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Research Note

RESOURCE USE EFFICIENCY OF IRRIGATED-HYV BORO RICE CULTIVATION BY DIFFERENT FARM SIZE GROUPS AND ITS IMPACT ON EMPLOYMENT AND DISTRIBUTION OF INCOME IN DTW II PROJECT AREA OF MYMENSINGH

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ABSTRACT

The study seeks to verify the contending propositions of size productivity relationship prevailing in DTW II Project, to measure and compare per hectare cost, returns, farm productivity, to estimate the impact of farm size on employment. It uses empirical data collected through a lengthy intensive farm survey of 220 sample farmers in an area of Mymensingh district in Bangladesh. The study shows that medium farms obtained the highest yield and gross margin despite using least amount of inputs. They were technically more efficient but no farm group was found to be efficient allocatively. The study also shows that there is scope to increse the doses of fertilizer despite its higher price in the recent years. It is also found that small farms created more employment opportunities and medium farms used resources more efficiently in the study area.

I INTRODUCTION

To feed the rapidly growing population, government of Bangladesh has given top priority to the resolution of the food shortage and set a plan to achieve food autarky by 1995. In fact, there is a substantial prospect for achieving food autarky by increasing agricultural productivity through the introduction of seed, fertilizer and irrigation technologies. Among them, irrigation is important in the sense that use of other technologies is limited in the absence of irrigation. For that reason, government with the help of donor agencies is spending lot of money on tubewell irrigation and has fixed a target of bringing 22 and 7 lakh hectares under shallow and deep tubewell (DTW) irrigation respectively by the end of fourth five year plan (GOB, 1990). One of the projects implemented is DTM II project under which 4000 DTWs are installed.

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However, farm size is an important factor to increase productivity of inputs. The field level studies on productivity in relation to farm size are inconclusive and confusing in policy recommendation. Those who observed inverse relationship between farm size and productivity are, among others, Sen (1964), Bardhan (1973) in India and Hossain (1977) in Bangladesh. No relationship was observed by Rao (1967) in India and Islam (1974) in Bangladesh. However, Ghosh (1973), Mandal (1979) and Bhuiyan (1986) found that medium farm size groups were more productive. Mandal (1979) and Chattopadhyay & Rudra (1977) were strongly in view that certain relationship might operate in a certain region at a certain time but that might vary due to variation in resource endowments and cropping patterns. Since it is still a cotroversial and largely inconclusive issue, it is crucially important to examine which situation is prevailing in DTM II project area; whether the farmers of different farm size categories are efficiently allocating their resources or not.

Agriculture is still the major source of employment in Bangladesh. It accounts for 60 percent of employment opportunities. In rural area, there is abundant labour force who sell out their labour as their prime source of income and employment. So it is necessary to estimate which farm size group absorbs more agricultural labour to eradicate unepmployment. Income distribution is also a vexed and long debated question. Income distribution among the factors of production is a crucial issue as it qualifies how factors of production are contributing to the gross value of production. Equity in income distribution is desirable for sustainable economic growth. But various field studies obsrved varied phinomenon relating to income distribution. Modern technology is criticised by many researchers for its adverse impact on income distribution. In this context, it is worthwhile to estimate how income generated from the HYV boro cultivation in the Project area is being distributed among various factors of production in different farm size groups. The study is an attempt to examine the resource use efficienc with respect to farm size of HYV Boro paddy cultivation and its effect on employment and income distribution in DTW II Project area. The hypotheses which are to be tested are: productivity, cost, return and resource use efficiency do not vary significantly among different farm size groups and farm size has no effect on employment and income generation. The paper is organised as follows: Section II discusses sources of data. Analytical techniques used in the paper are the presented in section III. Section IV deals with results and discussion. Summary and conclusions are made in section V.

