An Economic Study of Sugarcane Production in Selected Areas of Natore District

A THESIS

BY

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EXAMINATION ROLL NO. 21
REGISTRATION NO: 23536(1996-97)

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ABSTRACT

The present study was undertaken to examine the profitability of sugarcane production form the view points of small, medium and large farms. To achieve this objective, 90 sugarcane farmers were selected randomly. Data were collected from 9 villages of Natore district during the period from May-August 2003. Tabular and statistical analyses were done to achieve the objective.

Results of the study clearly show that sugarcane production is a profitable farm business. However, the medium farmers received the highest net returns. The averages per hectare net returns of sugarcane production were Tk 19430.00, 20949.50 and 18432.00 for small, medium and large farms respectively and their corresponding BCRs (undiscounted) were 1.29, 1.30 and 1.62. The large farms incurred the highest amount of production cost (Tk 96193.00) followed by medium (Tk 70418.00) and small (Tk 66915.00) farms. An average net return of all farms was Tk 19638.50 per hectare and corresponding BCR (undiscounted) was 1.26.

Cobb-Douglas production function was employed to study the key factors on production of sugarcane. Functional analysis showed positive contribution of using human labour, planting setts, application of fertilizers, manures and irrigation. Results indicated that the farmers have scope to increase farm profit by employing more human labour, manures, fertilizers and irrigation in producing sugarcane.

The farmers were found to have been facing some problems in producing sugarcane. The problems of sugarcane production were of four categories such as technical, economic, marketing and social. The findings suggest that if the problems could be solved, the yield of sugarcane would perhaps be much higher than the existing levels of and its yield per hectare in all probability would increase. Finally, some policy guidelines were suggested.

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GLOSSARY

BADC	:	Bangladesh Agricultural Development Corporation
BAU	:	Bangladesh Agricultural University
BARI	:	Bangladesh Agricultural Research Institute
BBS	:	Bangladesh Bureau Statistics
BCR	:	Benefit Cost Ratio
BSMC		Bangladesh Sugar Mills Corporation
DAP	:	Di-Ammonium Phosphate
DAE	:	Directorate of Agricultural Organization
FAO	:	Food and Agricultural Organizations
et al	:	et alia (and others)
FFYP	:	Fifth Five Year Plan
GDP	:	Gross Domestic Product
GoB	:	Government of Bangladesh
Gur	:	Red Sugar (Locally made)
HYV	:	High Yielding Varieties
i.e.	:	That is
IRR	:	Internal Rate of Return
IRRI	:	International Rice Research Institution
kg	:	Kilo gram
K_2O	:	Potassium Oxide
LDC's	:	Least Developed Countries
MFC	:	Marginal factor cost
MP	:	Murate of Potash
MVP	:	Marginal value product
N	:	Nitrogen
NGO	:	Non Government Organization
P_2O_5	:	Phosphorus Pentoxide
Tk	:	Taka
TCH	:	Ton Cane Per Hectare
TSP	:	Triple Super Phosphate
1 Gallon	:	4.864 Seers
1 gm	:	One Gram=0.09 Tollas
1 ha	:	One Hectare=2.47 Acre
1 Kg	:	One Killogram=1.07 Seers
1 lb	:	One Pound=0.486 Seers
1 Metric Ton	:	26.75 Maunds (Aproximately)
1 Ton	:	27.178 Maunds (Aproximately)
1 million	:	10 Lakhs
(%)	:	Percentage
(^{0})	:	Degree

INTRODUCTION

1.1 Importance of Agriculture in the National Economy of Bangladesh

Bangladesh is a developing country in the world with high density of population and unfavourable land man ratio. Most of the people of Bangladesh depend on agriculture. Agriculture plays a vital role in the economy of Bangladesh. The problem of rural poverty is of foremost concern in Bangladesh. Nearly half of the populations live below the poverty line.

