

Measuring the Cost of Production: A Study on Rice Farmers in Jessore District

Shaikh Moksadur Rahman* and Jun TAKEDA**

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Abstract

The quantity of production has increased regardless of the land ownership in recent years, but small and medium farmers still have a serious problem especially regarding the increasing cost involved in production. As rice is the main crop, the condition of production, cost incurred in different inputs, purchasing nature of inputs and the source of production elements influence the cost of production, which directly effects rural subsistence. The study included three categories of rice farmers: small (30), medium (23) and large (11) in the district of Jessore in the south-western part of Bangladesh. The objectives of this paper are to measure the differences in the cost of production of *boro* rice farmers on the basis of land held to determine further steps for their well being. The study found that although there were no significant differences in the quantity of inputs used for all categories of farmers, the cost of some inputs significantly varied between small-large and medium-large, thus affecting the cost of production. The reasons for the raised cost of production were that most of the small and medium farmers purchased inputs on credit, spending comparatively more than cash, and they paid higher interest on borrowed money.

Key Words: rice, farmer, land ownership, cost of production

1. Introduction

Agriculture retains a large share of national output and employment, accounting for 20.5% of GDP (WB, 2005), 63 percent of employment, with about 57% being employed in the crop sector. At present rice covers 75 percent of the cultivated land and produces 74 percent of produce among all crops. The output of food grains increased by 2.3 percent compared to the fiscal year 2002-03, reaching 27.3 million ton in fiscal year 2003-04. Where the output of *boro* rice, the single largest crop increased by 5.03% (BB, 2004). Bangladesh has reached self-sufficiency in rice production. Nevertheless, the country's rice production in terms of cost involved and returns pose a great challenge to survive for small and medium level of farmers.

A Small parcel of land not only acts as a constraint to investment, but also deprives farmers of access to formal credit, inputs and other institutional services required for improved agricul-

* The United Graduate School of Agricultural Sciences, Kagoshima University, Japan. E-mail:smasud 03@yahoo.com

** Professor, Faculty of Agriculture, Saga University, Japan. E-mail: takedaj@cc.saga-u.ac.jp

tural practices. As a result, farmers are often forced to continue traditional agricultural practices (Golam and Gopal, 2004; Devendra and Thomas, 2002). In Bangladesh, land ownership serves as a surrogate for a large number of factors as it is a major source of wealth, and influences crop production (Rahman, 2000). The ownership of agricultural land remains one of the most difficult problems in the countryside in Bangladesh (Rahman and Takeda, 2004). In general, pecuniary economies are said to exist when larger farms pay lower prices for their inputs due to lower transaction costs and or stronger bargaining power, thus lowering their average production cost. And for similar reasons, large farms may receive higher prices for their outputs (Chavas, 2001). Large farmers mainly deploy their own money and have easy access to the credit market for cultivation than those of small and medium farmers.

Since independence in 1971, the republic has introduced a revised agricultural policy in varying degrees. As a result the quantity of production increased regardless of the land ownership, but farmers still have a serious problem, especially regarding the increasing cost involved in production (Azad and Mustafi, 2004). Seeds, fertilizers, irrigation and labor are the four major inputs that are essential in producing any crop and contribute significantly to the total cost of production. As rice is the main crop, the conditions of production, cost incurred in different inputs, purchasing nature of inputs and source of production elements influence on cost of production, which has a direct effect on rural subsistence. For example, lower cost of production ensures higher returns thus influencing total income. Jahan and Jaim (2002) said, rural economy mostly depends on the farmers profitability i.e., costs incurred and return earned from rice production. However, the objectives of this paper are: (1) to measure the differences in the cost of production of *boro* rice farmers on the basis of land (small, medium and large) in the surveyed areas by considering the nature of inputs purchasing, inputs quantity and production elements used; and (2) on the basis of findings, to make recommendation for the further improvements.

2. Study site and Methodology

The study was based on an interview method during February to March 2005 for the year 2003/04 in Jhikargacha Upazila in the district of Jessore in Bangladesh of *boro* rice cultivation, which starts in December 2003/January 2004 and ends in April/May 2004. The Study site was 276 kilometers south west of Dhaka and 15 kilometers west of Jessore district. As shown in Table 1, in the study, 64 farmers (Small:30, medium:23 and large:11) were randomly selected as respondents, from two villages, namely Barbakpur and Bodhkhana. Both the villages have almost the same characteristics in terms of rice production. According to the definition of the Bangladesh Bureau of Statistics (BBS), the villages include landless, small (a farm holding having an operated area of 0.05 to 2.49 acres of land with a minimum of 0.05 acres as cultivated area), medium (a farm holding having an operated area of 2.50 to 7.49 acres of land) and large (a farm holding having an operated area of 7.50 acres and above) land holdings. In Jhikargacha Upazila, the percentage of small, medium and large households were 78, 19 and 3 respectively (BBS, 2002).

