Socioeconomic Impact of Changing Land Use Pattern on Food Security for Farm Households in Bangladesh

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Abstract

Farmers have changed their land use patterns and introduced new enterprises along with rice or without rice in different areas of Bangladesh to ensure food security for farm households. The present study was designed to determine the impact of changed land use patterns to increase the productivity of the farming system so that greater food security could be ensured for targeted farm households in Bangladesh. Fourteen land use patterns which are largely practiced by the farmers were selected for the present study. In total, 730 farm households were selected from 50 villages of 18 Upazilas under 8 districts namely Mymensingh, Tangail, Dinajpur, Rangpur, Pabna, Jessore, Khulna and Sathkira. Four categories of farmers such as marginal, small, medium and large farmers who are largely involved in present land use patterns were selected for the present study. Both men and women participants were selected and in total 28 FGD sessions were conducted to collect required data and information from 315 participants. Data were collected for the period 2007-2008. 'Before' and 'after' comparison were made to determine the changes of household assets and access to health services and sanitation. There are multiple socioeconomic factors such as household income and expenditure, housing structure and facilities, and owning household assets, access to drinking water and sanitation, and increasing services of health and hygiene. All these factors might have effect on sustainability of food security of farm households. Ninety three percent of sample farm households reported that quality and choice of food items increased under changing land use patterns. Under this circumstance, it implied that farm income, crop yield, supply of food, choice of food items, nutritional status, educational status, and employment opportunity of farm households and finally the food security increased under changing land use patterns.

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1. Introduction

Bangladesh is one of the most densely populated countries in the world, and as a result, per capita arable land is very low. It is known that, of the 17 million households in Bangladesh, about 80% are small farmers and some of these farmers are landless (BBS 2007). Due to its subsistence nature, agriculture in Bangladesh is characterized by diversified farming to meet the households, requirements and to minimize the risk and uncertainty. Dillon and Hardarker (1993) stated that small farmers have two characteristics, their small size of land in terms of resources and their low level of income.

Land is a major resource used by agriculture to provide products that service human needs and wants, including nutritious food such as meats, milk, eggs, grains, vegetables and fruits; fibres for clothing and furnishings; and industrial products like oils, leather, starches and building materials. Land use and land cover change is perhaps the most prominent form of global environment change since it occurs at special and temporal scales immediately relevant to our daily existence. The changes in land use patterns, especially when coupled with climate change and variability, are likely to affect natural resources and ecosystems in complex ways.

The actions and practices undertaken in using the resources to produce these goods have impacts on the condition of land, vegetation and water resources. Consequently, where land use and its practices are contributing to declining land condition, then the most obvious solution is to change land use patterns as well as land reform and practices to more appropriate ones. To do this effectively it is necessary to understand what and where land uses are now, and if and where trends and directions in land use are changing. Then it may be possible to describe desired scenarios for the future. Moreover, it is expected that land reform and changing land use patterns are a complex phenomenon that will differ greatly from place to place.

Ensuring food security for all is one of the major challenges in Bangladesh today. Despite the impressive achievements in food grains production during the last decades, food security at farm households and individual levels remains a major concern for the Government. However, the production and availability of other crops and non-crop foods to present a balanced diet and creating an environment for better utilization of land resources by changing land use patterns, are a great challenge for farm households in Bangladesh.

Most of the farmers of Bangladesh have currently changed the cropping pattern and introduced new technologies and better management to ensure food security

for farm households. Farmers have also changed their land use patterns and introduced new enterprises along with rice or without rice in different areas of Bangladesh.

With the intensive and integrated farming, total food grain production has been showing an increasing trend over the last two decades (28.81 million metric ton in 2005-06). It produces major agricultural crops, such as rice, wheat, maize, jute, vegetables and potato, pulses, oilseed, sugarcane, etc. Since total population is increasing day by day, the total agricultural production is not sufficient to meet domestic consumption. That is why the government is importing large amount of food grain (2.0-3.0 million tons) almost every year along with some manufactured goods (BER, 2007). Therefore, food security is important for the farm households and they should increase their farm production to improve their livelihood.

Aiming to enscure food security cropping pattern as well as farming system has been changed by the farmers with the introduction of new technologies and better management. Under this farming situation, farmers also changed their land use patterns and introduced new enterprises combination along with rice production.