II. DATA SOURCES

The study used the data collected for annual monitoring survey of DTM II Project for 1991-92 irrigation season. Crop production data collected from 220 sampled farmers in Mymensingh area were used in this study. The study area covers all the thanas of Mymensingh district. Farmers were selected by systematic sampling procedure from the "irrigation ledger" collected from the managers of the selected schemes. Data collection was made by the

field personnel of Directorate of Agricultural Extension during June-July, 1992. The selected farmers were classified into three groups on the basis of area owned: small farms (upto 1.00 hectare), medium farms (1.0 to 2.02 hectares) and large farms (above 2.02 hectares).

III. ANALYTICAL TECHNIQUES

Cobb-Douglas production function of the following type was used in this study.

$$Y = {}_{b0} X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} e^u$$

or $\ln Y = \ln b_o + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + u;$

Where,

Y = Physical output in kg per plot

x_1 = Mandays of human labour

x_2 = Pairdays of draft power

x_3 = Amount of fertilizer in kg

x_4 = Distance in metre of plot from well

x_5 = Plot area in decimal

u = Error term

The function was fitted for three groups of farms separately. Variable inputs like manure, pesticides and seed were excluded from the analysis for various reasons. Manure was excluded because a large number of farmers did not use it. Pesticides used in different farms are very difficult to quantify. Since farmers use seeds or seedlings in more of less fixed rate, it might not be reasonable to use seed as an argument of a production function. To see the impact of farm size on employment, total and hired labour were considered separately and covariance analysis of the following specification was used.

$$L = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + u$$

Where,

L= Total or hired labour requirement per hectare

x_1 = Yield per hectare

x_2 = Wage price ratio

x_3 = Size dummy for medium

x_4 = Size dummy for large

u = Error term

Factor share approach was applied to measure the impact of farm size on the distribution in income among the factors of production. In factor share approach, gross value added by

factors of production was decomposed into three parts such as payment to variable inputs other than human labour, payment to human labour and operator's earning as residuals.

IV. ANALYSIS OF RESULTS

Land Distribution Pattern

It is an overwhelmingly weight of anecdotal evidence that there is a drastic inequality in land distribution in a developing country like Bangladesh. Lorenz curves in Fig. 1 depict the

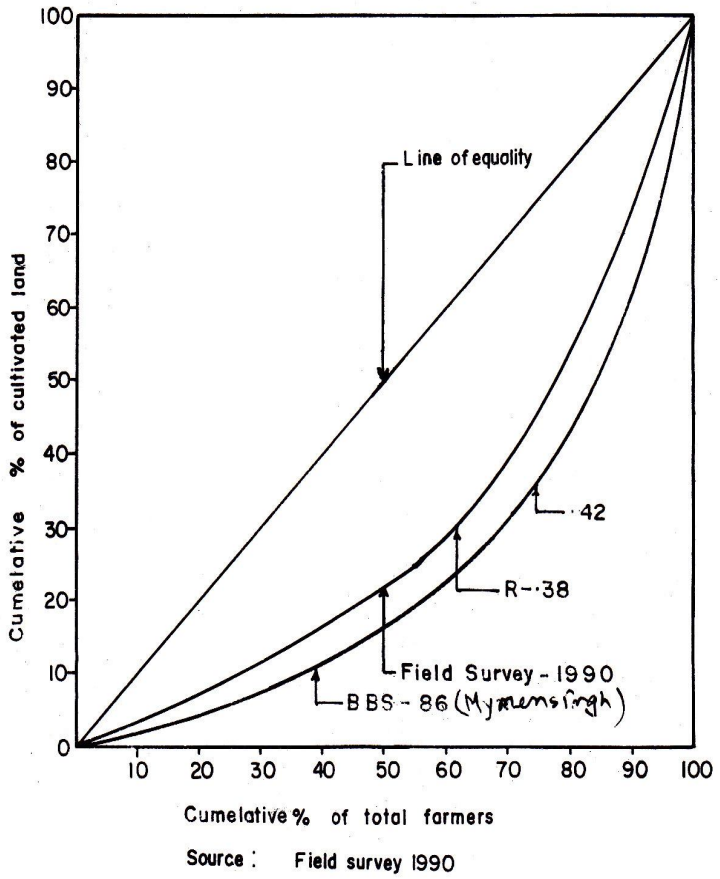

Figure-1. Lorenz curve showing distribution of sampled farmers and cultivated area

