CHAPTER – VI

PRODUCTIVITY OF FARM CREDIT IN NEPAL

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6.1 Introduction

In this chapter we have examined the relationship between farm credit and productivity on the basis of the data collected by us during the survey. The productivity of farm credit is expressed through marginal productivity of credit derived usually through Cobb-Douglas production function. Marginal productivity of credit is defined as the measure of the increase in total product with addition of one unit of credit above it's mean level, while other resources are held constant at their mean levels.

In the analysis concerning production of individual crops, it is worthwhile to study and assess the contributions and marginal value productivities of each one of the various inputs employed in achieving the total output of individual crops grown by the borrowers. Accordingly, the productivity of credit utilized for different crops is found out keeping in view the following three specific objectives:

1. To examine the functional relationship between inputs of human labour, bullock labour, fertilizer, manures and pesticides, seeds and irrigation, on the one hand, and output of different crops, on the other.
2. To examine the elasticities of outputs with respect to the inputs and the returns to scale.
3. To estimate the marginal value productivities (MVPs) of each input so as to assess the profitability of use of additional credit.

An evaluation of existing production relationships between the gross output and major inputs was made using a log linear Cobb-Douglas production function for paddy and wheat. The log linear form has given a better fit to the data and has therefore, been used. The Cobb-Douglas production function in its general form is expressed as

$$Y = b_0 X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} e^{u} \quad \ldots\ldots\ldots\ldots (1)$$

The function in log linear form can be expressed as

$$\text{Log } Y = \log b_0 + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + U \quad \ldots\ldots\ldots\ldots\ldots (2)$$

Where,

Y = Gross value of output in rupees, per hectare

X_1 = Human labour, (man-days), per hectare

X_2 = Bullock labour, (pair-days), per hectare

X_3 = Value of seeds used, Rs. per hectare

X_4 = value of fertilizer, manures and pesticides used, Rs. per hectare

X_5 = cost of irrigation utilized, Rs. per hectare

U = the error term

Where, b_1, b_2, b_3, b_4, and b_5 are the regression coefficients corresponding to the variables X_1, X_2, X_3, X_4 and X_5 respectively; and b_0 is the constant to be determined.

Assuming that errors are small and normally distributed, such a logarithmic transformation of variables presumes a nearly normal distribution of errors in the data. It also enables the data to approach normality even if the errors are not normally distributed.

The Cobb-Douglas type equation (1) gives for each one of the five inputs a coefficient that represents the percentage increase/decrease in the value of output as a result of one percent increase in the use of corresponding input. Accordingly, the coefficient of a particular input with a certain value indicates percent increment in the output by that value on account of the percent increment in the use of that input. The negative coefficient of a particular input with a certain value indicates percent decrease in the output by that value on account of one percent increment in the use of that input. The equation, however, allows diminishing marginal productivity to each input factor as well as increasing or decreasing returns to scale.

6.2 Regression Results

The Cobb-Douglas production function specified in equation (1) above is estimated for the marginal farmers, small farmers and medium and large farmers separately for paddy and wheat in low developed, moderately developed and developed areas of Morang district respectively using ordinary least squares (OLS) technique

The cost of production of irrigation is not included in the production function of the farmer borrowers in low developed area and developed area. The reason is that in low developed area farmers have adopted single cropping pattern due to the lack of irrigation facilities and in the developed area farmers get water for irrigation all the year round from the rivers. In developed area farmers make only a nominal

expenditure for maintenance of irrigation channels. So the cost of irrigation is found to be insignificant in the total cost of production. Hence, cost of irrigation is not included in the total cost of production in the developed area.

6.2.1 Marginal Farmers

Marginal Paddy Farmers – Low Developed Area

The results obtained for the marginal paddy farmers in the low developed area are presented in the table 6.1 below.

Table 6.1: Production Elasticities of the Respective Factors of Production for Marginal Paddy Farmers in Low Developed Area

Variable	b_i	SD error	t - value	Significance
X_1(Human Labour)	0.0507	0.058	0.867	N.S.
X_2 (Bullock Labour)	0.466	0.164	2.848	* *
X_3 (Seeds)	-0.181	0.092	-1.959	* * *
X_4 (Manures)	0.162	0.058	2.812	* *
	$\sum b_i = 0.498$			

$Y = 3.475X_1^{0.0507}X_2^{0.466}X_3^{-0.181}X_4^{0.162}$, $F = 8.424^{*}$, $R^2 = 0.722$, n =18, N.S. = Not significant

* = Significant at 1 % level of significance, * * = Significant at 5 % level, * * * = Significant at 10 % level of significance

Source: Computed from Survey Data, 2001

Note: - SD = Standard; b_i = regression coefficient

The results of the estimation show that R^2 for marginal paddy farmers in low developed area of Morang district is statistically significant as indicated by the significance of the F-ratio at 1 percent level. The estimated coefficients are the elasticities of production with respect to the factors of production showing in average the percentage change in the value of output resulting from a given percentage change in the given input. Traditional theory of production stipulates that the larger the value of the constant term the more technically efficient the farmers are (Mwakalobo: 2000).

Among the specified variables, all have the expected signs except seeds. The coefficients of human labour, bullock labour and manures are 0.0507, 0.466 and

0.162 respectively implying that bullock labour has the potential to contribute more to output than any other variable among the marginal paddy farmers in the low developed area of Morang district. This means that a one percent increase in bullock labour is associated with a 0.46 percent increase in output of paddy. The coefficient of seeds is negative and significant at 10 percent level implying that a one percent increase in seeds will lead to 0.182 percent decrease of output. Although the coefficient of human labour is positive it is not statistically significant. The coefficient of manures is positive and significant at 5 percent level.

However, the relatively high elasticity of production with respect to bullock labour among the marginal paddy farmers than that of other variables could be due to the fact that marginal paddy farmers are using lower levels of bullock labour and substantial increase in production can still be realized by these farmers.. The sum of the elasticities is positive and less than unity. This implies that the marginal paddy farmers are experiencing decreasing returns to scale. It means that if all the inputs are simultaneously increased by one percent, output will increase by less than one percent.

Marginal Paddy Farmers – Moderately Developed Area

The results obtained for marginal paddy farmers in moderately developed area are presented in the table 6.2 below:

Table 6.2: Production Elasticities of the Respective Factors of Production for Marginal Paddy Farmers in Moderately Developed Area

Variable	b_i	SD error	t - value	Significance
X_1 (Human Labour)	-0.286	0.228	-1.251	N.S.
X_2 (Bullock Labour)	**0.171**	**0.094**	**1.819**	**
X_3 (Seeds)	-0.149	0.157	-0.950	N.S
X_4 (Manures)	0.169	0.094	1.798	**
X_5 (Irrigation)	0.122	0.08	1.386	N.S.
	$\sum b_i = 0.599$			

$Y = 4.077X_1^{-0.286}X_2^{0.171}X_3^{-0.149}X_4^{0.169}X_5^{0.122}$, $F = 8.424^*$, $R^2 = 0.722$, n =18 N.S. = Not significant, * = Significant at 1 % level of significance, * * = Significant at 5 % level, * * * = Significant at 10 % level of significance

Source: Ibid

The results indicate that on the sampled marginal paddy farms in the moderately developed area of Morang district decreasing returns to scale prevailed which is indicated by $\sum b_i$ being less than unity. The results of the estimation show that R^2 for marginal paddy farmers in moderately developed area is statistically significant as indicated by the significance of the F-ratio at 5 percent level. The negative regression coefficients for the variables human labour and seeds indicate that the additional use of these variables keeping other associated inputs at their current levels, would decrease total production. Although these coefficients are negative, they are statistically insignificant, and hence we should not necessarily draw the conclusion that these inputs are overused.