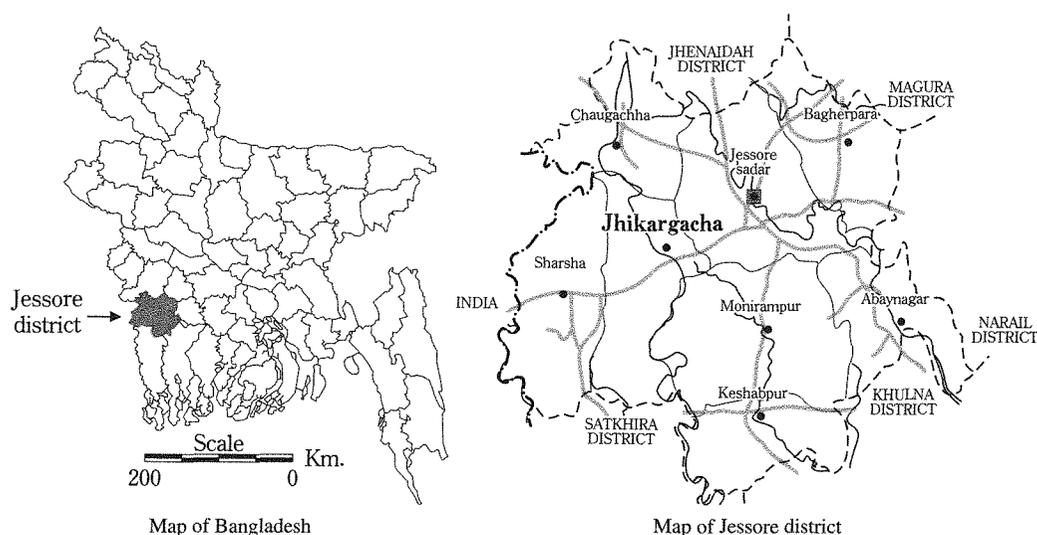


Figure 1. Location of the study site

In the study, the measurement used by Bangladesh Bureau of Statistics (BBS, 2005) for the calculation of the cost of production i.e. seeds, fertilizer, pesticide, labor, irrigation, interest on working capital and land rental, were adopted. Although depreciation on the fixed assets and maintenance costs are essential for the calculation of the cost of production, they were not mentioned in the BBS's calculation. However, depreciation and maintenance expenses were considered as per the practical situation in the surveyed area. Opportunity cost of seeds, organic fertilizer, labor, irrigation and land rental value have been considered for calculating the cost of production in the relevant cases. To investigate the significant difference of cost of production, one-way ANOVA: post hoc multiple comparisons by Tukey HSD method was adopted.

Table 1. Sample collection

Sample	Farmers (own land and tenant cultivation)
Scope	Regional, Jhikargacha Upazila under Jessore district
Data collection method	Face to face interview with individual farmer
Sample unit	Boro rice farmer
Sample size	64 farmers
Classification of the sample	Small farmers (30), medium (23) and large (11)
Sample procedure	Random sampling
Rice cultivation period	Started December 2003/January 2004 and ended in April/May 2004
Data used for the period	Year 2003/04
Data collection period	February-March 2005

3. Discussion

Agriculture in Bangladesh: Bangladesh is one of the most densely populated countries on earth. Rapid population growth and a tradition of bequeathing land to all heirs have led to fragmentation of holdings. Double cropping is the norm and many farmers grow as many as three crops a year.