distribution of land in accordance with the farm size for Mymonsingh district and for the sampled farmers. The curves diverge from the line of equality meaning inequality in land distribution in Mymensingh as well as for the farmers under study. The Lorenz curves for the sampled farmers is close to the line of equality than that for Mymensingh. The gini ratios are estimated to be 0.38 and 0.42 for Mymensingh and sampled farmers respectively. Thus it may be safely inferred that more equitable distribution of land prevails for the sampled farmers compared to Mymensingh district. Like land owned, land under Bore cultivation is also unequally distributed among the different categories of farmers in the study area. The small,

medium and large farmers cultivated Boro paddy average 0.13, 0.69 and 2.88 hectares of land in Mymensingh district respectively. (B. B. S., 1986).

Distance of plots from DTW II Location

The distance of a plot from the pump is important in the sense that closer plots are expected to receive more water supply. A distance of less than 182 yards is considered as nearer to the pump. It is observed from Table 1 that about one-half of all categories of farmers' plots are nearer to the pump. The result is contrary to the common belief that the tubewells are often installed near to the large farmers' plots.

Table 1. Distance of Plots From DWT Location by Farm Size Groups.

(No. of farms)

Farm size	Distance (metre)			
	(0-182)	(183-546)	(547-1092)	(above 1092)
Small	59	47	18	0
	(48)	(38)	(14)	(0)
Medium	42	33	12	1
	(48)	(38)	(13)	(1)
Large	23	20	3	0
	(50)	(43)	(7)	(0)

Figures in the parentheses are percentage of farmers in each distance category.

Input use, Cost and Return

Table 2 and Table 3 show the amount of various input used, cost and return of cultivating Boro paddy. Seeds are estimated to be 47.02, 41.46 and 53.41 kgs per hectare for small, medium and large farms respectively; except small with large their differences are found to be statistically significant. On the other hand, seed and seedling cost were Tk.684.59, Tk. 633.73 and Tk. 514.11 for small, medium and large size groups respectively, which implies that cost is immensely related to farm size. This may be explained by home grown seedling used by large farm size group.

Per hectare use of total fertilizer were 321.55, 310.55 and 472.17 respectively for small, medium and large farmers. Large farmers used significantly higher doses of fertilizer than their small and medium counterparts. But fertilizer doses of small and medium farmers did not differ significantly. Likewise, fertilizer cost was the highest for large farmer, followed by small and medium farmers.

Manure applied by small, medium and large farmers were 4930.49, 2490.38 and 3038.72 kgs per hectare respectively. As the small farmers possessed relatively more cattle per unit of land, they used higher doses of manure compared with other farmers. Bhuiyan (1986) observed the same phenomenon for organic manure in West Bengal. The cost of manure was also the lowest for the small farmars (Table 3). Small, medium and large farms used 207.46, 183.62 and 201.58 mandays of labour per hectare respectively in cultivating irrigated Boro rice (Table 4). Highest mandays were used by small group because of their abundant supply of family labour. Small and large farms

Table 2. Distribution of per Hectare Material Input Used by Different Farm Size Groups