The coefficients of bullock labour, manures and irrigation are positive. Only the coefficients of bullock labour and manure are statistically significant at 10 % percent level. Although the coefficient of irrigation is positive, it is statistically insignificant. From this result we can draw the conclusion that marginal paddy farmers are utilizing the bullock labour and manures at a lower level than required. Due to the lack of finance they are not using the required level of these inputs. So credit institutions while formulating credit policies in this area should pay attention to farmers for providing credit to purchase bullock and manures.

Marginal Paddy Farmers – Developed Area

The results obtained for the marginal paddy farmers in developed area of Morang district are presented in the table 6.3 below:

Table 6.3: Production Elasticities of the Respective Factors of Production for Marginal Paddy Farmers in Developed Area

Variable	b_i	SD error	t - value	Significance
X_1 (Human Labour)	0.278	0.342	0.814	N.S.
X_2 (Bullock Labour)	0.0057	0.441	0.013	N.S.
X_3 (Seeds)	0.273	0.309	1.289	N.S
X_4 (Manures)	**0.194**	**0.539**	**2.278**	* *
	$\sum b_i$=0.751			

$Y = 2.460X_1^{0.278}X_2^{0.0057}X_3^{0.273}X_4^{0.194}$, F= 3.092 * * R^2 = 0.563, n =18 N.S. = Not significant, * * = Significant at 5 % level, * * * = Significant at 10 % level of significance

Source: Ibid

The results indicate that on the sampled marginal paddy farmers in the developed area of Morang district decreasing returns to scale prevailed which is indicated by $\sum b_i$ being less than unity. Human labour and seeds are used liberally and are not contributing much at the margin of production. The coefficients of human labour and seeds are positive but not statistically significant. The coefficient of bullock labour is positive but insignificant.

The coefficient of manure is found to be positive and significant at 5 percent level. The coefficient of manure is 0.194 implying that a one percent increase in manure will increase output by 0.194 percent. This means that sufficient credit should be provided to the marginal farmers in developed area of Morang district to purchase required level of manures so that these farmers can realize optimum level of output.

All Marginal Paddy Farmers – Combined

An attempt was also made to study the production elasticities of all the marginal paddy farmers of Morang district. The results obtained are presented in the table 6.4 below.

Table 6.4: Production Elasticities of the Respective Factors of Production for All Sampled Marginal Paddy Farmers in Morang District

Variable	b_i	SD error	Z - value	Significance
X_1 (Human Labour)	-0.0293	0.073	-0.401	N.S.
X_2 (Bullock Labour)	0.0709	0.083	0.856	N.S.
X_3 (Seeds)	0.103	0.077	1.346	N.S
X_4 (Manures)	**0.224**	**0.043**	**5.239**	*
X_5 (Irrigation)	**0.0456**	**0.008**	**5.797**	*
$Y = 3.404X_1^{-0.0293}X_2^{0.0709}X_3^{0.103}X_4^{0.224}X_5^{0.0456}$; F= 13.995*, R^2 = 0.593 n = 54, N.S. = Not significant, * = Significant at 1 % level				

Source: Ibid

The results of the estimation for all marginal paddy farmers of Morang district combined show that R^2 is statistically significant as indicated by the significance of the F-ratio at 1 percent level. All the coefficients have the positive signs except that of human labour.

The coefficient of human labour is negative and statistically insignificant. The coefficients of bullock labour and seeds are positive but not statistically significant.

The coefficients of manures and irrigation are positive and significant at 1percent level. It implies that manures and irrigation are the important factors of production, which have the potentiality of increasing output of paddy in Morang district. The results show that $\sum b_i$ is less than unity, showing that the marginal paddy farmers in Morang district are experiencing decreasing returns to scale. This implies that marginal farmers are operating on the rational part of the production function.

Marginal Wheat Farmers - Moderately Developed Area

The marginal farmers do not grow wheat in the low developed area due to the lack of irrigation facilities. In the moderately developed area canal and water pump sets are used to irrigate the fields. The cost of irrigation in moderately developed area is found to be more than the cost incurred for irrigation in the developed area. So in the moderately developed area the marginal farmers borrow from outside for the purpose of irrigating when they use pump set for irrigation.. The results obtained for marginal wheat farmers in the moderately developed area are presented in the table 6.5 below.

Table 6.5: Production Elasticities of the Respective Factors of Production for Marginal Wheat Farmers in Moderately Developed Area

Variable	b_i	SD error	t - Value	Significance
X_1 (Human Labour)	-0.244	0.317	0.770	N.S.
X_2 (Tractor)	**1.615**	**0.492**	**3.280**	*
X_3 (Seeds)	0.557	0.634	0.878	N.S
X_4 (Manures)	**0.313**	**0.152**	**2.063**	* *
X_5 (Irrigation)	-0.00536	0.064	-0.084	N.S.
	$\sum b_i$= 2.2.35			
$Y = 4.075X_1^{-0.244}X_2^{1.615}X_3^{0.557}X_4^{0.313}X_5^{-0.00537}$, F= 3.121* *, R^2 = 0.565, n = 18, N.S. = Not significant, * = Significant at 1 % level, * * = Significant at 5 % level56				

Source: Ibid

The results of the estimation show that R^2 for marginal wheat farmers in moderately developed area is statistically significant as indicated by the significance of the F-ratio at 5 percent level. The results show that marginal wheat farmers are experiencing increasing returns to scale, as the sum of the elasticities $\sum b_i$ is greater than unity.

The coefficients of tractor service (X_2) and manures are statistically significant at 1 percent and 5 percent respectively. The coefficient of tractor expenditure is 1.615 and that of manures is 0.313, implying that tractor service has the higher potentiality to contribute more to wheat production than any other variable among the marginal wheat farmers in the moderately developed area of Morang district. The coefficient of seeds is positive but not statistically significant. The coefficients of human labour and irrigation expenses are negative but not statistically significant..

Marginal Wheat Farmers – Developed Area

The results obtained for marginal wheat farmers in developed area of Morang district are presented in the table 6.6 below.

Table 6.6: Production Elasticities of the Respective Factors of Production for Marginal Wheat Farmers in Developed Area

Variable	b_i	SD error	t - Value	Significance
X_1(Human Labour)	0.0108	0.175	0.0617	N.S.
X_2 (Tractor)	**0.404**	**0.185**	**2.184**	**
X_3 (Seeds)	**0.309**	**0.140**	**2.207**	**
X_4 (Manures)	0.0165	0.108	0.153	N.S.
	$\sum b_i$= 0.740			

$Y = 4.946X_1^{0.0108}X_2^{-0.404}X_3^{0.303}X_4^{0.0165}$, F= 3.50**, R^2 = 0.534, n = 18, N.S. = Not significant, * = Significant at 1 % level, ** = Significant at 5 % level

Source: Ibid

The function has yielded R^2 of 0.534, which is significant as, indicated by the F-ratio of 3.50 at 5 percent level. The farmers are experiencing decreasing returns to scale since the sum of the elasticities $\sum b_i$ is less than unity. The signs of all the coefficients are positive The positive and significant coefficient of tractor service on the wheat farms of the marginal farmers in the developed area indicates that additional one unit investment in this input would result in an increase of about 0.404 percent in the value of total output.

The coefficient of seeds is positive and significant. It implies that the investment in seeds will increase output of wheat by 0.309 percent. During the survey it was found that 75 percent of the marginal farmers were not using improved variety of seeds of wheat. Therefore, they can increase the output of wheat by investing more

on this input. There is need to encourage the marginal farmers to use HYV of wheat by borrowing from the formal credit institutions.

All Marginal Wheat Farmers - Combined

The results obtained for all the marginal wheat farmers combined in Morang district are given below 6.7.