Most of the farmers have similar objectives. These include the development of more farm enterprises, the generation of more agricultural products and income throughout the year, and the reduction of risk. Small farmers try to develop as many enterprises their farming system (FS) allows within the present socioeconomic and agroclimatic condition, and in accordance with household goals, preference and resources (Islam and Bakshi 1992). In this regard, more national and international research organizations are directing their attention to introduce scientific culture and management through integrated farming for the small farm development.

National Land Use Policy and Rules as introduced in 2001 stressed the importance of best possible use and optimum utilization of land and water resources to ensure food security and higher nutritional standards and realization of export potentialities of agro-processing industries and farming sector. The policy assigned high priority to maintaining food self sufficiency for the ever-growing population of the country and recognized the importance of the need for utilizing *khas* land for poor, marginal and landless farmers, protecting the interests of share croppers, preservation of land for future use, and classification of land for agricultural and non-agricultural purposes (Choudhury 2008). Considering these circumstances, a major aim of the present study is to adopt changed land use patterns to increase the productivity of the farming system so that greater food security could be ensured for targeted farm households in Bangladesh. Very

recently, Bangladesh Government has shown keen interest to introduce agriculture reform and land use policy and has taken steps to ensure better use of cropped land. The present study might help GoB and policy makers by providing information to introduce land use policy for greater food security for farm households.

2. Methodology and Sources of Data

Selection of Land Use Patterns and Data Collection

Land use patterns as well as cropping patterns are changing in Bangladesh because of changing technology and meeting up the demand of farm households and to have better economic returns from respective farm enterprises and greater food security for farm households. Moreover, following the agricultural development, most of the farmers in Bangladesh have introduced new enterprises and changed their enterprise combination and crop rotation for the last 2-3 decades. Many land use patterns are observed in different areas of Bangladesh but depending on climate and topography, local environment and agroecosystem, some particular land use patterns are followed by the farmers in different areas of Bangladesh.

Considering all these aspects, 14 land use patterns which are largely practiced by the farmers were selected for the present study (Table 1). Most of the selected land use patterns are rice based and the farmers usually produce different crops along with rice and to some extent, without rice.

Major land use patterns followed by the farmers in rural areas of Bangladesh are shown in Table 1. At present, along with rice other non-cereals and commercial crops are coming up to compete with the common and typical crops grown. However, considering the trend of changing land use patterns and farmers involvement, in total 730 farm households were selected from 50 villages of 18 Upazillas under 8 districts. Again, following the distribution of farm households in Bangladesh (BBS 2008), four categories of farmers namely marginal, small, medium and large farmers who are largely involved in present use patterns were selected for the present study.

Some farmers in Mymensingh, Gazipur, Sirajgonj, and Tangail have converted their land to practice rice-fish farming, alternate rice-vegetables and alternate rice-pulse *(khasari)* production. In Rangpur and Dinajpur, many farmers use their crop land for producing alternate rice- potato, rice- wheat and rice- maize. Similarly, farmers in Jessore districts produce year round golda shrimp and also practice

alternate golda- rice farming. On the other hand, in coastal areas mainly in Khulna regions, large areas of cropped land shifted to brackish water aquaculture. In fact, the present study covered the major land use patterns in Bangladesh.

In the study areas, agricultural crop land has been shifted and being used to produce different farm enterprises along with rice and to some extent without rice. The present study among others has the main objective to determine the socioeconomic factors influencing sustainability of food security for farm households in Bangladesh. Accordingly, a field level socioeconomic survey was conducted to address the objectives of the study. For this study data and information were collected from sample farm households who belonged to the selected land use patterns. Data were collected for the period 2007-2008. Again the farmers were asked to provide information about food production and food security before changing the land use patterns. However, to assess the impact of changing land use patterns on changing household assets, access to the services of health and sanitation 'before' and 'after' comparison were made.

Table 1 : Study design and sample distribution of farm households under selected land use patterns

Land use patterns selected	Categories of sample farm households				
	Marginal farmer	Small farmer	Medium farmer	Large farmer	All farmer
Year round rice production	21	31	26	4	82
Alternate rice and vegetables production	10	18	18	4	50
Alternate rice and mustard production	11	26	13	0	50
Year round banana production	2	13	20	13	48
Year round pangus fish farming	11	22	22	5	60
Alternate rice and wheat production	8	23	26	3	60
Alternate rice and maize production	7	23	27	3	60
Alternate rice and potato production	12	26	25	2	65
Alternate rice and pulse production	10	15	21	4	50
Year round floriculture	15	16	14	5	50
Alternate rice and prawn (golda) farming	0	8	21	11	40
Year round vegetables production	22	21	7	0	50
Alternate shrimp (bagda) and rice farming	2	7	14	12	35
Total	131(18)	252(35)	266(36)	81(11)	730(10

1. '0' means respective categories of farmers were not found.