Rice dominates the cropping pattern in most parts of the country and is grown in three different seasons *aus*¹, *aman*² and *boro*. After green revolution, HYV *boro* rice has gained importance. Because yields of *boro* rice are higher than yields of other types of rice. In most villages, a few families control enough land to live comfortably, while a large percentage of families have either no land or not enough to support them. The ready availability of large numbers of poor laborers and the fragmented character of many landholdings has perpetuated a labor-intensive style of agriculture and unequal tenancy relations. It is well recognized that fragmented holdings have been a major constraint in the implementation of farming practices by small-scale farmers (Srinath, et. al., 2000). Several socioeconomic factors hinder the application of new methods. In Bangladesh, the most important among the constraints are fragmented holdings and poor socioeconomic conditions of small farmers for whom the agriculture is a livelihood activity. Due to the lack of money for cultivation, small farmers not only borrow money but also cultivate small parcel of land although this types of farmers have available agricultural labor. At least one third of the households in most villages are using rented land. The production system dominated by a single crop (i.e. rice) is neither scientific nor acceptable from the economic point of view. It is, therefore, necessary to increase the cultivation and production of other crops. However, considering the increasing demand for food grains and with a view to ensuring food security on the one hand, reducing the cost of production of rice should get priority on the other.

Land ownership and cultivation: In terms of tenureship of land, three types of farmers: own land cultivator, owner-cum-tenant cultivator and tenant cultivator were found in the surveyed area. 61, 72 and 82 percent of small, medium and large farmers were respectively using own land. 36, 27 and 18 percent of small, medium and large households used both own and tenant land. On the other hand, 2.24 and 0.22 and 0.12 percent of small, medium and large households respectively used only tenant land. The operated area of small, medium and large households were 1, 4 and 11 acres respectively. The percentage of the gross cropped area of the entire district were 12, 13 and 15 for small, medium and large respectively. The areas for net cultivation for small, medium and large households were 1, 3 and 9 acres respectively. The intensity of cropping was found to be the highest among small households (194). Irrigation device ownership (89%) and irrigated area (73%) were found to be the highest among the large households. Both small, medium and large households were engaged in cultivating the rice: HYV *aus* & *pajam*, HYV *aman* & *pajam* and HYV *boro* & *pajam*. Individual farming activities among all categories of farmers for purchasing inputs, accumulation of production elements and cultivation practice was observed in the area.

4. Results

Seeds: Rice seeds for sowing can come from a variety of sources. Traditionally, it came (and still

¹ Premonsoon direct-seeded and transplanted rice crop generally planted in March-May and harvested in June-August. In many places *aus* is cultivated before *aman*, and is thus an alternative to *aman* in deep-flood areas.

² Generally planted before or during the monsoon season, and is either broadcast or transplanted.

Broadcast *aman* is direct-seeded, normally in March, and transplanted *aman* is generally planted in June-August and harvested in November-January.

comes) from farmers saving their own seed, which continues today in both developing and developed countries, particularly for cereal crops. The traditional seed markets in Bangladesh involve farmers producing seed for their own use and for sale to markets. It is uncommon for some farmers to specialize in the production of seeds (WB, 2002). Government and Non-Government Organization (NGO) seed programs are sometimes initiated to provide a short-term substitute. Table 2 shows, for the production of rice, farmers used both home supplied and purchased seeds. The table shows 67 and 65% of small and medium farmers used credit-purchasing seeds, while large farmer were 9%. The study found that a large number of small and medium farmers used credit-purchasing seeds. A large portion of large farmers used cash purchasing seeds. The quantity of seeds by credit purchasing was the highest for small farmers followed by medium and large farmers. The application of seeds was estimated at 22, 21, 23 kg acre⁻¹ for small, medium and large households respectively (Table 7). There was no significant difference found in the amount of seeds used in respect to the farmers' categories. Table 8 shows the amount of money spent for seeds for small, medium and large households were Tk. 453, 435 and 364 respectively. The amount of money spent for seeds was found to be significantly different between small-large and medium-large farmers. The price variation must be stated as a being due to the purchasing nature; i.e., whether cash or credit. It is natural phenomenon that the credit-purchasing price of the same goods is higher than the cash purchasing price for rural farmers. Therefore, money spent for seeds was comparatively higher for small and medium farmers than for large farmers.