Table 6.7: Production Elasticities of the Respective Factors of Production for All Marginal Wheat Farmers Combined in Morang District

Variable	b_i	SD error	z - Value	Significance
X_1 (Human Labour)	0.250	0.170	1.468	N.S.
X_2 (Tractor)	-0.249	0.206	-1.205	N.S.
X_3 (Seeds)	**0.230**	**0.127**	**1.812**	***
X_4 (Manures)	0.0667	0.099	0.674	N.S.
X_5 (Irrigation)	0.00437	0.054	0.081	N.S.
	$\sum b_i = 0.302$			

$Y = 3.745X_1^{0.250}X_2^{0.230}X_3^{0.303}X_4^{0.0667}X_5^{0.00437}$, $F = 3.12^{**}$, $R^2 = 0.534$, n = 36, N.S. = Not significant, * = Significant at 1 % level, * * = Significant at 5 % level

Source: Computed from survey data, 2001

All the coefficients are positive except that of tractor. The coefficient of tractor is negative but statistically insignificant. The coefficient of seeds is positive but it is significant only at 10 percent level of significance.

Although the value of R^2 is very low it is significant as indicated by the significance of F-ratio at 5 percent level of significance. The positive coefficients of the variables show positive relationship between output of wheat and the inputs. It means that applying the more units of these inputs, output of wheat can be increased. Although the signs of these coefficients are positive, they are not statistically significant. The farmers are experiencing decreasing returns to scale as indicated by the sum of elasticities $\sum b_i$ which less than unity.

6.2.2 Small Farmers

Small Paddy Farmers – Low Developed Area

The results obtained for small paddy farmers in low developed area of Morang district are presented in the table 6.8 below

Table 6.8: Production Elasticities of the Respective Factors of Production for Small Paddy Farmers in Low Developed Area of Morang District

Variable	b_i	SD error	Z - Value	Significance
X_1 (Human Labour)	0.0559	0.167	0.334	N.S.
X_2 (Bullock Labour)	**-0.202**	**0.120**	**1.681**	*** * ***
X_3 (Seeds)	0.059	0.090	0.670	N.S.
X_4 (Manures)	**0.127**	**0.023**	**5.528**	*****
	$\sum b_i = 0.0399$			
$Y = 3.881X_1^{0.0559}X_2^{-0.202}X_3^{0.059}X_4^{0.127}$, F= 10.749 *, $R^2 = 0.537$, n = 42, N.S. = Not significant, * * * = Significant at 10 % level, * = Significant at 1 % level				

Source: Ibid

The function has yielded R^2 of 0.537, which is significant as indicated by the significance of F-ratio at 1 percent level of significance. The results indicate that on the sample small paddy farmers decreasing returns to scale prevailed which is indicated by $\sum b_i$ being less than unity.

In the tests for individual regression coefficients only the coefficients of bullock labour and manures are significant. The coefficient of bullock is negative and significant at 10 percent level implying that small paddy farmers are using excessive units of bullock labour than required. The coefficient of manures is positive and significant at 1 per cent level.

The relatively high elasticity of production with respect to manures among the small rice farmers than that of other variables could be due to the fact that small paddy farmers in the low developed area are using lower levels of this input and substantial increase in production can still be realized among these farmers by increasing the level of utilization of this input. Manures, therefore appears to be relatively more important in terms of its contribution to total output.

Small Paddy Farmers – Moderately Developed Area

The results obtained for the small paddy farmers in the moderately developed area are presented in the table 6.9 below.

Table 6.9: Production Elasticities of the Respective Factors of Production for Small Paddy Farmers in Moderately Developed Area of Morang District

Variable	b_i	SD error	Z - Value	Significance
X_1 (Human Labour)	-0.089	0.264	-0.338	N.S.
X_2(Bullock Labour)	-0.0547	0.197	-0.277	N.S.
X_3 (Seeds)	**0.637**	**0.367**	**1.736**	*** * ***
X_4 (Manures)	**0.170**	**0.052**	**3.258**	*****
X_5 (Irrigation)	0.0249	0.029	0.869	N.S.
	$\sum b_i = 0.688$			

$Y = 2.240X_1^{-0.089}X_2^{0.0547}X_3^{0.637}X_4^{0.170}X_5^{0.0249}$, $F = 4.048^{*}$ $R^2 = 0.360$ n = 42 N.S. = Not significant, * = Significant at 1% level, * * = Significant at 5 % level, * * * = Significant at 10 % level

Source: Ibid

The results indicated that on the sample small paddy farms decreasing returns to scale prevailed which is indicated by $\sum b_i$ being less than unity. The test for the overall regression coefficient has yielded significant results. The R^2 is 0.360. In the tests for individual regression coefficients only the coefficients of seeds and manures are significant. The coefficients of human labour and bullock labour are negative but statistically not significant. The coefficient of irrigation is positive but not significant. This implies that seeds and manures are the only inputs, which have the potentiality to increase output by increasing their doses.

Small Paddy Farmers – Developed Area

The results obtained for the small paddy farmers in developed area are presented in the table 6.10 below.

Table 6.10:Production Elasticities of the Respective Factors of Production for Small Paddy Farmers in Developed Area of Morang District

Variable	b_i	SD error	Z - Value	Significance
X_1 (Human Labour)	-0.0347	0.152	-0.229	N.S.
X_2 (Bullock Labour)	-0.164	- 0.163	-1.006	N.S.
X_3 (Seeds)	0.347	0.302	1.149	N.S.
X_4 (Manures)	**0.164**	**0.037**	**4.418**	*
	$\sum b_i = 0.312$			

$Y = 2.723X_1^{-0.0347}X_2^{-0.164}X_3^{0.347}X_4^{0.164}$ · F= 5.298 *, $R^2 = 0.424$, n = 42, N.S. = Not significant, * = Significant at 1% level, * * = Significant at 5 % level, * * * = Significant at 10 % level

Source: Ibid

The function has yielded R^2 of 0.424, which is significant as indicated by the significance of F-ratio at 1 percent level of significance. The small farmers in developed area of Morang are experiencing decreasing returns to scale as indicated by the sum of elasticities $\sum b_i$ being less than unity.

In the developed area of sampled small paddy farms only the coefficient of manures is positive and significant. The coefficients of human labour and bullock labour are negative but statistically insignificant. The coefficient of seeds is positive but statistically insignificant.

. The only important input which is used at lower levels and which can contribute to more production is manures.

All Small Paddy Farmers – Combined

The results obtained for all the sampled small paddy farmers in Morang district are presented in the table 6.11 below.

Table 6.11:Production Elasticities of the Respective Factors of Production for All Small Paddy Farmers in Morang District

Variable	b_i	SD error	Z - Value	Significance
X_1 (Human Labour)	- 0.039	- 0.108	- 0.368	N.S.
X_2 (Bullock Labour)	- 0.034	- 0.081	- 0.425	N.S.
X_3 (Seeds)	**0.157**	**0.092**	**1.706**	* * *
X_4 (Manures)	**0.156**	**0.018**	**8.53**	*
X_5 (Irrigation)	**0.051**	**0.007**	**7.347**	*
	$\sum b_i = 0.291$			

$Y = 3.432X_1^{-0.039}X_2^{-0.034}X_3^{0.157}X_4^{0.156}X_5^{0.051}$, F= 26.009 *, $R^2 = 0.520$, n = 126, N.S. = Not significant, * = Significant at 1% level, * * = Significant at 5 % level, * * * = Significant at 10 % level

Source: Ibid

The R^2 value indicates that the independent variables included in the production function explained about 52 per cent of the variations in the production of paddy among the all sampled small paddy farmers. The R^2 is significant as indicated by the significance of the F-ratio at 1 percent level. The sum of the elasticities being less than unity depicts decreasing returns to scale.

The results show that the coefficients of human labour and bullock labour are negative but insignificant. The coefficients of seeds, manures and irrigation are positive and significant at 10 percent, 5 percent and 5 percent respectively.

The relatively high elasticity of production with respect to manures and irrigation among the sampled small paddy farmers in Morang district could be due to the fact that farmers are using lower levels of these inputs and these farmers can still realize substantial increase in production by increasing the level of utilization of these inputs. Manures and irrigation, therefore, appears to be relatively more important inputs, which can make more contribution to total output if farmers increase their use in farm operations even from borrowing.