The population of Bangladesh is nearly 12,31,51,000 and her population density is 834 persons per sq km (BES, 2001). Its land-man ratio is 0.25 acre and the population growth rate is 1.42 per annum (BES, 2001). This indicates that Bangladesh is a very densely populated country in the world. To attain the goal of overall nutritional self-sufficiency, optimum utilization of its internal resources is essential. Government has, therefore, laid special emphasis on the development of cash crops.

Crops are selected in each season based on soil and plant condition with a climate favourable for a wide variety of crops. Nearly 100 different crops are currently grown in Bangladesh. Out of 100 crops, 32 occupy 96 percent of the total cropped area (Task Forces Report, 1991).

Rice occupies about 78 percent of the total cropped area and remainder 22 percent of total cropped area is devoted to grow other non-rice crops which include wheat, sugarcane, oilseeds, pulses, condiments and spices (BBS, 2001). Although food production should get first priority but this plan should be well adjusted with the long run development plans of crop diversification and cash crop production (Task

Forces Report, 1991). The area and production of major crops are shown in Table 1.1.

Table: 1.1 Areas and production of major agricultural crops in Bangladesh 1999-2000

Crops	Area (ha)	Production ('000 tons)	% of total cropped area
Rice	10713.36	23067	85.29
Jute	408.09	711	3.24
Sugarcane	170.44	6910	1.35
Tea	48.58	114640 (lbs)	0.38
Pulse	498.38	384	3.96
Oilseeds	436.43	406	3.47
Condiments & spices	252.22	401	2.00
Tobacco	32.38	35	0.25
Total	**12559.92**	-	**100**

Source: BBS (2000)

1.2 Importance of Sugarcane Production

There are three sugar crops in Bangladesh i.e. sugarcane, date palm, palmyra palm. Sugarcane is one of the major cash crops in Bangladesh. More than half of the world sugar supply is obtained from the sugarcane which is grown in tropical and subtropical climates. Sugarcane is grown in the United States in Hawaii, Louisiana, and Florida. It is also grown in Puerto Rico. The countries producing the largest amounts of sugar and they are Brazil, Cuba, Kazakhstan, Mexico, India, and Australia. Production, supply and distribution of centrifugal sugar of different countries are presented in Table 1.2 and Figure 5.

Sucrose is used as a sweetening agent for foods and in the manufacture of candies, cakes, puddings, preserves, soft and alcoholic beverages and many other foods. As a basic foodstuff, sucrose (sugar) supplies approximately 13 percent of all energy that is derived from foods. Two major products such as juice sugar and gur which are important constituents of human food are made of from sugarcane. Sugar supplies energy to human body and makes the food palatable.

Table 1.2 World production, supply and distribution of centrifugal sugar

Name of the country	'000' metric tons							
	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
India	18,225	14,616	14,592	17,436	20,219	19,300	16,765	17,308
Brazil	13,700	14,650	15,700	18,300	20,100	17,000	17,750	16,743
United States	6,686	6,536	7,276	7,597	8,203	7,710	7,653	7,380
Australia	5,049	5,659	5,567	4,997	5,448	4,181	4,734	5,091
Mexico	4,660	4,835	5,490	4,985	4,977	4,925	5,050	4,989
Cuba	4,250	3,350	3,800	4,100	3,600	3,700	4,000	3,829
Colombia	2,002	2,132	2,110	2,199	2,330	2,370	2,400	2,220
Argentina	1,590	1,380	1,750	1,830	1,670	1,540	1,540	1,614
Guatemala	1,334	1,566	1,720	1,561	1,617	1,632	1,632	1,580

Source: USDA. 2002

Sugarcane is the most important cash crop of the world. At present more than 100 countries cultivate sugarcane (FAO, 1996).

1.3 Production and Consumption Status of Sugarcane in Bangladesh

Each and every year Bangladesh has to import sugar from foreign countries to meet up its domestic consumption. A detailed yearly picture of production, supply and distribution of centrifugal sugar has shown in Table 1.1 and Figures 1, 2 and 3. From these pictures it is clear that the demand for sugar is increasing gradually from year to year.

