)	0.187**	0.022	2.329	0.023
Income from business (X ₄)	0.284***	0.015	3.363	0.001
Income from livestock rearing (X ₅)	0.312***	0.027	3.814	0.000
R ²	0.970	0.012	-	
F value	18.662***	-	-	0.000

Note: *** and ** represent significant at 1% and 5% level of significant respectively.

Table 6. Annual income of fodder producer cum dairy owners from milk sale

(In '000 Taka)

Milch cow (No.)	All average	
	Cross	Local
1-2	120.22	33.65
3-4	191.72	51.60
5-6	417.28	113.55

Note: Author's calculation based on field survey, 2014.

Table 7. Livelihood status of respondent dairy farmers along with fodder

(% of farm household reported)

Asset category	Sathia	Shahjadpur
	(Increased)	(Increased)
Human capital	75	76
Social capital	62	68
Natural capital	6	7.33
Financial capital	25.33	33
Physical capital	70.4	75

Source: Authors' estimation, 2014.

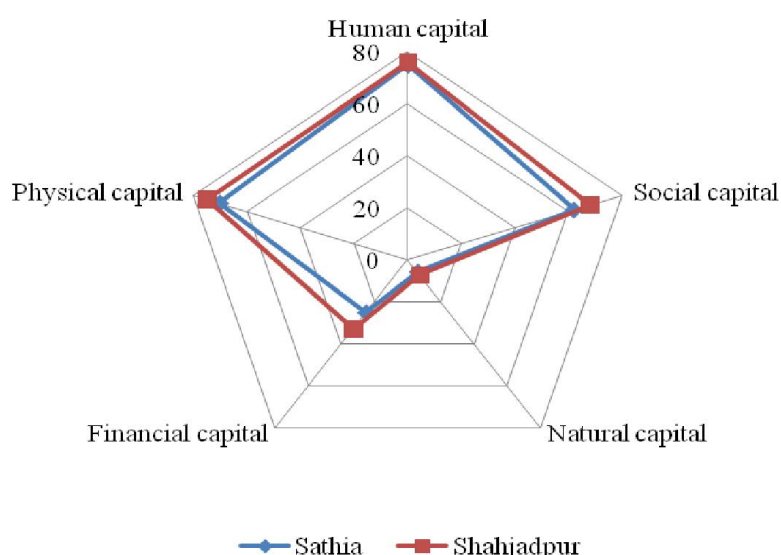


Fig 1. Livelihood Status of Dairy cum Fodder farmers

Fodder producer cum dairy owners annual income from milk sale: It was observed that on an average the dairy owner having 1-2 cross-bred milch cow earned Tk. 1,20,227 whereas from local cattle Tk. 33,658. It was also observed that dairy owner having 3-4 cross-bred dairy cattle earned Tk. 1,91,728 whereas from local cattle Tk. 51,601. In the same way, dairy owner having 4-5 cross-bred dairy cattle earned Tk. 4,17,287 whereas from local cattle Tk. 1,13,558 (Table 6).

Livelihood Framework Analysis: The asset pentagon approach showed noteworthy improvement on different capitals (human capital, social capital, natural capital, physical capital and financial capital) of farm households in Sathia and Shahjadpur (Table 7).

Dairy farming with fodder cultivation and farmers' responses

Farmers' responses on dairy farming with fodder production are shown in table 8. Cent per cent farmers of the study areas opined that cattle rearing increasing dramatically due to fodder production. As green grasses are more conducive to milk production, it has a great demand to the dairy cattle farmers. Almost all the farmers give positive consent in case of more milk production, increasing family income, more milk consumption by the family members and development cost increased (such as education, health, sanitation, housing, clothing and nutrition etc.) due to gain more family income in household.

Table 8. Farmers' responses on fodder cultivation and dairying

Sl. No.	Particulars	Percentage
1.	Cattle rearing increasing	100 %
2.	Milk yield increasing	100 %
3.	Family income increasing	100 %
4.	Milk consumption increasing by family members	100 %
5.	Development cost increasing	100 %

Source: Field survey, 2014.

SWOT Analysis on Dairy Farming along with Fodder Production

Table 9 shows the strengths, weaknesses, opportunities and threats of dairy farming along with fodder cultivation. Majority of the farmers (93%) opined that dairy farming is a hidden source of income and employment. Almost 75% sample farmer reported that lack of good quality fodder is a major weakness of this sector. Importation of adulterated powder milk, various virus and bacterial diseases pushed in through border and dependency are the major threats towards developing and reviving the dairy farming in the country. Despite of all these threats and constraints, the dairy farming along with fodder production has an ample scope for its improvement.

Conclusion

Fodder production along with dairy cattle rearing is a highly profitable enterprise now a day. It created an employment opportunity for the rural youth and empowered women financially too. Farmers are turning towards fodder production from cereal crops as fodder brought high profit to their household income. Cross-bred cattle rearing, milk and meat production increased in dramatically due to fodder production in the areas. Farmers are using more land under fodder production. Farmers are being observed cultivated Napier fodder more compare with other fodders. Quality fodder is a challenge. For increasing the production and minimizing the gap of fodder, recommendations are as follows:

- ❖ Quality fodder species are not available. Government along with other non-government institutions should come forward and take necessary initiatives to boost the HYV fodder production system.
- ❖ Training on scientific fodder cultivation and preservation practices should be available to the farmers.

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Table 9: SWOT analysis on dairy farming along with fodder cultivation

Strengths		Weaknesses	
i)	A large number of energetic and enthusiastic rural youth are interested in dairy farming	i)	Low genetic potentiality of native cattle breed
ii)	Demand for milk and meat is very high to meet animal protein	ii)	Milk marketing system and its price is unstable and volatile
iii)	Women can rear dairy cattle easily and empower gaining financial solvency	iii)	Lack of good quality fodder
iv)	Demand for HYV and quality fodder is also very high due to decrease of pasture land for grazing	iv)	Lack of knowledge for scientific preservation of fodder
v)	BLRI has developed several varieties of HYV fodder and scientific management packages	v)	Unaware about scientific management packages
Opportunities		Threats	
i)	Number of dairy farming increased along with cattle population	i)	Importation of adulterated powder milk that caused ill health and child mortality
ii)	Gap between demand and supply of milk and meat could be minimized	ii)	Various virus and bacterial diseases pushed in and outbreak through importation of Indian disease infected cattle
iii)	It might be a potential source of export of milk, meat, leather and bone instead of import	iii)	Dependency on import. Dependency destroy potentiality
iv)	Potential source of employment creation and income generation		

Source: Field survey, 2014.

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