Material input used	Unit	Farm size				Difference		
		Small	Medium	Large	All group	Small with medium	Medium with large	Small with large
Seeds	Kg	47.02	41.46	53.41	47.71	2.69***	-11.95*	-5.77
						(1.67)	(-2.66)	(-1.41)
Seedlings	Taka	206.64	172.75	0	166.38	32.53	172.75*	206.64*
						(0.17)	(3.51)	(3.43)
Urea	Kg	204.86	186.64	308.69	220.96	18.22	-122.05***	103.83
						(1.44)	(-1.91)	(1.63)
TSP	Kg	86.83	85.57	107.35	90.55	1.26	-21.78	-20.51
						(0.09)	(-1.51)	(-1.49)
MP	Kg	29.86	38.34	56.14	38.36	-8.48***	-17.80	-26.28**
						(-1.75)	(-1.28)	(-1.93)
Total fertilizer	Kg	321.55	310.55	472.18	349.87	11.00	-161.62**	-150.62***
						(0.76)	(-1.97)	(-1.83)
Manure	Kg	4930.49	2490.38	3038.72	4000.14	2440.11	-548.34	1891.77
						(1.32)	(-0.64)	(0.97)
Pesticides	Taka	296.76	304.55	355.43	323.00	7.85	50.88	-58.73
						(0.14)	(0.68)	(-0.97)
Human labour	Man-day	207.46	183.62	201.58	200.91	23.84*	-17.96**	5.87
						(2.58)	(-2.45)	(0.85)
Draft power	Pair day	45.25	30.13	41.60	40.76	15.12*	-11.46*	3.66
						(10.05)	(-3.76)	(1.08)
Yield :								
Paddy	Kg	4256.04	4743.14	4359.31	4429.68	487.11**	383.82	-103.27
						(1.99)	(1.29)	(-0.52)
Straw	Kg	2647.57	2694.18	2339.59	2776.43	-46.61	354.59	307.98
						(-0.10)	(0.67)	(0.85)

Figures in the paraenthesis are t values

*, ** and *** indicate significant at 1% 5% and 10% levels respectively.

Table 3. Farm Cost and Income of Different Farm Size Groups.

(Tk./Hectare)

Resource used	Farm size			
	Small	Medium	Large	All size
Seed and seedling	684.59	633.73	514.11	649.81
Fertilizer	1734.56	1679.67	2538.49	1871.52
Manures	1132.69	572.10	697.78	918.96
Pesticides	296.70	304.55	355.43	323.00
Total labour	7873.77	6969.35	7543.99	7587.47
Total draft power	2109.78	1557.95	1862.55	1863.49
Water charge	2827.24	2827.24	2827.24	2827.24
Total full cost	16659.31	14561.59	16339.59	16041.49
Gross income	2528.53	27944.59	26368.73	26302.39
Net income	8579.22	13383.00	10029.14	10260.90
Human labour hired	3932.81	4317.76	5802.03	3915.86
Draft power hired	223.26	192.98	252.46	355.43
Total cash cost	8014.57	9312.20	11775.65	9293.05
Income over cash cost	17223.96	18632.39	14593.08	17009.34

used significantly higher labour than medium farms. The reason behind the lower labour use by the medium farmers is that unlike large farmers they can neithee hire labour as required nor they have abundant family labour like small farmers. Mandal (1979) observed that medium farmers used less labours on some important operation like land preparation, weeding and harvesting because of hiring out their family labour for cash wage. On the other hand, large farmers could not use more labour for scarcity.

As expected, Table 4 shows that family labour use is inversely related whereas hired labour use is directly related to the farm size. It is also found that cost of total labour and farm size are inversely related and hired labour cost increases with the increase of farm size.

Per hectare paired days of bullock power was estimated to be 45.25, 30.13 and 41.60 for small, medium and large farm size groups respectively. Small and large farms used significantly higher draft power than medium farms, but, the difference between small and large farms are insignificant. Cost of draft power was the lowest for medium farms followed by large and small farms (Table 3).

Table 4. Operationwise distribution of labour by farm size group.