Sugarcane covered 1.35 percent of the total cropped area in Bangladesh and total cane production was 6910 thousand metric tones (Table 1.3) which is very insignificant compared to other sugar growing countries of the world. The year wise production of sugarcane and white sugar in Bangladesh are shown in Table 1.3.

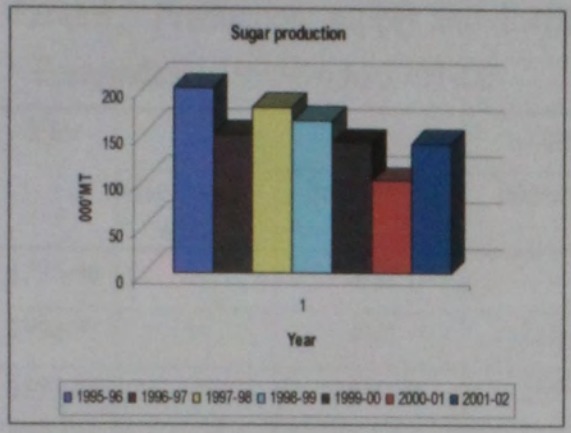

Figure: 1
Yearly sugar production of Bangladesh.

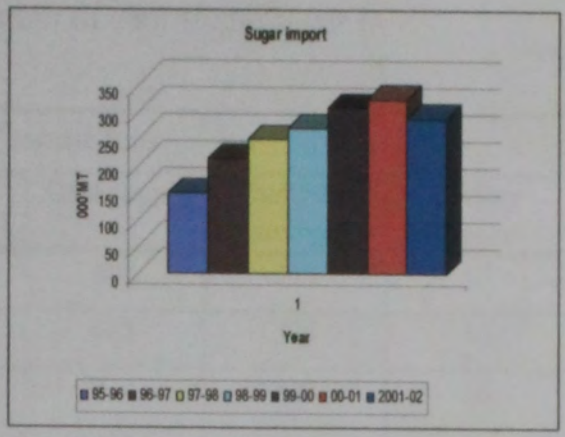

Figure: 2
Yearly sugar imports in Bangladesh.

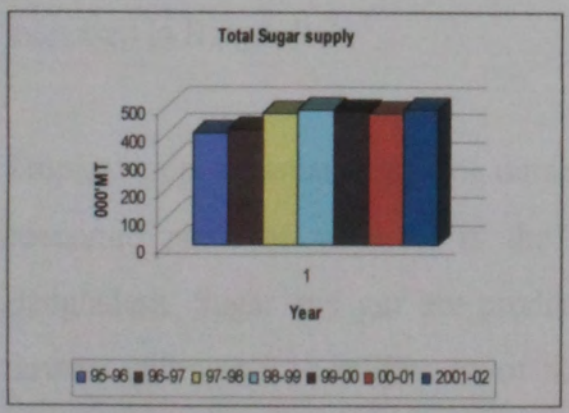

Figure: 3
Sugar supply for domestic consumption in Bangladesh.

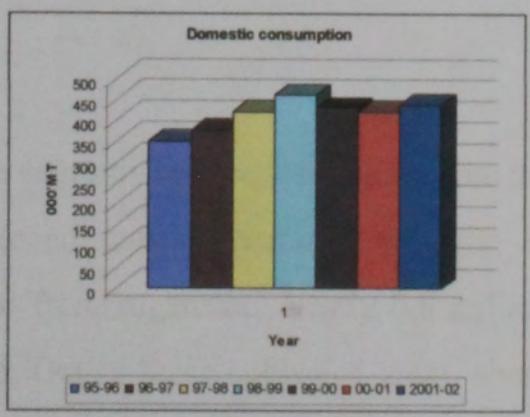

Figure:4
Domestic sugar consumption in Bangladesh.