Small Wheat Farmers – Moderately Developed Area

The results obtained for the small wheat farmers in moderately developed area are presented in the table 6.12 below.

Table 6.12: Production Elasticities of the Respective Factors of Production for Small Wheat Farmers in Moderately Developed Area of Morang District

Variable	b_i	SD error	Z - Value	Significance
X_1 (Human Labour)	0.108	0.087	1.244	N.S.
X_2 (Tractor)	0.125	0.235	0.532	N.S.
X_3 (Seeds)	0.102	0.161	0.633	N.S.
X_4 (Manures)	**0.156**	**0.052**	**1.894**	* * *
X_5 (Irrigation)	0.051	0.034	0.250	N.S.
	$\sum b_i = 0.542$			
$Y = 1.582X_1^{0.108}X_2^{0.125}X_3^{0.102}X_4^{0.156}X_5^{0.051}$, F= 3.50 * *, $R^2 = 0.329$, n = 42, N.S. = Not significant, * * * = Significant at 10 % level, * * = Significant at 5 % level				

Source: Ibid

The results indicate that although the R^2 is very low, it is significant as indicated by the significance of F-ratio at 5 percent level. In the tests for individual regression coefficients, only the coefficient of manures is significant at 10 percent level. The coefficients of other variables are positive but statistically insignificant. The farmers are experiencing decreasing returns to scale as indicated by the sum of the elasticities being less than unity.

Small Wheat Farmers – Developed Area

The results obtained for the small wheat farmers in Developed area of Morang district are presented in the table 6.13 below.

Table 6.13:Production Elasticities of the Respective Factors of Production for Small Wheat Farmers in Developed Area of Morang District

Variable	b_i	SD Error	Z - Value	Significance
X_1 (Human Labour)	-0.157	0.092	-1.706	* * *
X_2 (Tractor)	-0.183	0.081	-2.252	* *
X_3 (Seeds)	0.247	0.139	1.780	* * *
X_4 (Manures)	0.224	0.055	4.072	*
	$\sum b_i = 0.131$			
$Y = 1.220X_1^{-0.157}X_2^{-0.183}X_3^{0.247}X_4^{0.224}$, F= 6.540 *, $R^2 = 0.567$, n = 42, N.S. = Not significant, * * * = Significant at 10 % level, * * = Significant at 5 % level, * = Significant at 1 % level				

Source: Ibid

The table 6.13 above shows that the coefficients of manures and seeds are positive and significant at 10 percent and 1 percent level respectively. The coefficients of human labour and the expenditure on tractor service are negative and significant at 10 percent and 5 percent level implying that the use of these inputs has crossed the optimum level of utilization. The further use of these inputs would decrease output rather than increase of total output.

All Small wheat Farmers – Combined

The results obtained for all small wheat farmers of Morang district are presented in the table 6.14 below.

Table 6.14:Production Elasticities of the Respective Factors of Production for All Small Wheat Farmers in Morang District.

Variable	b_i	SD Error	Z - Value	Significance
X_1 (Human Labour)	-0.0425	0.067	-0.630	N.S.
X_2 (Tractor)	**0.705**	**0.284**	**2.476**	* *
X_3 (Seeds)	0.149	0.109	1.367	N.S.
X_4 (Manures)	**0.145**	**0.319**	**3.367**	*
X_5 (Irrigation)	**0.0982**	**0.022**	**4.499**	*
	$\sum b_i = 1.0547$			

$Y = 0.635X_1^{-0.0425}X_2^{0.705}X_3^{0.149}X_4^{0.145}X_5^{0..0982}$, F= 12.349 *, $R^2 = 0.584$, n = 84, N.S. = Not significant, * * = Significant at 5 % level, * = Significant at 1 % level

Source: Ibid

The function has yielded R^2 of 0.584, which is insignificant as indicated by the significance of F-ratio at 1 percent level of significance. The sum of he elasticities greater than one indicates that the small wheat farmers in Morang district are experiencing increasing returns to scale.

The results show that the coefficients of expenditures on tractor, manures and irrigation are significant at 5 percent, 1 percent, and 1 percent level respectively. It implies that there is sufficient scope to raise production by utilizing these inputs.

6.2.3 Medium and Large Farmers

All Medium and Large Paddy Farmers – Combined

The regression results obtained for medium and large farmers in all the areas gave lower and insignificant R^2 values because the F-ratios were not significant for all the areas (values are not presented hers). So the analysis for the medium and large farmers in each area was not conducted separately. The analysis here is based on all the medium and large paddy farmers combined. The results obtained for the entire sampled medium and large paddy farmers are presented in the table 6.15 below.

Table 6.15:Production Elasticities of the Respective Factors of Production for All Sampled Medium and Large Paddy Farmers in Morang District.

Variable	b_i	SD error	Z - Value	Significance
X_1 (Human Labour)	0.00085	0.119	0.007	N.S.
X_2 (Bullock Labour)	-0.257	0.228	-1.127	N.S.
X_3 (Seeds)	**-0.152**	**0084**	**-1.812**	*** * ***
X_4 (Manures)	**0.157**	**0.044**	**3.608**	*****
X_5 (Irrigation)	**0.0434**	**0.010**	**4.390**	*****
	$\sum b_i$ = - 0.2077			
$Y = 4.561X_1^{-0.00085}X_2^{-0.257}X_3^{-0.152}X_4^{0.157}X_5^{0.0434}$, F= 7.686 *, R^2 = 0.564, n = 45, N.S. = Not significant, * * = Significant at 5 % level, * = Significant at 1 % level, * * * = Significant at 10 % level				

Source: Ibid

The function has yielded a R^2 of 0.496, which is significant as indicated by the significance of F-ratio at 1 percent level of. The farmers are experiencing diminishing returns to scale as indicated by the sum of elasticities ($\sum b_i$) being less than unity.

The coefficient of bullock labour is negative but statistically insignificant. The negative sign of bullock labour indicates excessive use of bullock labour but since the coefficient is statistically insignificant we cannot make a strong conclusion of excessive use of bullock labour.

All Medium and Large Wheat Farmers – Combined

The results obtained for the entire sampled medium and large wheat farmers of Morang district are presented in the table 6.16 below:.

Table 6.16:Production Elasticities of the Respective Factors of Production for All Sampled Medium and Large Wheat Farmers in Morang District.

Variable	b_i	SD error	Z - Value	Significance
X_1 (Human Labour)	-0.0584	0.083	-0.794	N.S.
X_2 (Tractor)	-0.243	0.551	-0.441	N.S
X_3 (Seeds)	-0.0763	0.156	-0.488	N.S.
X_4 (Manures)	**0.128**	**0.052**	**2.461**	**
X_5 (Irrigation)	0.00699	0.025	0.280	N.S.
	$\sum b_i$ = - 0.243			
$Y = 5.034X_1^{-0.0584}X_2^{-0.243}X_3^{-0.0763}X_4^{-0.128}X_5^{0.00699}$, F= 3.423**, $R^{2'}$= 0.453, n = 45 N.S. = Not significant, * * = Significant at 5 % level				

Source: Ibid

The function has yielded a R^2 of 0.453, which is significant as indicated by the significance of F-ratio at 5 percent level of significance. The coefficients of human labour, tractor service and seeds are negative but they are statistically insignificant. Only the coefficient of expenditure on manures is positive and significant at 5 percent. The coefficient of irrigation is positive but statistically insignificant. Diminishing returns to scale prevailed in the wheat farms of all medium and large farmers as indicated by the sum of elasticities ($\sum b_i$) which is less than unity.

However, an important issue here is related to the question of how efficiently are these farmers organizing their production activities so as to maximize their profits given the prevailing input and output prices. In order to measure productivity of different agricultural resources, marginal value products (MVPs) have been worked out.