Operation item	Farm size											
	Small			Medium			Large			All size		
	Family	Hired	Total	Family	Hired	Total	Family	Hired	Total	Family	Hired	Total
Land preparation	19.41	10.15	29.57	17.49	10.77	28.26	16.97	18.62	35.59	18.53	11.93	30.46
Sowing/transplanting	16.94	32.90	49.84	10.70	30.70	41.40	2.89	44.81	47.70	12.15	34.88	47.03
Weeding	13.86	20.72	34.58	9.76	22.80	32.55	8.37	29.74	38.11	11.93	22.21	34.14
Irrigation	5.95	1.09	7.04	3.09	2.57	5.66	2.87	1.28	4.15	5.93	1.51	7.43
Manure application	3.29	3.14	6.42	2.69	2.64	5.34	1.70	4.42	6.13	3.53	3.24	6.77
Fertilizer application	0.32	0.00	0.32	2.22	1.19	3.41	2.27	0.91	3.19	3.31	1.19	4.50
Chemical application	1.24	0.25	1.48	0.86	0.40	1.26	0.47	0.54	1.01	0.79	0.32	1.11
Harvesting	15.49	28.03	43.52	9.68	25.07	34.75	4.96	30.26	35.22	12.23	27.59	39.82
Carrying	9.90	4.67	14.57	3.80	7.95	11.76	2.05	11.49	13.54	5.09	6.74	11.83
Threshing drying etc.	12.13	4.74	16.87	9.46	9.78	19.24	4.77	12.18	16.94	10.13	7.71	17.83
Total labour (manday)	101.74	105.72	207.46	69.01	114.61	183.62	47.33	154.25	201.58	83.61	117.30	200.91
Percentage of total	49	51	100	38	62	100	23	77	100	41	59	100

Four different modes of water charge payment such as fixed cash, crop share, farmers' fuel and fixed crop were found in the study area. Under fixed cash and fixed crop methods, a fixed amount of money and crop are paid respectively as water charge. In case of crop share, users usually pay 1/4 of their harvest as payment for water. In farmers' fuel method, apart from fixed cash, farmers supply fuel for irrigating their land. Per hectare water charge were calculated to be Tk. 2806.17, 3211.00 and 6261.20 for fixed cash, farmers' fuel and crop share payment method respectively. Water charge were maximum for crop share because in this method the users were benefitted as they pay nothing as water charge before harvest.

Total full costs per hectare were computed as TK.16659.31, 14561.59 and 16339.59 for small medium and large size groups respectively. This was the highest for small farms followed by large and medium farms. On the other hand, the respective cash costs were found to be Tk. 8014.57, 9312.20 and 11775.65 for small, medium and large farms. (Table 3). The total cash costs were positively related to farm size which may be due to the fact that larger group of farmers used more hired labour in their plots. It is mentioned that labour cost was the highest cost item (about 50% of total cost) followed by irrigation charge.

Paddy yield was the highest for medium farms followd *by by* large and small farms (Table 2). Medium farms' yield was found to differ significantly with small farms. The result is consistent with Mandal (1979) and Hossain et. al. (1987). However, Hossain (1977) and Bhuiyan (1986) observed higher yield on small farms. Rathore (1984) observed two different results in two different places. Abedin and Bose (1988) found higher output on medium and large farms due to the adoption of modern technology.

Gross farm income was estimated at Tk.25238.53, 27944.59 and 26368.73 and net income was Tk. 8579.22, 13383.00 a nd 10029.14 for small, medium and large size group respectively. The study thus reveals that gross as well as net income were the highest for medium farmers followed by large and small farmers. But in case of income over cash cost, large farmers' income was the lowest because of their higher cash cost. The highest income of the medium farmers may be attributed to their lower input use and by their size owned as observed by many researchers.

Estimated Production Function

The estimated production functions are presented in Table 5. The corresponding coefficients of various inputs are elasticities of yield with respect to those inputs. The estimated elasticity of human labour is positive and significant for small farm size group. The negative coefficient of human labour for medium and large farms may be explained by their hired labour use. The result thus implies that small farms are more productive in human labour use compared with medium and large farms. Similar results were also observed by Hossain *et. at.* (1987) and Jahan (1985). Hossain (1977) also observed inverse relationship

Table 5. Estimated Cobb-Douglas Production Function for Different Groups of Farms Estimated Per Plot Basis.