Table 2. Sources of seeds (Kg./acre)

Parameters	Farmer						Qty. of seeds (Kg.)					
	Number			%			Qty.			Std. Dev.		
	S	M	L	S	M	L	S	M	L	S	M	L
Seeds:												
Home supplied	14	9	7	47	39	64	11	13	12	5	7	7
Cash purchase	17	13	9	57	57	82	12	12	18	7	7	6
Credit purchase	20	15	1	67	65	9	16	15	5	6	6	-
Both cash and credit	10	8	1	33	35	9	19	19	13	4	5	-

S-Small, M-Medium, L-Large

Fertilizers: A gradual liberalization of markets for modern inputs in agriculture was carried out between 1978 and 1990 under pressure from foreign donors and with the realization that various direct interventions were fiscally unsustainable and unproductive in the long run (WB, 2002). These reforms greatly reduced the role of the Bangladesh Agricultural Development Corporation (BADC) in marketing and distribution of fertilizer, irrigation equipment, power tillers, pesticides and seeds. Liberalization and privatization of input markets coincided with a large expansion in tube well irrigation and winter (*boro*) season rice cultivation in the late 1990 s. Agricultural inputs such as seeds, fertilizers and pesticides are available in both primary and secondary market in Bangladesh. In rice producing, Table 3 shows farmers used five kinds of inorganic and one type of organic fertilizer. The highest number of farmers using credit purchasing for inorganic fertilizers were small farmers, followed by the medium and large farmers. As shown in Table 3, all farmers used inorganic fertilizer, but 30, 26 and 27% of small, medium and large farmers re-

Table 4. Purchasing nature of pesticides (Kg./acre)

Parameters	Farmer						Qty. of pesticides (Kg.)					
	Number			%			Qty.			Std. Dev.		
Pesticides:	S	M	L	S	M	L	S	M	L	S	M	L
Cash purchase	17	14	11	57	61	100	4	4	5	1	2	1
Credit purchase	19	15	-	63	65	-	5	5	-	2	1	-
Both cash and credit	6	6	-	20	26	-	6	6	-	1	1	-

Labor (Man day): Labor is used for land preparation, transplanting, weeding, using fertilizer, insecticide spraying, harvesting, threshing, transporting and other purposes. Six working hours per day is considered as a man-day in the surveyed area. Table 5 shows that two types of labor are used for production i.e. family and hired labor. Most of the small farmers used family labor, followed by the medium and large farmers. For the production of rice, as shown in Table 7, 83, 88, and 88 man day acre⁻¹ is used by small, medium and large farmers respectively and their respective costs were Tk. 4411, 4673 and 4451 (Table 8). According to Table 7 and 8, no significant differences were found either in the man-day or in the amount of money spent.

Table 5. Nature of labor (Man day/acre)

Parameters	Farmer						Man day					
	Number			%			Man day			Std. Dev.		
Labor:	S	M	L	S	M	L	S	M	L	S	M	L
Family labor	25	15	6	83	65	55	60	43	29	22	24	9
Hired labor	18	21	11	60	91	100	56	65	73	19	21	17
Both family and hired	13	13	6	43	57	55-	87	90	90	7	9	8

Irrigation: In Bangladesh, in the absence of adequate surface water in the dry season, irrigation is heavily dependent on groundwater. During the last two decades, the area under irrigation has been increased significantly to raise food production. Much of this has been accomplished through the installation of Shallow Tube Wells (STW). For the production of rice, farmers used both their own device and purchased water for irrigation. In the surveyed areas, only Shallow Tube Wells (STD) were found for irrigation. All large farmers in the surveyed areas had their own irrigation device. Table 6 shows that the small farmers had the least number of irrigation devices followed by the medium farmers. The per acre irrigation hours for small, medium and large farmers were 116, 119 and 115 (Table 7) respectively and their respective costs were Tk. 5262, 5225 and 4626 (Table 8). As seen in table 7, no significant difference was found in the irrigation hours among the farmers but as Table 8 shows, the money spent for this purpose was found to significantly different between small-medium and medium-large farmers. The higher cost to small and medium farmers than large farmers was due to credit purchasing the irrigation water.

Table 6. Nature of irrigation (hour/acre)

Parameters	Farmer						Irrigation hour					
	Number			%			Hour			Std. Dev.		
	S	M	L	S	M	L	S	M	L	S	M	L
Irrigation:												
Own machine	6	12	11	20	52	100	81	95	95	24	27	21
Cash purchase	22	14	6	73	61	55	64	66	37	31	34	8
Credit purchase	22	10	-	73	43	-	72	66	-	33	32	-
Both cash and credit	16	8	-	53	35	-	114	110	-	28	39	-