6.3 Marginal Value of Productivity Measures

The MVPs of resources are computed for only those resources whose regression coefficients are statistically significant in the production functions estimated above.

From the Cobb-Douglas production function, the marginal value productivities can be computed from the estimated production elasticities and the average productivity measures (Atieno: 1995) as follows:

$$MVP = b_i \frac{\overline{Y}}{\overline{X}_i}$$

Where,

MVP = Marginal value product for the given factor of production

b_i = The estimated elasticity of production function for i^{th} input

$\overline{Y}$ = Geometric mean of particular output

$\overline{X}_i$ = Geometric mean of the ith input used

The MVP gives the absolute response per unit of factor input and enables the comparison of relative efficiencies of resource use within the given farms. The MVP of an input indicates the increase in the value output, which will result from the use of one additional unit of an input. Using the estimated production elasticities, geometric mean of input and output for paddy and wheat for marginal, small and medium and large farmers in low developed, moderately developed and developed area are presented in the tables 6.17 and 6.18 below.

6.3.1 Marginal Paddy Farmers

Table 6.17:Marginal Value Productivity Measures of the Specified Factors of Production for Marginal Paddy Farmers

1.Low Developed Area			G.M.of output =19853.25
Input	b_i	Geometric Mean	MVP
Bullock labour	0.466	32.23	287.05
Manures	0.162	2370.14	1.36
Seeds	- 0.181	807.36	- 4.45
2.Moderately Developed Area			G.M.of output =21540.38
Input	b_i	Geometric Mean	MVP
Bullock labour	0.171	28.41	129.65
Manure	0.179	2624.74	1.39
3.Developed Area			G. M. of Output =23678.43
Input	b_i	Geometric Mean	MVP
Manure	0.194	1890.11	2.43
4.All Marginal Paddy Farmers			G.M.of Output =23350.49
Input	b_i	Geometric Mean	MVP
Manure	0.224	2273.96	2.30
Irrigation	0.0459	392.23	2.73

Source: Computed from survey data, 2001

Table 6.18:Marginal Value Productivity Measures of the Specified Factors of Production for Marginal Wheat Farmers

1.Moderately Developed Area			G.M. of Output =17007.4
Input	b_i	G.M.	MVP
Tractor	1.615	4337.59	6.33
Manures	0.313	3966.85	1.34
2. Developed Area			G.M. of Output = 22078.25
Input	b_i	Geometric Mean	MVP
Tractor	-0.404	4149.55	-2.15
Seeds	0.309	2234.74	3.05
3.All Marginal Wheat Farmers			GM. 0f Output = 19378.20
Input	b_i	Geometric Mean	MVP
Seeds	0.230	2367.73	1.88

Source: Ibid

The MVP of human labour is not been computed because it was not significant in all the areas related to marginal paddy and wheat farmers. The marginal value product of bullock labour input is higher in low developed area than in moderately developed area among the marginal paddy farmers implying that one additional pair of bullock applied would add more to output of paddy in the low developed area.

This result shows that marginal paddy farmers are using less units of bullock labour in proportion to other resources. This high marginal value product of bullock labour input can also be attributed to the high production elasticity of this resource among them and the low level at which it is used. Therefore, given the production elasticity, the high marginal productivities and low level of utilization of these inputs, production levels can be substantially increased by increasing the level at which they are used.

The coefficient of manures is positive in all the areas of marginal paddy farmers and the MVPs of manures show low level of utilization of this input in all the areas.

For marginal wheat farmers in the moderately developed area the MVP of tractor service is higher than the MVP of other resources. It is negative in the developed area indicating over utilization of this resource. The MVP of seeds is positive in developed area and also for all the marginal paddy farmers indicating that more output can be obtained by utilizing more units of these inputs even by borrowing

Small Paddy Farmers

The marginal value products, geometric means of inputs used, geometric mean of output paddy for small paddy farmers are presented in the table 6.19 below

Table 6.19 Marginal Value Productivity Measures of the Specified Factors of Production for Small Paddy Farmers

1.Low Developed Area			G.M.of output = 19028.30
Input	b_i	Geometric Mean	MVP
Bullock labour	-0.202	31.39	-122.45
Manure	0.127	2085.7	1.6
2.Moderately Developed Area			G.M.of output = 22749.29
Input	b_i	Geometric Mean	MVP
Seeds	0.637	620.38	23.35
Manure	0.170	2184.04	1.77
3.Developed Area			G. M. of Output = 25428.84
Input	b_i	Geometric Mean	MVP
Manure	0.164	1269.64	3.45
4.All Marginal Paddy Farmers			G.M.of Output = 22244.56
Input	b_i	Geometric Mean	MVP
Seeds	0.157	675.2	5.17
Manure	0.156	1795.03	1.93
Irrigation	0.051	375	3.02

Source: Ibid

The MVP of manures is positive for all the small paddy farmers in all the areas. The MVP of manures in developed area is higher than the MVPs of manures in low developed area, moderately developed area and all small paddy farmers.

6.3.2 Small Wheat Farmers

The marginal value products, geometric means of inputs used, geometric mean of output paddy for small paddy farmers are presented in the table 6.20 below.

Table 6.20: Marginal Value Productivity Measures of the Specified Factors of Production for Small paddy Farmers

1.Moderately Developed Area		G.M.of output = 17007.40	
Input	b_i	Geometric Mean	MVP
Manure	0.156	3170.07	0.84
2. Developed Area		G.M.of output = 22078.28	
Input	b_i	Geometric Mean	MVP
Human labour	-0.157	46.05	-75
Tractor	- 0.183	2942.63	-1.37
Seeds	0.247	2229.15	2.45
Manure	0.224	3259.33	1.52
4.All Marginal Wheat Farmers		G.M.of Output = 19378.20	
Input	b_i	Geometric Mean	MVP
Tractor	0.705	2995.01	4.56
Manure	0.15	3214.39	0.87
Irri	0.0982	469.61	4.05

Source: Computed from survey data, 2001

The MVP for tractor input is higher among all the small wheat farmers. The high marginal value product of tractor service input among the small paddy farmers can also be attributed to the high production elasticity of this resource among them and the low level at which it is used.

6.3.3 All Medium and Large Paddy Farmers

The marginal value products, geometric means of inputs used and geometric mean of output paddy for all sampled medium and large wheat farmers are presented in the table 6.21 below.

Table 6.21:Marginal Value Productivity Measures of the Specified Factors of Production for All Medium and Large Paddy Farmers

G.M. of Output = 21934.22			
Input	b_i	G.M.	MVP
Seeds	- 0.157	583.07	- 5.72
Manure	- 0.152	1672.13	- 2.06
Irrigation	0.0434	237.47	4.08

Source: Ibid

The MVP of seeds and manures for all medium and large paddy farmers are negative indicating over utilization of these inputs. The MVP of irrigation is positive which indicates that more output can be realized by increasing the expenditure on irrigation facilities.

6.3.4 All Medium and Large Wheat Farmers

The marginal products, geometric means of inputs used and geometric mean of output of paddy for all sampled medium and large paddy farmers are presented in the table 6.22 below.

Table 6.22:Marginal Value Productivity Measures of the Specified Factors of Production for All Medium and Large Wheat Farmers

G.M. of Output = 20349.10			
Input	b_i	G.M.	MVP
Manure	0.128	3352.98	2.06

Source: Ibid

Only the coefficient of manures for all sampled medium and large farmers is significant. The MVP of manure among the all medium and large wheat farmers is positive which indicates that substantial output of wheat can be increased by utilizing more units of this resource.

6.4 Marginal Returns to Opportunity Cost Ratios (MROCRS) and Percentage of Credit Utilization

The marginal returns to opportunity cost ratios provide a measure of the efficiency of resource use prevailing on the average throughout the sample. It statistically measures the mean efficiency of resource use by each sampled farm population. It is computed as the ratio of the marginal value product to marginal input cost given as the opportunity of the respective resource. For profits to be maximized, the ratio of the marginal value product to the marginal cost must be equal to one. This means that the revenue from using one additional of input is equal to the cost of acquiring that additional unit. A ratio of less than one implies that too much of the resource is being used under the existing price conditions, implying inefficient resource use. If the ratio is greater than one, it indicates that too little of the resource is being used and increased use of the resource would result in increased profits.