Size	Particulars	Constant	Human labour (X_1)	Bullock power (X_2)	Fertlizer Distance (X_3)	Distance (X_4)	Plot size (X_5)	df	F ratio	R^2
Small	Regression coefficient (b)	-0.11	0.20	0.27	0.17	-0.04	0.40	118		0.72
	t (b)		1.50	3.13	1.96	0.90	2.99		60.17	
	Level of significance		(0.10	(0.10)	(0.05)	ns	(0.01)		(0.01)	
Medium	Regression coefficient (b)	0.06	-0.17	0.12	-0.03	-0.06	0.99	52		0.72
	t (b)		1.08	0.88	0.29	1.35	5.09		26.23	
	Level of significance		ns	ns	ns	ns	(0.01)		(0.01)	
Large	Regression coefficient (b)	-0.55	-0.65	0.42	0.24	-0.01	1.30	38		0.82
	t (b)		3.46	2.87	2.53	0.49	6.92		29.87	
	Level of Significance		(0.01)	(0.01)	(0.05)	ns	(0.01)		(0.01)	

'ns' indicates not significant

between labour productivity and farm size. This inverse relationship may be explained by distribution of human labour. Large farms, compared to small and medium farms, depend more on hired labour than family labour. There might be qualitative difference between family labour and hired one as family labour become more sincere when they work on own land. Besides this, large scale hired labour used in peak season over a scattered plots is a serious management problem for large farms.

In case of draft power, the estimated coefficients for small and large farms are positive and significant but the magnitude of coefficient for small farms is lower compared with large farms. As the small farm has relatively more bullock power per unit of land , they use bullock power lavishly. So, the productivity of bullock for small farms is low. On the other hand, large farmers may have better quality of bullock and comparatively more land to use them productively. So, their productivity is high. From this it may be inferred that productivity of bullock power is more for large farms compared with small farms. Bhuiyan (1986) obtained the similar result in case of Aman paddy.

The higher and significant positive coefficient of fertilizer for large farmers indicates that they obtained more yield from the use of fertilizer. Since they are more educated, they perhaps used fertilizer in proper amount at proper time. The negative and insignificant coefficient of fertilizer for medium farms may be explained by the fact that in their production function, plot size acted as a dominat variable which absorbed almost all the variation of output keeping nothing for the others.

The coefficients related to the distance of plot are all negative and insignificant with the exception of medium farm's coefficient which is significant at 10% level. This indicates that except medium farm distance factor does not hamper the crop production. Even then the effect of distance on crop production can not be ruled out since it affects the productivity in different ways. As for example the nearer plots may be affected by excessive water supply.

All the coefficients of plot size are positive and significant. However, small farmers' coefficient is lower compared with other farmers. That means in case of small farmers, plot size is not a more important variable like medium and large farms.

The summation of estimated elasticities are 1.00, 0.85 and 1.30 for small, medium and large farms respectively (Table 6). This signifies that small, medium and large farge farms are operating respectively under constant, decreasing and increasing return to scales.

Comparison Among Various Production Functions:

To test difference in production functions among the farm groups three production functions with pooled data for small and medium, medium and large and small and large farm size groups are estimated and are presented in Table 7. The significance of Chow test's F ratios

Table 6. Production Elasticities and Returns to Scale According to Farm Size in Physical Terms

Size groups	elasticities					
	b_1	b_2	b_3	b_4	b_5	E= bj
Small	0.20	0.27	0.17	-0.04	0.40	1.00
Medium	-0.17	0.12	-0.30	-0.06	0.99	0.58
Large	-0.65	0.42	0.24	-0.01	1.30	1.30

indicate that two farm size groups have different production functions. To see whether these difference are due to difference in intercept, three more production functions with intercept dummies are estimated. The significant coefficients of intercept dummies point out that intercepts differ among the production functions.