Table 1.3 Production, supply and distribution of centrifugal sugar in Bangladesh, 1995-96 to 2001-02

Year	'000' metric tons					
	Beginning stocks	Production	Imports	Total supply	Domestic consumption	Ending stocks
1995-96	56	200	150	406	350	56
1996-97	56	150	215	421	375	46
1997-98	46	180	250	476	420	56
1998-99	56	165	270	491	460	31
1999-00	31	141	310	482	428	54
2000-01	54	100	325	479	420	59
2001-02	59	140	290	489	435	54

Source: USDA, 2002

According to Food and Agricultural Organization (FAO) the annual requirements of sugar per capita is 13 kg. The per capita availability in Bangladesh is less than 6 kg. Therefore; sugarcane production should be increased in Bangladesh.

Tropical crop, sugarcane is a long durable vegetative propagated plant. From the economic point of view, it is the second most important cash crop in Bangladesh. Sugar and gur are produced from sugarcane. Nearly 0.8 million farmers cultivate 0.18 million ha of land. Out of these cultivated areas, about 0.95 million hectares are in the sugar mills zone areas and the rest is in the non-mills zone areas which produces sugarcane mostly for making gur consumed by the rural people in our country(FFYP, 1997-2002).

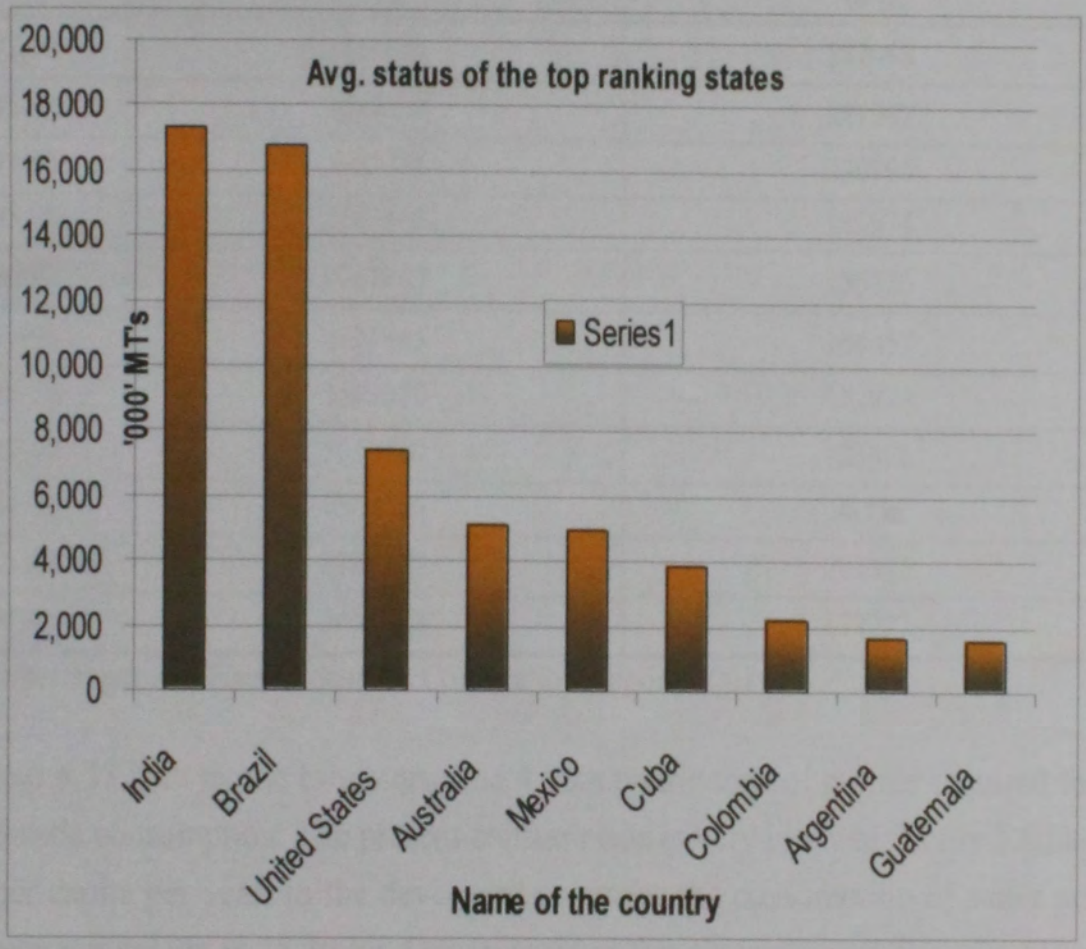

Figure.5: Annual average sugar production status of the top ranking countries of the world.