The MVPs of different resources and ratios of these MVPS to their factor costs and share of credit utilized for these inputs are presented in the tables

6.4.1 Marginal Paddy Farmers

Table 6.23 : MVPs of Factors of Production, Ratios of MVPs to Their Factor Costs and Percentage of Borrowed Amount to Total Amount Used on Different Resources by Marginal Paddy Farmers

1.Low Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Bullock labour	287.05	2.29	32.34
Manures	1.36	1.36	20.10
Seeds	-4.45	-4.45	6.00
2.Moderately Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Bullock labour	129.65	1.03	34.45
Manures	1.39	1.39	22.50
3.Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Manures	2.43	2.43	24.25
4.All Marginal Paddy Farmers			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Manures	2.30	2.30	22.25
Irrigation	2.73	2.73	2.37

Source: Ibid

The MVPs of different resources and ratios of these MVPs to their factor costs for marginal farmers in different areas are presented in the above table 5.23.The results reveal that the MROCRs are greater than unity for all factors except seeds in the low developed area. These ratios indicate that too little of the respective resource inputs that is bullock labour, manure and irrigation are being used in relation to the prevailing market conditions. The negative ratio of seeds indicates that there is excess utilization of seeds in the low developed area by marginal paddy farmers.

Hence the farmers are allocatively inefficient in the use of the available factors of production.

The overall functional analysis brought out that the marginal farmers are rational in making investments (which includes more than 44 percent of borrowed amount) on bullock labour and manures as the ratios of these resources to their costs are significantly greater than unity. Thus the marginal farmers can further increase their income by curtailing expenditure on seeds. So the marginal farmers should decrease the expenditure on seeds and it is not justified to borrow for these resources.

Too little use of bullock labour and manures by the marginal paddy farmers is a reflection of high prices of inputs, lack of input credit and inadequacy of cash for purchasing these inputs. If the farmers were supplied with adequate credit to purchase these inputs they could have improved crop productivity and hence efficient resource use by farmers.

6.4.2 Marginal Wheat Farmers

Table 6.24: MVPs of Factors of Production, Ratios of MVPs to Their Factor Costs and Percentage of Borrowed Amount to Total Amount Used on Different Resources by Marginal Wheat Farmers

1.Moderately Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Tractor	6.33	6.33	36.04
Manures	1.34	1.34	24.45
2.Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Tractor	- 2.15	-2.15	34.56
Seeds	3.05	3.05	5.00
3.All Marginal Wheat Farmers			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Seeds	1.88	1.88	7.24.

Source: Ibid

In the above table 6.24 we find that the ratio of MVP to the acquisition costs of tractor service is significantly different from unity in the moderately developed area. The ratio of MVP of tractor to its cost is (–) 2.15, in the developed area, which is negative and significantly different from unity. This showed that the cost of tractor is higher on the marginal farms in the developed area than its optimal return and consequently farm income can be raised through reduction by reducing its use on the farm. The percentage of borrowed amount used for this input is 34.56 and it is not justified to borrow for these resources. The MVPs of manures and seeds are significantly greater than unity, which indicated that the marginal wheat farmers can enhance the expenditures on these inputs to obtain more production even by taking credit from outside.

6.4.3 Small Paddy Farmers

Table 6.25: MVPs of Factors of Production, Ratios of MVPs to Their Factor Costs and Percentage of Borrowed Amount to Total Amount Used on Different Resources by Small Paddy Farmers

1.Low Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Bullock labour	-122.45	- 0.979	24.82
Manures	1.16	1.16	34.56
2.Moderately Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Seeds	23.35	23.35	8.34
Manures	1.77	1.77	48.25
3.Developed Area			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Manures	3.45	3.45	24. 54
4.All Small Paddy Farmers			
Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Manures	1.93	1.93	26.25
Seeds	5.17	5.17	4.40
Irrigation	3.02	3.02	3.58

Source: Ibid

The ratio of MVP to MFC for manures, seeds and irrigation is greater than unity, which indicated that the farmers can enhance the expenditure on these inputs and realize more output. These expenditures can be justified even by borrowing from outside.

6.4.4 All Medium and Large Paddy Farmers

Table 6.26: MVPs of Factors of Production, Ratios of MVPs to Their Factor Costs and Percentage of Borrowed Amount to Total Amount Used on Different Resources by All Medium and Large Paddy Farmers

Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Irrigation	4.0	4.0	15.81
Manures	-2.06	-2.06	24.65
Seeds	-5.72	-5.72	6.20

Source: Ibid

The ratio of MVP to MFC for manures and seeds was negative and greater than unity. This indicated that the medium and large farmers could further increase their income by curtailing expenditure on manures and seeds and increasing the expenditure on irrigation. The percentage of credit used for manures and seeds can be reallocated to increase irrigation facilities and substantial output can be realized.

6.4.5 All Medium and Large Wheat Framers

Table 6.27: MVP of Factors of Production, Ratio of MVP to It's Factor Costs and Percentage of borrowed Amount to Total Amount Used on Different Resources by All Medium and Large Wheat Farmers

Input	MVP	Ratio of MVP to MFC	% of borrowed amount to total amount used
Manures	2.06	2.06	22.95

Source: Ibid

The ratio of MVP to MFC is greater than unity indicating that more output can be realized by them increasing the expenses on manures. The percentage of credit used for manures applied in the wheat farm by medium and large farmers is 22.95. So, more output can be realized by borrowing more for manures and thereby increase their products.

6.5 The impact of Credit on Production

An attempt is made to compare the average yield of crops of paddy and wheat grown by sampled farmers before and after credit use by sampled marginal, small and medium and large farmers in low developed, moderately developed and developed area of Morang District. In order to study the impact of credit on production. Paired - t test is used for the samples of size n < 30 and Z - test is used for the samples of size n > 30.The calculated test statistics are compared with tabulated values of the test statistic and conclusions are drawn on the basis of whether the calculated values are less than or greater than the tabulated values. A one tailed test is applied.

The null and alternative hypotheses are formulated as:

$H_0: \mu_x = \mu_y$ (i.e. there is no significant difference between the mean yield of the crop before and after credit use).

$H_1: \mu_x < \mu_y$ (i.e. there is significant increase in the mean yield of the crop after the credit use).

Here x is used to denote the production of crop before use and y is used to denote the production of crop after credit use. The t statistic for paired t–test used is,

$$t = \frac{\bar{d}}{S/\sqrt{n-1}}$$

Where, $\bar{d} = \sum d_i/n$ = mean difference

$d_i = x_i - y_i$

S = standard deviation of the differences

n = number of paired observations

The Z- statistic used for differences of mean yields is

$$Z = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Where, X = mean yield of the sample before credit

Y = Mean yield of sample after credit

S_1^2 = Variance of the sample before credit

S_2^2 = Variance of the sample after credit

n_1 = Size of the sample before credit

n_2 = Size of the sample after credit

6.5.1The Impact of Credit on Production – Marginal Farmers

The differences between the average yield of crops before use of credit and after use of credit, the calculated t–ratios and the significance for sampled marginal farmers are presented in the table 6.28 below.