Economic Efficiency

Economic efficiency is the combination of technical and allocative efficiency. By seeing the regression constant of each group of farm it is possible to point out which group of farm is technically more efficient. The regression constant are estimated to be -0.11, 0.06 and -0.55 for small, medium and large farms respectively. This shows that the medium farm group is technically more efficient as it's constant only possesses a positive sign. The study support Ghosh (1973) and Mandal (1979).

Allocative efficiency can be measured by the ratio of marginal value product (MVP) and marginal factor cost (MFC). A farm is said to be allocatively efficient if its ratio of MVP and MFC is equal or close to one. Table 8 shows the farmwise MVP/MFC ratios for different inputs. It is found that except human labour for small farms, all the ratios are different from one. Thus the study reveals that only the small farms are allocatively efficient in case of human labour. Draft power ratios for small and medium farms are close to one indicating that they more or less allocated draft power efficiently. On the other hand, it is more economic to increase the draft power input by the large farms in the study area as revealed by their higher draft power ratios (2.50). The higher fertilizer ratios for small and large farm implies that they can increase their profit by applyig more fertilizer per unit of land. Finally, it can be concluded that no farm is found to be allocatively and thereby economically efficient in using inputs in the study area.

Table 7. Estimated Production Function of Two Group of Farmer

Variable	Pooled			Pooled With intercept dummy		
	Small With Medium	Medium With Large	Small with Large	Small with Medium	Medium With Large	Small with Large
Constant	-0.09	-0.20	1.77	-0.06	-0.16	1.83
Human	0.09	-0.32**	0.05	0.08	-0.32**	0.03
Labour	(0.92)	(-2.47)	(0.31)	(0.80)	(-2.55)	(0.28)
Bullock	0.20*	0.19***	0.27**	0.27*	0.26**	0.30*
Power	(2.99)	(1.90)	(2.54)	(3.92)	(2.56)	(3.95)
Fertilizer	0.09***	0.07	0.34*	0.11***	0.10	0.17***
	(1.40)	(1.07)	(3.76)	(1.65)	(1.52)	(2.52)
Distance	-0.05**	-0.02	0.08***	0.04	-0.02	-0.03
	(-1.80)	(-0.80)	(1.81)	(1.49)	(-0.78)	(-0.96)
Plot Area	0.63*	1.08*	-0.44**	0.54*	1.02*	-0.43*
	(5.79)	(7.86)	(-2.87)	(4.96)	(7.37)	(-3.87)
Intercept Dummy (a)	-	-	-	0.09*	-	-
				(3.60)		
Intercept Dummy (b)	-	-	-	-	-0.07**	-
					(-2.33)	
Intercept Dummy (c)-	-	-	-	-	-	0.39*
						(12.97)
R^2	0.71	0.71	0.19	0.73	0.73	0.61
F ratio	33.10*	17.40*	7.15*	43.43*	21.09*	39.21*

*, ** & *** indicate significant at 1, 5 & 10 per cent level respectively.

Figures in the parentheses are t values.

a: 1 for medium and 0 for small farms

b: 1 for large and 0 for medium farms.

c: 1 for small and 0 for large farms.

Table 8. Marginal Value Product (MVP) and Marginal Factor Cost (MFC) Ratio for Different Groups of Farmers.