Table 1.4 Production of Crushed Sugarcane and Centrifugal Sugar in Bangladesh

Year	Crushed sugarcane (mt)	Sugar production (mt)
1992-93	2233114	187483
1993-94	2699901	221547
1994-95	3482741	270196
1995-96	2387481	183934
1996-97	1763153	135320
1997-98	2121845	166457
1998-99	2313952	152979
1999-00	1612320	123498
2000-01	1369026	98355
2001-02	2785567	202375
2002-03	2633432	177227

Source: Sugar and Food Industries Corporation Report, 2001-02

About 4.35 lakh metric tons sugar and 4 lakh metric tons of gur are required for domestic consumption. The present consumption is very low which only 5.80 kg is per capita per year. In the developed countries the consumption of sugar per person per annum is 25-30 kg. Government of Bangladesh is striving to achieve self-sufficiency in both sugar and gur so that people can get at least 30 kg sugar and 6.0 kg gur annually. It is obvious that more land will not be available and the country is confronted with a serious problem of land constraints.

1.4 Economic Importance of Sugarcane Production

Economic development of Bangladesh largely depends on the availability of exportable commodity and foreign exchange. Bangladesh has to develop its industrial and agricultural sectors. If the country fails to produce required quantity of sugar to cope up with the increasing demand, the nation will have to suffer for this. With the existing facilities in the country, sugarcane may also be used for other purposes. About 2.01 million tons of cane can be crushed to produce 170 thousand tons of white sugar. Also 0.08 million tons of surplus bagasses, 0.06 million tons of presumed and appreciable quantity of furnace can

be produced from sugarcane. Out of the surplus bagasses about 18,000 tons of high quality paper may be produced. Molasses can be utilized for producing 0.2 million gallons of spirit and 45 thousand gallons of alcohol (Rashid, 1997; Ali, 1974). The unused bagasses and presmud may be a good source of organic matter in the soil. Green leaves, cane tops and young sucker are used as rich cattle feed.

Sugarcane has an important role on employment. Sugarcane farming, sugarcane trade and sugar industries employ a large number of people (Rashid, 1997). In addition, a large number of labourers are also engaged in transportation of canes towards mills and the distribution of white sugar throughout the country specially in the North-Western region of Bangladesh (Ali and Ali, 1990).

The production of sugarcane and sugar mills are contributing significantly to the development of the rural areas by providing rural employment, improvement of the rural infrastructure and also saving foreign exchange and adding directly and indirectly to the national exchequer. Thus the importance of sugarcane production per unit area is very important.

Sugarcane is cultivated in almost all the district of Bangladesh but it concentrates mainly in the greater district of Rajshahi, Kustia, Jessore, Rangpur, Dinajpur, Bogra, Pubna, Faridpur, Barisal, Dhaka and Mymensingh.

The government of Bangladesh is emphasizing the attainment of self-sufficiency in sugar and gur production by stabilizing sugarcane area and increasing yield. Bangladesh Sugarcane Research Institute (BSRI) has recommended a number of improved production practices from planting to harvesting with a view to increase the per hectare production of sugarcane through varietal improvement, better management of water resources, fertilizers and other inputs and improved cropping systems. So sugar mills, DAE, NGOs including some other agencies have been working for a long Time to increase the production of sugarcane per unit area adopting those practices.