Table 6.28: Mean Differences, Standard Errors, t-values and Significance for Paddy and Wheat of Sampled Marginal Farmers

1.Low Developed Area					
Crop	n	M-D	S.E.	t-value	Significance
Paddy	18	9.39	1.08	8.69	*
2. Moderately Developed area					
Crop	n	Mean Difference	S.E.	t-Value	Significance
Paddy	18	14.19	1.03	13.78	*
Wheat	18	12.56	0.99	12.68	*
3. Developed Area					
Crop	n	M-D	S,E,	t-value	Significance
Paddy	18	10.21	1.32	7.73	*
Wheat	18	6.99	1.23	5.68	*
4. All Marginal Farmers					
Crop	n	M-D	S.E.	Z- value	Significance
Paddy	54	11.26	0.71	15.86	*
Wheat	36	9.52	0.87	10.94	*
S.E. = Standard Error * = Significant at 1 % level n = Sample Size					

Source: Ibid

In the above table all the t – ratios are significant at I percent level and also for all sampled marginal farmers the z- statistic is found to be significant at I percent level. These results suggest that there is positive impact of credit on productivity of crops among the marginal farmers of Morang District.

6.5.2 The Impact of Credit on Production – Small Farmers

The differences between the average yield of crops before use of credit and after use of credit, calculated t–ratios and the significance for sampled small farmers are presented in the table below.

Table 6.29:Mean Differences, Standard Errors, t-values and significance for Paddy and Wheat of Sampled Small Farmers

1.Low Developed Area					
Crop	n	Mean Difference	Standard Errors	Z -value	Significance
Paddy	42	7.49	1.31	5.71	*
2. Moderately Developed area					
Crop	n	Mean Difference	S.E.	Z -value	Significance
Paddy	42	8.87	1.33	6.67	*
Wheat	42	6.9	2.86	2.41	* *
3. Developed Area					
Crop	n	Mean Difference	S, E,	t-value	Significance
Paddy	42	8.5	3.77	2.25	* *
Wheat	42	5.84	1.44	4.05	*
4. All Small Farmers					
Crop	n	Mean Difference	S.E.	Z- value	Significance
Paddy	126	6.63	1.72	3.85	*
Wheat	84	6.34	1.64	3.87	*
S.E. = Standard Error * = Significant at 1 % level n = Sample Size * * = significant at 5% level					

Source: Ibid

All the t–ratios are significant implying that there exists positive impact of credit on production of crops produced by small farmers in Morang district.

6.5.3 The Impact of Credit On Production–Medium and Large Farmers

The differences between the average yield of crops before use of credit and after use of credit, the calculated t-ratios and the significance for sampled medium and large farmers are presented in the table 6.30 below.

Table 6.30: Mean Differences, Standard Errors, t-values and Significance for Paddy and Wheat of Sampled Medium and Large Farmers

1.Low Developed Area					
Crop	n	Mean Difference	S.E.	Z -value	Significance
Paddy	15	6.88	1.25	5.50	*
2. Moderately Developed area					
Crop	n	Mean Difference	S.E.	Z -value	Significance
Paddy	15	8.92	1.09	15.57	*
Wheat	15	6.08	0.83	7.3	*
3. Developed Area					
Crop	n	Mean Difference	S,E,	t-value	Significance
Paddy	15	5.38	1.01	5.33	*
Wheat	15	3.97	0.72	5.51	*
4.All Medium and Large Farmers					
Crop	n	Mean Difference	S.E.	Z- value	Significance
Paddy	45	6.53	1.76	3.71	*
Wheat	30	5.02	2.11	2.37	* *
S.E. = Standard Error * = significant at 1 % * * = Significant at % level n = Sample size					

Source: Ibid

The results presented above in the tables 6.28, 6.29 and 6.30 show that the use of credit by all farmers has positive impact on production of crops. The results justify the hypothesis that the use of credit increases farm income

6.6 Optimal Utilization of Credit by Sampled Farmers

To study optimal utilization of credit by farmers we have made an attempt to compare the per hectare requirements of inputs for production per hectare as recommended by the agricultural technicians and expected output which can be realized if the farmers follow the recommendations with the actual amounts of inputs used by the sampled farmers per hectare and realized output per hectare. To make the comparisons input-output ratios as recommended by the agricultural technicians and actual input-output ratios are also calculated. The proportions of credit used out of total credit borrowed for each crop are also presented to know whether the farmers are using credit optimally or not. The physical amounts of input requirements for different crops as recommended by the agricultural technicians were obtained from district agriculture office Morang. of this research work. Here, in this section, we have presented the input and output in terms of prevailing prices of input and output during the period of survey. The results are presented in the tables and discussed thereafter.

6.6.1 Required Amount of Inputs and Expected Output as Recommended

The required amount of inputs as recommended by the agricultural technicians working in the agriculture sector and the production of crops obtained from experiments are presented in the table 6.31 below.

Table 6.31: Per Hectare Cost of Production and Expected Production and Input - Output Coefficients as Recommended by Technicians

CROP	Seeds Rs.	Manures Rs.	B/T Rs.	Labour Rs.	Irrigation Rs.	Total cost Rs	Expected output (in Qtl.)	Expected output (In Rs.)	Input-output ratio
E. Paddy	1000	7010	5760	2500	5400	21670	30	22500	1:1.038
L. Paddy	1000	6010	5760	1250	5400	19420	32	24000	1:1.24
S. Paddy	1000	6010	5760	1500	5400	19670	43.2	32400	1:1.65
Wheat	2400	7044	5000	2500	4500	21444	45	33750	1:1.57
Maize	562	7553	4500	1000	2100	15715	47	32900	1:2.1
Mustard	300	5277	3300	250	1500	10627	8	16000	1.51
Lentil	1200	2814	1800	250	1200	7264	6.16	9240	1:1.27

Source: District Agriculture Office, Biratnagar

The above table 6.31 shows that the highest cost of production is incurred in the production of paddy and wheat, which is more than Rs. 19,000.0 at current prices. The table 6.31 also shows that among the paddy crops, the summer paddy has the highest potential. One of the reasons for highest yield potential of summer paddy is that it gets sufficient water for crops during the summer from surface and rain.

The table 6.31 shows that if inputs are utilized properly as recommended, other things remaining the same, production will certainly increase than when inputs are not used as recommended. The input-output ratios indicate that there is more return than investment. All the ratios are greater than one.

In order to study whether the farmers are using the borrowed credit in an optimal way we have presented the level of input used at the farm level together with output realized. We have also computed the input-output ratios for each crop.

6.6.2 Optimal Use of Credit by Farmers–Low Developed Area

The results obtained for marginal, small and medium and large farmers in low developed area are presented in the table 6.32 below.

Table 6.32:Per Hectare Cost of Production, Realized Output and Input-output Coefficients of Sampled Farms

(Low Developed Area)

1.Marginal Farmers					(in Rs.)	Actual output Produced (In Qtl)	Output (In Rs.)	Input –0utput Ratio	% of Credit Used
Crops	Seeds	Manures	B/T	Labour	Tc/ha				
SP	844.85	2326.6	4060	5075.5	12307.0	18.42	12894	1:1.04	58.44
Maize	350.0	1200.0	4200.0	2500.0	8250.0	12	6900	1: 0.76	No Credit Used
Mustard	200.09	1500.0	3000.0	2000.0	6700.0	2.5	5000	1:0.74	
Lentil	600.0	1600.0	1800.0	1500.0	5500.0	2.0	3000	1:0.55	
2.Small Farmers						Actual output produced (In Qtl)	Output (In Rs.)	Input-output ratio	% of credit used
Crops	Seeds	Manures	B/T	Labour	Tc/ha				
SP	549.4	2355.8	3949.0	4031.1)	10885.5.5	18.5	14392	1:1.13	67.44
Maize	250	1250	4400	2500	8400.0	12	7200	1:0.83	No Credit Used
Mustard	200.0	750.0	2600.0	2000.0	5550.0	2.75	4125	1:0.74	
Lentil	1200.0	1600.0	2000.0	1600.0	6400.0	2.25	3375	1:0.53	
3. Medium and Large Farmers						Actual output produced (In Qtl)	Output (In Rs.)	Input –output ratio-	% of credit used
Crops	Seeds	Manures	B/T	Labour	Tc/ ha				
SP	743.46	2527.45	3790.0	4392.8	11453.7	20	15000	1:1.31	68.05
Maize	350.0	1200.0	4200.0	2000.0	7750.0	12.65	7115	1:0.91	No Credit used
Mustard	200.0	1200.0	3000.0	1500.0	5900.0	3.2	5200	1:0.88	
Lentil	600.0	1600.0	1800.0	1500.0	5500.0	2.85	4631	1:0.84	