Agricultural Reform and Tenurial Arrangement

Land tenure security and insecurity are very important to impose the land use policy. Land tenure security is essential if producers are to invest and enjoy the fruits of their work on land development, culture and management (FAO 2006). Land is the most important asset for farm households because farm families depend mainly on land. Secondly, changes in land use patterns depend on land reform and ownership of land and tenurial arrangement. Land holdings and tenurial arrangement of farm households are shown in Table 2. It may be noted that shrimp farmers increased their shrimp farm through leasing arrangement. Other than shrimp farm, the average farm size was 1.18 ha and considering all farms it was 2.07 ha. It may be noted here that average shrimp farm was 3.55 times higher than all farmers (2.07 ha) average and more than 6 times higher other than shrimp farms (1.18ha). In the study areas, almost all categories of farmers increased their crop land through tenurial arrangement.

Table 2 : Land holdings and tenurial arrangement of farm households

Categories	Own land	Rented in	Rented out	Pond size	Farm size
		Other than shrimp farms			
Marginal farmers	0.221	0.184	0.012	0.020	0.413
Small farmers	0.623	0.160	0.030	0.033	0.786
Medium farmers	1.487	0.219	0.095	0.102	1.714
Large farmers	3.794	0.544	0.616	0.208	3.930
All farmers	0.994	0.210	0.084	0.063	1.183
		Shrimp farms			
Marginal farmers	0.658	0.000	0.000	0.309	0.968
Small farmers	0.489	0.000	0.024	0.542	1.006
Medium farmers	1.144	0.015	0.000	1.482	2.640
Large farmers	8.800	2.099	0.000	12.078	22.977
All farmers	2.915	0.546	0.006	3.900	7.354
		All farms			
Marginal farmers	0.234	0.179	0.012	0.029	0.429
Small farmers	0.608	0.143	0.029	0.090	0.811
Medium farmers	1.423	0.181	0.077	0.361	1.887
Large farmers	5.782	1.162	0.371	4.921	11.493
All farmers	1.270	0.259	0.073	0.615	2.071

It was observed that marginal and small farmers rented in more land compared to medium and large farmers. This might indicate that marginal and small farmers have surplus manpower for crop production. On the other hand, some of the farmers rented out land, but the average size of rented land other than shrimp farms (20.7 decimal) was higher than the shrimp farmers (1.6 decimal). However, farmers practse tenurial arrangement with the intention that, lands are rented in or rented out for crop production, but the lands (pond) are leased in for fish and/ or shrimp production with some terms and conditions. Farmers reported that lease value of land was very high to produce shrimp or any other commercial farming.

3. Socioeconmic Factors Influencing Sustainability of Food Securtty

There are multiple socioeconomic factors influencing sustainability of food security in developing countries. Some of the most commonly used factors in the assessment of food security include those related to households income and expenditure, expenditure spen on food, households structure and facilities, owning households assets, transport and communication facilities, and access to drinking water and sanitation and services of health and hygiene, and other basic need of farm households. All these socioeconomic factors are discussed here in relation to data and information collected for the present study.

Table 3 : Average annual income (Tk) of farm households, 2007-08

Land use patterns	Farm households				
	Marginal	Small	Medium	Large	All farms
Year round rice production	119796	119657	193554	356556	154679
Alternate rice and vegetables production	88640	104655	234326	319823	165347
Alternate rice and mustard production	67990	119633	236419		138636
Year round banana production	189649	189521	273442	441940	292857
Year round pangus fish farming	64182	58659	82582	204423	80590
Alternate rice and wheat production	113046	117970	216337	707749	189428
Alternate rice and maize production	81935	148434	278555	748574	229237
Alternate rice and potato production	109817	195916	346961	380725	243802
Alternate rice and pulse production	95682	157416	262574	683556	231327
Year round floriculture	96890	184232	379947	561326	250539
Alternate rice and prawn (golda) farming		90858	183270	412742	227892
Year round vegetables production	97905	108210	167087		111919
Alternate shrimp (bagda) and rice farming	113130	108521	232250	600463	326942
Year round shrimp (bagda) farming	-	138957	183193	609171	391759
All average	97873	131602	235829	506511	205127

Household Income and Expenditure

Household income is all income, received by all members of a household and household expenditure includes household purchasing and payments, and also estimated values of goods and services received.

