EXTENT OF ADOPTION OF MODERN TECHNOLOGY ON HYV BORO RICE FARMS: A STUDY IN A SELECTED AREA OF BANGLADESH

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ABSTRACT

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The overall objective of the study was to accomplish a comparative analysis of adoption of modern technology under owner and tenant farms in a selected area of Dinajpur district. A total of 60 households, 30 owner operators and 30 tenant operators were selected on the basis of purposive random sampling technique. Majority of the owner farmers were between 41-50 years and tenant farmers were between 30-40 years of age. Agriculture was the major occupation of both types of farmers. Overall literacy level of the sample farmers was 50 percent. Owner farmers had bigger farm size than tenant farmers. Income from the crop constituted the highest for both categories of farmers. The degrees of adequacy level in the application of modern farm inputs were higher in owner farms than in tenant farms. An attempt was made in this study to explore a composite view of the adoption of modern technology on HYV Boro rice growing farms. For Boro rice production, the majorities (67 per cent) of owner farmers of the study area were low adopters and 33 per cent of them were medium adopters. On the other hand, 87 per cent tenant farmers producing Boro rice were low adopters and 13 per cent of them were medium adopters. The study also revealed that because of poor resource base the tenants were unable to invest on modern farm inputs.

Key words: Adoption, modern technology, owner and tenant farmers

INTRODUCTION

Land tenure refers to the possession of right to the use of land. People hold varying kinds of rights in the use of land and are said to belong in different tenure classes (Bishop and Toussaint, 1958). In other words, tenure system implies the interrelationship among (i) landlord, (ii) tenant and (iii) government. There are many different types of tenure arrangements in Bangladesh agricultural economy today. These arrangements influence the efficiency with which inputs are used. They also affect the degree of uncertainty encountered in the operation of a farm. Although innumerable classifications are possible, most tenure arrangements can be placed in one of the three main classes: a) Owner operators; b) Owner – cum – tenant operators; and c) Tenant operators (Zaman, 2004).

Agricultural development in an agrarian economy largely depends on the existing nature of land-man relationship. Crop-sharing tenancy is one of the earliest forms of production organization in agriculture. It is still a matter of considerable importance in peasant agriculture in many countries. Although the technological break-through as such in Bangladesh agriculture is no longer a new phenomenon, yet it has got a significant relevance particularly for the regions which are still lagging behind in adopting modern technology in agriculture. A large number of researchers and economic analysts are concerned about knowing the potentialities created by new technology in the underdeveloped regions and their implications for agricultural development policies and programmes in meeting the socio-economic goals of these regions. New farm technology, the concept of which revolves around the increasing returns per unit of time, is the prime mover for any agricultural transformation. The important new farm technologies are HYV seeds, fertilizer, irrigation, pesticide, tractor power, etc (GOB, 2002).

The new agricultural technology is believed to have generated more income to the cultivators. But the increase in income is distributed among the various categories of farms at various levels of technology adoption is a matter of socio-economic significance. Several available studies on technology adoption have separately addressed either factors affecting the adoption or its impact on farm economy. Thus the present study is an attempt to examine the potentialities created by new technology in a less developed region of Bangladesh and its implications for rapid development in the region. The specific objectives of the study were i) to identify some major socioeconomic characteristics of owner farmers and tenant farmers and ii) to explore the extent of modern technology adoption on the two categories of farms.

METHODOLOGY

Two villages namely Basudebpur and Rajapur under Chirirbandar Upazila of Dinajpur district were purposively selected for present study. The survey schedule was designed in accordance with the objectives of the research. About 60 sample farms (30 owner farms and 30 tenant farms) were selected for the present study. Purposive random sampling technique was followed. Data were collected during the period from December 2000 to November 2001. An attempt was made to examine the degree of adequacy of modern inputs by the selected tenure classes of farmers, i.e.; how adequately the modern inputs were applied. Modern inputs included in the present study were chemical fertilizers, pesticides and irrigation.