Size group	MVP/MFC		
	Human labour	Draft power	Fertilizer
Small	1.00	0.89	4.56
Medium	-0.95	0.86	-0.85
Large	-3.90	2.50	6.96

Farm Size and Employment

Several studies (Hakim, 1985; Mandal, 1979) show that irrigation increases the demand for labour by increasing net cropped area. In this section, we will see how farm size affects labour requirement in an irrigated farming situation. For that purpose covariance analysis was used and the results are shown in Table 9. The positive and significant coefficient of yield

Table 9. Results of Covariance Analysis

Independent Variable	Labour	
	Hired (manday)	Total (manday)
Intercept	-3.40	1.80
Yield (maund)	1.82*	0.21*
	(0.37)	(0.04)
Wage rate/price	-2.42*	0.21*
	(-0.88)	(0.08)
Size dummy (medium)	0.09	-0.07*
	(0.21)	(-0.02)
Size dummy (large)	0.42*	-0.04
	(0.24)	(-0.03)
Adjusted R^2	0.17	0.15
F-ratio	11.23***	10.76***
No. of observations	220	220

Figures in the parentheses are the standare errors.

*, ** and *** indicate level of significance at 1, 5 and 10 percent level respectively.

indicates that higher yield increases the demand for labour in the study area. Higher yield increases labour demand in two ways. First, higher yield requires higher amount of harvest and post-harvest labour. Second, farmers use higher mandays of labour if they can foresee higher yield. The negative and significant coefficient of wage rate price ratio for hired labour is consistent to the employment theory. But for total labour, the coefficient is positive and significant. Rahman (1988) observed the similar relationship between wage rate and labour in the Philippines. The positive relationship between wage rate and total labour use may be explained by family labour use by small farms which outweighs the negative relationship for other categories of farms.

In case of total labour, coefficients of medium farm dummies are negative and significant. This signifies that small farm groups employed more labour than medium farms which means that small farms created more employment opportunities in the study area. In case of hired labour, coefficient of large farm dummy is positive and significant which implies that compared with others, large farms used more hired labour. Thus the study reveals that farm size differs in respect of labour employment. In other word, farm size affects significantly the employment.

Farm Size and Distribution of Income

The impact of farm size on distribution of income can be seen in Table 10. Factor payment as well as factor share for current inputs and human labour were the lowest for medium farms because they used less amount of variable inputs and human labour.

Table 10. Factor Share of Irrigated HYV Boro Rice Cultivation.

Farm	Factor payment (Tk./hac.)				Factor share (%)			
group	Variable input*	Human Labour	Operators residual**	Gross return	Variable input	Human Labour	Operator's residual	Gross return
Small	8121	7874	9243	25238	32	31	37	100
Medium	7358	6998	13589	27946	26	25	49	100
Large	8796	7790	10028	26370	33	29	38	100
All group	8042	7588	10673	26303	31	29	40	100

*includes seeds and seedling, fertilizer, manure, insecticides, draft power cost and water charge.
** returns over land and capital.

On the other hand, medium farm operator received the highest return over capital and labour because of the fact that they obtained higher gross income despite less amount of variable inputs and human labour used. Income distribution was more or less same for small and large farms. Thus the study shows that regarding distribution of income medium farms differ significantly from small and large farms.

V. SUMMARY AND CONCLUSION

Land distribution among the farm groups shows serious inequality and skewed distribution in the study area. However, this inequality in land ownership was less for sampled farmers compared to Mymensingh district. Regarding installation of DTW, the study does not find any bias toward large farms.

Medium farms, compared with large and small farms, were found to use less amount of material inputs as well as labour inputs in the study area. As a result, their total cost of production was the lowest. On the other hand per hectare yield as well as gross margin was the highest for the medium farms. The study shows that medium farm group was technically more efficient. However, no farm group was found to be allocatively efficient. In case of fertilizer, Marginal Value Product was much higher than the Marginal Factor Cost for small and large farms. This implies that there is scope to increase the doses of fertilizer despite its higher price in the recent past. For that purpose, government should ensure the timely availability of fertilizer at a reasonable price.

Farm size affects significantly the employment as the small farms created more employment opportunities in the study area. The result of factor payment and factor share reveals that medium farms are more efficient in resource use as they received the highest operator's residual.

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