Level of household income

Household income is the main factor influencing sustainability of food security for farm households. Sustainable household income ensures the sustainable food security for farm households. Annual household income according to land use patterns and farm categories is presented in Table 3. It is revealed from the table that annual income per household was the lowest (Tk 58659) for small farmers beloing to year round pangus fish farm and the highest (Tk 748574) for large farmers of alternate rice and maize production. Irrespective of land use patterns, the annual household incomes of marginal, small, medium and large farm households were Tk 97873, 131602, 235829 and 506511 respectively. Regardless of land use patterns and farm categories, annual income per household was Tk 205127 which is higher than national average of Tk 86436 (HIES, 2007). This implies that the annual income per household of sampled farmers was higher and increased significantly compared to before changing land use patterns.

Sources of household income of farm households are shown in Table 4. As there was a large variation in household income of shrimp farming and other land use patterns, sources of income are shown according to shrimp and non-shrimp farm households. Sources of household income included agriculture, livestock, services, business, remittance, dowry/gift and labour selling. Shrimp farm households earned 86.4 percent of total household income from agriculture i.e., shrimp farming. On the other hand, non-shrimp farm households earned 75.1 percent of total household income from agriculture. Shrimp and non-shrimp households earned 11.1 and 12.0 percent of total household income respectively from business. Shrimp farm households earned only 2.5 percent of total household income from other than agriculture and business sources while it was 12.9 percent for non-shrimp farm households. Irrespective of shrimp and non-shrimp farm households, the sampled farm households earned 77.4 percent of total income from agriculture. As all the sampled farm households were landed farmers, the lion share of household income was earned form agriculture and it sustained the food security for the farm households.

Table 4 : Sources of income of farm households

Sources	Percentage distribution of household income Farm households				
	Marginal	Small	Medium	Large	All
Non-shrimp farms					
Agriculture	55.7	73	79.7	78	75.1
Services	11.9	5.5	7.4	4.9	6.9
Business	24.1	14.8	7.9	11.2	12
Remittance	2.9	3.2	3.8	5.4	3.8
Dowry/gift	1.2	1.9	0.7	0.5	1.1
Labor selling	4.3	1.6	0.4	0	1.1
Total (Tk)	97636	133591	243982	468468	187891
Shrimp farms					
Agriculture	60.2	73.5	86.1	87.9	86.4
Services	0	3.5	1.9	2.5	2.4
Business	26.5	23	11.9	9.5	11.1
Remittance	-	-	-	-	-
Dowry/gift	-	-	-	-	-
Labor selling	13.3	-	0.1	-	0.1
Total (Tk)	113130	105743	197840	549560	307728
All farms					
Agriculture	55.8	73.1	80.6	83.1	77.4
Services	11.7	5.3	6.6	3.7	6
Business	24.1	15.3	8.5	10.3	11.8
Remittance	2.8	3	3.3	2.7	3
Dowry/gift	1.2	1.8	0.6	0.2	0.8
Labor selling	4.4	1.5	0.4	0	0.9
Total	97873	131602	235829	506511	205127

Table 5 : Heads of household expenditure of farm households

Heads of expenditure	Percentage distribution of household expenditure Farm households				
	Marginal	Small	Medium	Large	All farms
Food	47	37	29	19	31
Clothing	6	5	4	4	5
Medicare	3	3	2	1	2
Education	4	5	5	4	5
Housing	7	7	10	10	9
Farming	29	41	47	60	47
Others*	3	3	2	1	2
Total (Tk)	92709	130784	195227	377104	174765

*Soap, cosmetics, etc.