The degrees of adequacy for chemical fertilizers, pesticides and irrigation were measured as follows: Degree of adequacy = Applied doze per hectare/Recommended doze per hectare *100

In order to fulfill the objective of the study, the technology adoption index for individual farmers was developed by following formula employed by Chandra and Singh (1992):

$$\text{Ali} = \sum_{j}^{m} \left(\frac{AH_{ji}}{CA_{ji}} + \frac{FA_{ji}}{FR_{j}} + \frac{IA_{ji}}{IR_{j}} + \frac{PA}{PR_{j}} \right) \text{x} \frac{CA_{ji}}{\sum CA_{ji}}$$

Where, I = 1, 2, 3 ...n; n = total number of farmers,
J = 1, 2, 3 ...m; m = total number of crops.
Ali = technology adoption index for ith farmer (%)
AH_{ji} = area under HYV of jth crop of ith farmer (ha)
CA_{ji} = gross cropped area (HYV+Local) of jth crop of ith farmer (ha)
FA_{ji} = amount of chemical fertilizer applied per unit of area in the cultivation of HYV of jth crop
FRj = amount of chemical fertilizer recommended per unit of area in the cultivation of HYV of jth crop
IA_{ji}= number of irrigation applied to jth crop of ith farmer
IR_{j}= number of irrigation recommended for jth crop of ith farmer (ha)
PA_{ji}= amount of pesticides applied to jth crop of ith farmer (ha)
PA_{ji}= amount of pesticides recommended to jth crop of ith farmer (ha)

This section attempts to examine the degrees of adequacy of modern inputs by the selected tenure classes of farmers i.e., how adequately the modern inputs were applied. Modern inputs included in the present study were chemical fertilizers, pesticides and irrigation. The degrees of adequacy for chemical fertilizers, pesticides and irrigation were measured as follows:

$$\text{Degree of adequacy} = \frac{\text{Applied doze per hectare}}{\text{Recommended doze per hectare}} \text{x} 100$$

It may be noted, however, that data on recommended doses were obtained from “Some Appropriate Technologies of rice Cultivation” a book published by BRRI (1999). The adoption index (AI) may vary from 0 to 100 per cent. On the basis of adoption index, all the 60 sample farmers were classified into three categories, viz., low adopter (0 to 19 per cent AI), Medium adopter (20 to 39 per cent AI) and high adopter (above 40 per cent AI).

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Sample Farmers

Data presented in Table 1 indicates that an overwhelming majority (90%) of the respondents belong to age between 30-50 years. More than half (53%) of them belong to the group under illiterate to can sign only. It was found that there were no major difference in the age of owner and tenant farmers.

Table1 shows that in case of owner farmers 73 percent farmers were engaged in agriculture, 27 percent in non-agriculture as their main occupation. In the case of tenant farmers, 77 percent farmers were engaged in agriculture and 23 percent in others. It is found that there were no major difference in the occupational status of owner and tenant farmers.

Table 1 shows detailed land ownership pattern of owner and tenant farmers. The total cultivated land for owner and tenant farmers in the small sizes were 0.49 and 0.47 hectares. In the large farm size, the total cultivated land for only owner farms was 5.36 hectares.

It shows that the average annual incomes of owner and tenant farmers were Tk. 53703.67 and Tk. 29500.00 respectively. This is evident from Table 1 that owner operators and tenant operators obtained the highest percentage of income from crop production and owner farmers were much better off than tenant farmers in terms of income.
This study attempted to explore how tenancy practices tend to affect the adoption of modern technology. In the study area both owner and tenants were found to use HYV seeds, fertilizer, irrigation facilities and power tiller mainly. No such case of using thresher and sprayer were known. Only a few farmers were known to use pesticide or sprayer. It is expected that tenancy has an important influence on adoption of modern farm technology. The study was likely to reveal that because of poor resource base the tenants would invest modern farm inputs.

Table 1 Percentage distribution of socioeconomic features of the HYV Boro rice growers

Description	Owner farmers	Tenant farmers	All farmers
Farm size of the farmers	50	50	100
Small (less than 1 ha)	30	93	37
Medium (1.21-3.03 ha)	30	7	18
Large (above 3.03 ha)	40	-	20
Age group of the farmers			
Less than 30 years	3	60	1.60
30-40 years	43	27	51.70
41-50 years	47	13	36.70
51 years and above	7	-	10
Education level of farmers			
Illiterate	20	27	23.5
Ability to sign	33	20	26.5
Primary	40	50	45
Secondary	07	3	5
Above secondary	-	-	-
Occupational status of the farmers			
Agriculture	73	77	75
Non-agriculture	27	23	25
Land ownership pattern (in hectare)			
Small	0.49	4.72	
Medium	1.42	1.42	
Large	5.36	-	
Modern farm inputs use			
(% of farmers used)	93	90	
HYV seeds	93	93	
Power tiller	67	60	
STW	83	67	
Pesticide	73	93	
Fertilizer	6.7	3.3	
Thresher	6.7	6.7	
Sprayer			
Annual incomes of farm households(Tk./year)			
Crop and vegetables production	33950.00	21000	
	(63.22)	(71.20)	
Others	19751.34	8500	
	(36.78)	(28.80)	