Interest on WC: At present, rural financial markets in Bangladesh are fragmented and inadequate. There are very limited savings services available in rural areas and the wealthy have relatively better access to cheap credit. The recovery rate of public money disbursed by financial institutions to the farmers is very poor. Some NGOs extend their credit programs to rural farmers but they cannot function without subsidy elements in their financing. The barriers hindering rural credit delivery to small farmers largely derive from institutional failures for monitoring and enforcing credit transactions and ineffective mechanisms for reaching the poor farmers (ERD, 2003). "Rural Sector Finance: Current Issues and Perspectives", the essay by Shahidur R. Khandker reviews the existing structure of rural financial markets and identifies broad sectoral policy actions that might improve their functioning. He suggests that the fact that small and medium farmers, who account for more than 80 per cent of farmers with a holding of more than 50 decimals, do not have access to credit is a clear indication of market failure, and the sluggish performance of agriculture in Bangladesh may be attributed to such credit constraints (WB, 2002).

The amount of money deployed to meet the expenses on hired and purchase inputs i.e. seeds, fertilizers, pesticide, labors, irrigation, land rental and maintenance were treated as working capital (WC). The study found that farmers used their own money and borrowed money for cultivation. 47, 96 and 100% of small, medium and large farmers respectively used their own money; while on the other hand, 97, 65 and 18% of them used borrowed money. 43, 61 and 18% of small, medium and large farmers used both their own and borrowed money. For the cultivating of the land, farmers borrowed money from informal sources and the paid interest rate was found to be 30-60%. As Table 8 shows, interest on working capital for small, medium and large were Tk. 663, 540, 324 acre⁻¹ showing significant variation between small-medium and small-large.

Land rental: Three types of rice farmers were found in the surveyed area; own land cultivators, tenant cultivators and owner-cum-tenant cultivators. The study revealed that 77, 100 and 100% of small, medium and large farmers respectively used their own land, while on the other hand 47 and 26% of small and medium farmers respectively used tenant land for cultivation. No large farmers used tenant land in the surveyed areas. Small and medium farmers who used both their own and tenant land were 27 and 26% respectively. As Table 8 shows, rental value of land for small, medium and large farmers were Tk. 2802, 2726 and 2855 acre⁻¹ and so were not significantly different among the farmers.

Depreciation: Depreciations on machinery, building and other fixed assets was calculated on the basis of straight-line method and found that they were (Table 8) Tk. 171, 234 and 312 acre⁻¹ for the small, medium and large farmers respectively. The amount needed for depreciation was found to be not significantly different.

Maintenance: During the cultivation of rice, the amount of money needed to meet expenses for maintenance such as draining, ridging, allaying, inputs carrying, labor for irrigation, labor for fertilizing and labor for pesticing etc. were treated as maintenance cost. Table 8 shows that the maintenance costs for small, medium and large farmers were Tk. 364, 414 and 352 acre⁻¹ respectively and so were not significantly different among the farmers.

Cost of production: Farm production methods always aim to obtain a combination of minimum costs. The farmers try to combine their working resources

Table 7. Quantity of inputs for one acre (one-way ANOVA based on land)

Parameters	Qty. of inputs			Std. Dev.		
	S	M	L	S	M	L
Seeds (Kg.)	22	21	23	2	2	2
Fertilizer (Kg.)						
Urea	149	150	143	18	18	23
TSP	42	41	43	3	4	5
MP	20	21	20	2	3	3
Sulphur	11	12	11	1	1	2
Gypsum	58	60	58	7	7	8
Organic fertilizer ¹	1470	1638	1817	326	293	407
Pesticide (Kg.)	5	6	5	1	1	1
Labor (Man day)	83	88	88	12	11	8
Irrigation hour	116	119	115	14	18	13

Total number of farmer: S-30, M-23, L-11, but for¹: S-9, M-6, L-3.

No significant difference found in the quantity of inputs used.

Table 8. Cost for production for one acre, Tk. (one-way ANOVA based on land)

Parameters	Tk.			Std. Dev.		
	S	M	L	S	M	L
Seeds	453 ^a	435 ^a	364 ^b	87	70	56
Fertilizer:						
Urea	1110 ^a	1064 ^a	912 ^b	167	152	151
TSP	749 ^a	742 ^a	661 ^b	66	94	99
MP	316 ^a	322 ^a	268 ^b	43	65	28
Sulphur	190 ^a	176 ^a	150 ^b	28	21	21
Gypsum	215 ^a	218 ^a	175 ^b	43	37	26
Organic fertilizer	253	281	343	78	74	75
Pesticide	376 ^a	390 ^a	305 ^b	82	62	53
Labor	4411	4673	4451	702	623	549
Irrigation	5262 ^a	5225 ^a	4626 ^b	593	700	505
Interest on WC ²	663 ^a	540 ^b	324 ^b	169	192	154
Land rental	2802	2726	2855	257	207	264
Depreciation ³	171	234	312	102	144	155
Maintenance and other	364	414	352	115	123	141
Cost of production	17050 ^a	17124 ^a	15641 ^b	858	1059	825