Household expenditure and savings

Household expenditure on different heads such as food, clothing, health, education, housing and farming are presented in Table 5. It is evident from the

Table 6 : Annual income, expenditure and savings (Tk) of far

Households saving	Farm households				
	Marginal	Small	Medium	Large	All farms
Households Income	97873	131602	235829	506511	205127
Households Expenditure	92709	130784	195227	377104	174765
Households Savings/Dis-saving	5164	818	40602	129408	30363

table that expenditure on food for marginal, small, medium and large farm households were 47, 37, 29 and 19 percent respectively. In other words, 29, 41, 47 and 60 percent of household expenditure spent on farming by marginal, small, medium and large farm households respectively. It may be noted that irrespective of farm categories, expenditure was the highest (47 percent) for farming followed by 31 and 9 percent for food and housing. The result implies that most of the farmers spent relatively lower amount on food items which indicates the better food security for the farm households.

Table 7 : Changes in housing facilities of farm households

Housing types	Percentage distribution of farm households				
	Marginal	Small	Medium	Large	All
	At present 2007-2008				
Building	8	21	26	56	24
Tin shed	66	53	49	54	54
Straw roof houses	29	31	28	32	30
	Before				
Building	5	5	12	12	8
Tin shed	47	52	55	42	51
Straw roof houses	24	30	28	15	27

Table 6 shows annual income, expenditure and savings of sampled farm households, 2007-2008 It is revealed from the table that all the sampled farm household categories had savings ranged from Tk 818 to Tk 129408. This implies that the sampled farm households were food secured.

Changing Basic Needs of Farm Household

Housing structure and facilities

It is evident from Table 7 that housing facilities increased significantly compared to before changing land use patterns. At present, about 8, 21, 26 and 56 percent of marginal, small, medium and large farm household have building while the corresponding percentages were 5, 5, 12 and 12 respectively for the farm households before changing land use patterns.

Table 8 : Changes in tangible assets of farm households

Tangible assets	Percentage distribution of farm households				
	Marginal	Small	Medium	Large	All
		At present 2007-2008			
Refrigerator	-	2	5	7	3
Watch	55	64	68	83	66
Chair/table	77	73	79	90	78
Cot	81	75	79	90	79
Electric fan	33	40	50	58	44
		Before			
Refrigerator	-	1	3	1	2
Watch	29	33	40	30	35
Chair/table	53	59	58	49	56
Cot	56	63	58	48	58
Electric fan	11	13	21	16	16

It is remarkable that the percentage of building house increased about 3 times than before whereas percentage changes are almost the same in before and after situation in case of tin shed and straw roofed house. So after changing land use patterns the housing facilities of farm households are also being improved.

Table 9 : Household water and sanitation facilities of farm households

Water and sanitation facilities	Percentage distribution farm households				
	Marginal	Small	Medium	Large	All
		At present 2007-2008			
HTW	50	54	56	77	57
Pucca toilet	24	34	48	75	42
Kutcha toilet	44	37	21	16	30
		Before			
HTW	24	31	32	26	30
Pucca toilet	13	14	18	14	15
Kutcha toilet	16	17	15	10	15

Household assets

Other tangible assets of farm Households also increased significantly. Table 8 reveals that considering all farm categories 3, 66, 78, 79 and 44 percent of farm households had refrigerator, watch, chair/table, cot and electric fan whilst before changing land use patterns the corresponding percentages were 2, 35, 56, 58 and 16, respectively, for farm households.

Table 10 : Changes in communication facilities of farm households

Communication facilities	Percentage distribution of farm households				
	Marginal	Small	Medium	Large	All
		At present 2007-2008			
Radio/TV	37	37	58	75	49
Bicycle/motor cycle	41	51	55	63	52
Mobile phone	33	41	61	85	52
		Before			
Radio/TV	11	15	17	17	15
Bicycle/motor cycle	18	17	23	16	19
Mobile phone	2	10	7	7	7

Access to drinking water and sanitation

Changes in household water and sanitation facilities are presented in Table 9. It can be seen from the table that considering all categories of farms, 57, 42 and 30 percent of farm households had owned hand tube well (HTW), *pucca* toilet and *kutcha* toilet while the corresponding percentages were 30, 15 and 15 before changing land use patterns. It may be noted that earlier some of the farm households did not have toilet facilities and now about 30 percent households are used to use *kutcha* toilet. It is interesting to note that under changing land use patterns, household water and sanitation facilities of sample farm households had significant improvement for all categories of farmers.