Source: Zaman, 2004

Extent of adoption of modern technology

This section attempted to examine the degrees of adequacy of modern inputs by the selected tenure classes of farmers i.e., how adequately the modern inputs were applied. The degrees of adequacy of different modern inputs in owner and tenant farms are shown in Table 2. It was observed that, the degree of adequacy of chemical fertilizers and power tiller (mechanical power) was higher in owner farmers than tenant farms. The use of Urea was higher in tenant farms than in owner farms. The degrees of adequacy of TSP, MP, Zinc and Gypsum were higher in owner farms than in tenant farms**.** The adequacy of irrigation was higher in tenant farms than in owner farms. It also shows that the adoption rate of pesticides was higher in owner farms than in tenant farms.

Table 2. Degree of adequacy in the use of modern inputs in HYV Boro growing owner and tenant farms

Modern inputs	Owner farmers (%)	Tenant farmers (%)
Chemical fertilizers: Urea	104.18	112.71
TSP	90.47	88.31
MP	59.22	56.24
Gypsum	48.06	21.11
Zinc	45.93	28.82
Irrigation	106.12	109.11
Pesticides	71.31	69.62
Power tiller	80.00	70.00

Source: Zaman, 2004

Degree of adequacy of the use of single input provides a partial view of the adoption situation. Because in the case of one input, for example, the degree of adequacy may be high but in the case of another input it may be low. Thus it fails to delineate an overall or average picture of the extent of adoption a composite view of the adoption of modern technology on HYV Boro rice growing farms would be more reliable. Level of modern farm inputs use under owner and tenant farms is shown in Table 3 and the percent distribution of farms according to the level of technology adoption is given in Table 4. It is evident from Table 3 that 100% area of both types of farmers is under HYV. The expenditures on fertilizer, pesticides and power tiller were higher in owner farms than in tenant farms. But irrigation is exceptional, i.e; the tenant farmers expend more money for irrigation than owner farmers.

Table 3. Level of modern farm inputs use under owner and tenant farms

Items	Owner farmer	Tenant farmers
1.Area under HYV(%) of GCA)	100	100
2. Expenditure on fertilizer (Tk./ha)	3814.95	3750.78
3. Expenditure on irrigation (Tk./ha)	3820.16	3927.85
4. Expenditure on pesticides (Tk./ha)	499.16	487.32
5. Expenditure on power tiller (Tk./ha)	2489.85	2472.87

Note: GCA = Gross cropped area
Source: Zaman, 2004

It is evident from Table 4 that majority of the sample farms belonged to low and medium technology adoption classes. When the extent of adoption and distribution of different categories of farmers under various levels of adoption were examined, it was observed that for Boro rice production a major portion (67 per cent) of owner farmers of the study area were low adopters and 33 per cent of them were medium adopters. On the other hand, 87 per cent tenant farmers producing Boro rice were low adopters and 13 per cent of them were medium adopters. Finally, the study also revealed that there were no high adopter groups. It revealed that the adoption of technology had not made an appreciable headway. It was also examined that the adoption of modern technology was higher in owner farms than in tenant farms. Lack of capital and land were the two major reasons which made the farmers unable to apply recommended doses of inputs. Thus the findings were-- the existing “fifty-fifty” crop sharing arrangement does not discourage farmers to adopt improved farm technology.

Table 4.Per cent distribution of farms according to the level of technology adoption

Items	Owner farmer	Tenant farmers
Low adopter	20 (67)	26 (87)
Medium adopter	10 (33)	4 (13)
High adopter	-	-
Total	30 (100)	30 (100)

Source: Zaman, 2004

As concluding remarks it may be mentioned that in Bangladesh the predominant tenancy arrangement is sharecropping; under which the gross output is shared equally between tenant and land owner, while most of the cultivation cost is borne by the tenants. It can be argued that under these circumstances, the tenants would be discouraged from adopting the new technology because they would have to bear the large incremental cost of labour, fertilizer, irrigation, while the incremental output would be shared equally between tenant and land owner. Due to the reasons mentioned above, the data did not fit the model perfectly; and there was no high adopter class either in owner or tenant farms. Besides, the inclusion of only one crop might have generated this low adoption index. Further, the farmers under review belong to low adoption area. Tenants' farmers also have lower income and they possess a low resource base. Hence the level of technology adoption is likely to be lower for the tenant farmers. From the findings of this research, it may be argued that tenant farmers were initially lagging behind in technology adoption.

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