Same letter indicates no significant difference but different letters indicate significant difference at the 0.05 level. Total number of farmer: S-30, M-23, S-11 but for²: S-30, M-23, L-4, for³: S-11, M-12, L-11. US\$1= Tk. 62.25

in such a way that the cost of any given production process is minimized (Rahman and Takeda, 2004). However, study of the cost of production of HYV *boro* rice cultivation at surveyed areas summarized in Table 8. In considering the cost of production, seeds, fertilizers, pesticide, labor, irrigation, interest on working capital, land rental, depreciation and maintenance costs were considered. The cost of production for small, medium and large farmers were Tk. 17050, 17124 and 15641. The table shows a significant difference between small-large and medium-large farmers.

5. Conclusions and recommendations

The study revealed that the quantity of agricultural inputs used in respect to land ownership showed no significant difference, but the money spent for seeds, inorganic fertilizers, pesticides, irrigation and interest on working capital differed significantly among the farmers, influencing the cost of production. Small and medium farmers have inadequate production facilities in terms of the source of money for cultivation. These types of farmers have the highest cost of production compared to large-scale farmers. On the other hand the market value of their produce is the lowest (Hayami et al. 1999; Sandra and George, 2005). Small and medium farmers cultivate small areas, not only due to small parcels of land but also due to inadequate capital for buying inputs. They either have no assets to mortgage or have very little, and therefore banks are generally unwilling to give them credit (Edison, 1997; WB, 2002). Small farm households may face higher interest rates on working capital due to capital market imperfections (Chavas, 2001). When in need, large farmers have easy access to the credit market for agricultural production. Moreover, they can borrow money without any interest from their relatives and friends, which lower their production cost. Large farmers purchase larger quantity of inputs at a time, so their rate is cheaper than small and medium farmers. Price also depends upon the supply and demand situation, purchasing nature, payment nature, frequency of purchasing, interpersonal relationship etc. The cost variations explained here consider only the payment nature of purchased inputs, i.e., whether they were cash or credit. The study found that most of the small and medium farmers purchased their inputs on credit, uplifting their cost of production.

Although all small and medium farmers in the area know that the credit purchasing of inputs and borrowing money from informal sources raises the cost of production, they could not limit these types of practices due to the economic constrain in deploying their own money. Raising the cost of production adversely affects the income of the farmers. The farmers income can be enhanced by reducing the different types of costs involved in production. As small and medium farmers are the major portion of the farming community, their existence is closely related to the existence of the total agriculture of Bangladesh. Finally, to prevent the credit purchasing of inputs and the borrowing of money from informal sources, institutional loans should be made available on easy terms and conditions to these farmers.

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生産コストの計量 —ジェッソール地区の稲作農業者に関する研究—

シャイク モクサドウール ラーマン・武田 淳
(地域資源学研究室)

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概 要

近年の土地所有にかかわらず米の生産量は増加したが、未だに中小規模の農業者は、生産量に伴って増加するコスト面で特に深刻な問題を抱えている。米が主作物である場合、生産の状態、異なる投入資本にかかるコスト、特徴のある投入資本の購入、および生産費に影響を及ぼす生産要素の供給先は直接農村の生計維持に影響を及ぼす。本研究では、バングラデシュ南西部ジェッソール地区における小規模(30)、中規模(23)、大規模(11)の3種類に分類される稲作農業者を研究対象とした。本研究の目的はボロ(*boro*)を生産する稲作農業者の生活水準を高めるため、土地所有に基づいて生産コストの差異を計量することにある。本研究において、3種類に分類された稲作農業者の投入資本の総量において違いは見られなかったが、投入資本のコスト面において小規模と大規模、そして中規模と大規模な農業者の間においてかなり異なっていることが判明した。その結果、生産コストが影響しているという仮説は明らかになった。生産コストを増加させている理由は、中小規模の農業者の大部分が投入資本を現金より割高になるクレジットで購入しており、高利貸しに高い利子を支払っているからである。