Access to necessary services and communication facilities

There had been a noteworthy improvement in communication facilities of farm households in the study areas. The results are presented in the Table 10. Regardless of farm categories, 49 and 52 percent of farm households had radio/TV and bicycle/motor cycle whereas the percentages were 15 and 19 before changing land use patterns. It can be noted that about 33, 41, 61 and 85 percent of

Table 11 : Statement of sampled farm households on socioeconomic impact of changing land use patterns

Indicators	Percentage of farm households reported Changes		
	Increased	Decreased	Remain same
Farm income	93	4	3
Quality/choice of taking different food items	93	2	5
Home supplied vegetables and fruits	43	30	27
Nutritional status	94	2	4
Supply of food grain	68	12	20
Food security	95	2	3
Educational status	88	1	11
Employment opportunity for family members	61	4	35
Knowledge about economic land use pattern	68	4	28
Land for rice production	19	35	46
Grazing land and livestock production	12	83	5
Share cropping	21	65	14
Yield	72	9	19
Input used	85	5	10
Irrigation area	94	2	4
Cash crop production	63	7	30
Marketing facilities	85	2	13
Transportation and communication	91	3	6

marginal, small, medium and large farm households were using mobile phone while the percentages were 2, 10, 7 and 7 respectively for the farm households before changing land use patterns.

In summary, it may be concluded that increased household income ensured better food security of farm households and accordingly, access to household and physical assets increased.

Changing Socioeconomic Condition

In the study areas, sampled farm households were asked to identify the socioeconomic impact of changing land use patterns on their food security. The respanes are presented in Table 11.

Table 12 : Changing indicators of health and hygiene

Indicators of health and hygiene	Percentage of farm households reported		
	Decrease	Increase	Same
Visiting doctors for male adult	16.1	51.1	32.8
Visiting doctors for female adult	17.9	49.5	32.6
Visiting doctors for children	21.2	39.8	39.1
Seasonal incidence of disease for male adult	30.7	37.2	32.1
Seasonal incidence of disease for female adult	31.4	43.1	25.5
Seasonal incidence of disease for children	31.5	48.4	20.1
Ability to pay for doctors and medicine	6.5	90.5	2.9
Access to safe drinking water	2.2	96.4	1.5
Access to sanitation	1.1	98.2	0.7
Ability to bear cost for family members' education	0.7	97.5	1.8

About 95 percent of sampled farm households informed that their food security increased with the introduction of scientific culture and management under changing land use patterns. Ninety four percent of farm households stated that their nutritional status and irrigated area increased. Ninety three percent of sampled farm households reported that their farm income and quality/choice of taking different food items increased under changing land use patterns. Farmers responses thns indicati that farm income, crop yield, supply of food, choice of taking different food items, nutritional status, educational status, and employment opportunity of farm households and finally the food security increased under changing land use patterns.

Changing Condition of Health and Hygiene

Table 12 reveals that 51.1, 49.5 and 39.8 percent of sampled farm households respectively stated that visiting doctors by male adult, female adult and children increased. Most of the sampled farm households (90.5 percent) informed that their ability to pay for doctors and medicine increased after changing land use patterns. About 96.4 and 98.2 percent of farm households reported that access to safe drinking water and sanitation increased. Majority of the sampled farm households (97.5 percent) opined that their ability to bear the cost for family members' education increased. It may be concluded that under food security condition, sampled farm households access to health and education facilities increased.

4. Policy Implications and Recommendations

The study confirmed that the lion's share of household income is still earned from agriculture. It is found that the selected new cropping patterns have contributed a lot to increase household income of the farmers. In fact, they are enjoying better livelihoods than before due to following these new cropping patterns. More farmers should be encouraged to follow these cropping patterns for earning higher farm income and ensuring food security for farm households in Bangladesh. While agricultural production has increased manifold, it is showing signs of diminishing marginal returns. Given the scarcity of cultivable land and a evers growing population, land use and cropping intensity is approaching a maximum. This severely limits the ability of many farmers to earn livelihood from farming. Present study shows that farm size had positive impact on per capita calorie intake whereas family size has negative impact on it. In this regard, changing land use pattern with scientific culture and efficient management is a path way to increase food production to ensure food security of farm households.

Despite some limitations, the study is very important from the viewpoints of farmers and policy makers. Farmers in the study have gradually been changing their land use patterns. In fact, food grain production, food security and its availability as well as farm income per household have increased substantially than the old patterns. This implies that the changing land use patterns have had some positive impacts not only on food production and consumption, but also per capita daily calorie intake and nutritional status have also improved.

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