Source: Computed from Field Survey Data, 2001

Note:- SP = Summer paddy; B/T = Bullock or tractor; Tc/ha =Total cost per hectare

The above table 6.32 shows that the farmers in the low developed area are not using credit optimally. Only 58.44 percent of the total credit borrowed by the marginal farmers is used for production of paddy and the input-output ratio for paddy is slightly greater than one. If we compare this ratio with the recommended level we find that there is significant difference between the two. If inputs are used optimally the input-output ratio comes out to be 1:1.65 (Table 6.31). All other ratios except for paddy are less than one implying lower levels of inputs used in the production. If the farmers had used the total credit borrowed for the production of other crops, total output would have increased more than what they were producing. The farmers did not use credit for the production of other crops as shown in the (Table 6.32). The similar trend is observed for small and marginal farmers in the low developed area. The small and medium and large farmers are using 67.44 and 68.05 percent of the total credit borrowed respectively. One important point to be noted is that in the total cost of production the rent paid by the farmers and expenditure made for capital expenditure are not included. If we take into consideration these expenditures also, then all the farmers farm business will be in loss and more credit will require continuing farm operations.

6.6.3 Optimal Use of Credit by Farmers–Moderately Developed Area

The results obtained for marginal, small and medium and large farmers in moderately developed area are presented in the table 6.33 below.

Table 6.33: Per Hectare Cost of Production, Realized Output and Input-output Coefficients of Sampled Farms

(Moderately Developed Area)

1.Marginal Farmers						(in Rs.)	Actual output Produced (In Qtl)	Output (In Rs.)	Input-output ratio	% of credit used
Crops	Seeds	Manure	**B/T**	**Labour**	**Irri**	**Tc/ha**				
SP	1129.2	2699.0	3903.3	5464.2	570.0	13766	22.42	15694.0	1: 1.14	60.24
Wheat	1600.0	3500.0	4355.2	5500.0	1400.0	16355.0	20.0	15000.0	1:0.91	57.55
Maize	350.0	1250.0	4200.0	2400.0	200.0	8400.0	11.5	8050	1:0.95	No Credit Used
Mustard	200.0	1500.0	3000.0	200.0	200.0	6500.0	3.0	5250.0	1:0.81	
Lentil	600.0	250	1600	1400	250.0	4100.0	2.5	2500.0	1:0.60	
2.Small Farmers							Actual output produced (In Rs.)	Output (In Rs.)	Input-output ratio	% of credit used
Crops	Seeds	Manures	B/T	Labour	Irri	Tc/ha				
SP	626.45	2689.0	3760.6	3888.3	540.6	11505	22.5	15750.0	1:1.37	63.14
Wheat	2394.9	3527.0	4336.4	2311.5	1059.0	13629.0	21.5	15050.0	1:1.10	70.12
Maize	50.0	1200	4200	2400	550.0	8700.0	13.25	8612.50	1:0.99	No Credit Used
Mustard	200.0	1200.0	3000.0	1800.0	250.0	6450.0	3.05	5337.5	1:0.83	
Lentil	437.14	145.1	1354.0	1361.7	250.0	3547.94	2.75	2475	1:0.70	
3.Medium and Large Farmers							Actual output produced (In Rs.)	Output (In Rs.)	Input-output ratio-	% of Credit Used
Crops	Seeds	Manures	B/T	Labour	**Irri**	**Tc/ha**				
SP	596.2	2212.0	3552.4	4082.8	576.0	11019.0	20.25	14175.0	1:1.33	62.35
Wheat	2381.6	3504.0	4081.3	2890.5	1519.0	14376.0	18.5	12950.0	1:0.90	65.64
Maize	250.0	750.0	4200.0	20-00.0	250.0	7450.0	12.45	8092.0	1:0.92	No Credit Used
Mustard	200.0	750.0	3200.0	1500.0	260.0	5910.0	2.28	3990.0	1:0.68	
Lentil	600.0	500.0	2000.0	1200.0	250.0	4550	2.5	2500.0	1:0.55	

Source: Computed from Field Survey Data, 2001

In the above table 6.33 we see that in the moderately developed area also the farmers are not using credit optimally. The marginal farmers are using 60.24 percent of the total borrowed amount. The input-output coefficients except paddy are all less than unity implying lower levels of production than investment per hectare. The small farmers are also not using credit optimally. Therefore, the production of crops when compared to recommended level is far below the optimum level. The medium and large farmers are also not using credit optimally in moderately developed area. All the input-output ratios except paddy are less than unity implying that the farmers are not able even to cover the variable costs.

6.6.4 Optimal use of Credit – Developed Area

The results obtained for marginal, small and medium and large farmers in the developed area are presented in the table 6.34 below.

Table 6.34:Per Hectare Cost of Production, Realized Output and Input -output Coefficients of Sampled Farms

(Developed Area)

1.Marginal Farmers						(in Rs.)	Actual output produced (In Qtl)	Output (In Rs.)	Input-output ratio	% of Credit Used
Crops	Seeds	Manure	B/T	Labour	Irrigation	Tclha				
EP	1000.0	3500.0	4800.0	5500.0	2000	16800.0	21.5	15050.0	1:0.89	50.5
LP	1000.0	2500.09	4600.0	5500. 0	1200.0	14800.0	18.2	12740.0	1:0.86	No credit Used
SP	544.84	1941.43	3767.86	4489.23	243.65	10987.0	20.05	15037.5	1:1.37	
Wheat	2099.60	3021.07	3753.95	3112.6	373.02	12360.0	16.5	11550.0	1:0.93	60.25
2.Small Farmers							Actual output produced (In Qtl)	Output (In Rs.)	Input-output ratio	% of Credit Used
Crops	Seeds	Manure	B/T	Labour	Irrigation	Tclha				
EP	1000.0	3500.0	4600.0	5500.0	1500	16100.0	22.46	15722.0	1:0.97	70.05
LP	1000.0	4500.0	4800.0	5500.0	2000.0	17800	19.05	13335.0	1:0.75	No Credit Used
SP	626.45	2688.75	3760.6	3888.3	540.6	11505.0	20.85	15637.0	1:1.36	
Wheat	2394.93	3527.18	4336.4	2311.5	1059.0	13629.0	17.5	12250.0	1:0.89	75.05
3.Medium and Large Farmers							Actual output produced (In Qtl)	Output (In Rs.)	Input-output ratio-	% of Credit Used
Crops	Seeds	Manure	B/T	Labour	Irrigation	Tclha				
EP	1000.0	2500	4500.0	5500.0	1500.0	15000.0	18.5	12950.0	1:0.86	54.06
LP	1000.0	4500.0	4600.0	6600.0	2000.0	18100.0	17.55	12285.0	1:0.68	No Credit Used
SP	596.2	2212.3	3552.4	4082.8	575.5	11019.2	18.86	13770.0	1:1.24	
Wheat	2381.6	3503.8	4081.3	2890.5	1519.0	14376.2	16.68	11676.0	1:0.81	66.75

Source: Computed from Field Survey Data, 2001
Note:- EP = Early paddy; LP = Late paddy

In the developed area it was found that farmers grew crops three times and most of them took loan for producing early paddy and wheat. They borrowed for early paddy and wheat and self-finance was used for late paddy and summer paddy. The results show that all the input-output coefficients are less than unity except summer paddy. This means the production level of early paddy and wheat can be increased by rationally utilizing the borrowed loan in the production of other crops.

From the discussions presented above we come to the conclusion that the farmers in Morang district are not using credit optimally.