1.5 Justification of the study

Bangladesh is a developing country. Agriculture sector contributes about 25 percent to its GDP (BBS, 2001). For long run development of our country, proper management of our manpower and natural resources like land are inevitable. The present study attempts to identify the problems and prospects of sugarcane production. Many farmers have lost their interest to produce sugarcane. It is, therefore, important to find out the actual causes, constraints or problems of producing sugarcane. A few systematic economic investigations on sugarcane were undertaken either by private or government organisations and findings from those studies may prove to be inadequate to frame up-to-date policies. In this regard an up-to-date study on cost of production and profitability of different categories of farmers growing sugarcane may help bridging the knowledge gap. The research workers will also be benefited in doing further studies of similar nature. The study is expected to assist planners in making effective and judicious plan in respect of production and consumption and in formulation of macro and micro policies for agricultural development.

1.6 Objective of the Study

The specific objectives of the present study are as follows:

1. To identify the socioeconomic characteristics of the farmers cultivating sugarcane.
2. To determine the cost and returns of producing sugarcane under different categories of farms.
3. To determine the factors responsible for variations of yield and economic returns of sugarcane.
4. To identify the major problems faced by the farmers in producing sugarcane.

1.7 Outline of the Study

The study is divided into 8 chapters. In chapter 2, the review of literature related to sugarcane. Chapter 3 deals with the methodology as well as the analytical technique used for the study. A brief description of the study area and socio-economic condition of the study area is presented in chapter 4. Chapter 5 deals with costs and returns of sugarcane production. Chapter 6 deals with effects of inputs on gross returns and efficiency of resource use. Chapter 7 deals with problems and constraints of sugarcane production. and Chapter 8 deals with summary and conclusions.

REVIEW OF LITERATURE

A little effort was made to study on the economics of sugarcane production. However, recently, BSRI, Ishurdi, DAE, Faculty of Agricultural Economics and Rural Sociology of Bangladesh Agricultural University, Mymensingh have completed some economic studies on sugarcane.

A modest attempt has been made here to review the pertinent literature dealing with the economic aspect of sugarcane.

Rathi *et al.* (1974) conducted a study at Uttar Pradesh Institute of Agricultural Science, Kanpur, India during 1970-71 to 1972-73 with some Rabi crops that included three varieties of wheat, two varieties of barley, mustard and potato taking as intercrops. They found intercropping of wheat (all varieties) that reduced cane yield significantly but intercropping sugarcane was more profitable than that of sugarcane as a sole crop. They also found that sugarcane and mustard combination gave the highest net return per hectare followed by sugarcane and wheat combination.

Mathur, B. S. (1975) conducted an experiment in Uttar Pradesh on sugarcane (autumn planted) alone, sugarcane (autumn planted) intercropped with wheat and sugarcane (spring planted) after harvesting wheat. He conducted this experiment in three years. He got highest yield of cane on sugarcane (alone) of 89.27 tonne/ha followed by that of autumn planted sugarcane with intercrop wheat 73.01 and spring sugarcane (after harvest wheat) 59.13 tonne/ha But he got higher net profit of Rs. 1168.87 per hectare from sugarcane (autumn) +

wheat than that of sugarcane (autumn) alone, while the spring sugarcane (after harvested wheat) and wheat showed a profit of Rs. 471.37.

Uddin (1975) in his study found that per acre costs of production of sugarcane were Tk 2445.89, Tk 2130.38 and Tk 1918.64 for small medium and large farms respectively. The per acre net returns were calculated at Tk 1206.60, 1554.38 and 1172.08 for small, medium and large farms respectively, where the highest net return was earned by the medium farms and the highest size group earned the lowest net return.

Islam (1975) conducted a study where per acre costs of producing sugarcane were Tk 2423.06, 2336.06, 2249.30 and 2029.40 for found varieties namely CO. 1158, B.O. 17, CO. 633 and CO. 513 respectively. Human labour constituted the most important and largely used single input in the production process. The per hectare acre costs of human labour were Tk 1042.71 (43.03%), 994.23 (42.56%), 946.44 (42.08%), and Tk 961.95 (47.40%) for CO. 1158, B.O. 17, CO. 633 and CO. 513 varieties respectively. Cost of marketing constituted 12.6, 12.6, 9.9 and 11.8 per cent of the total costs for the four varieties respectively. On an average, per acre returns were calculated at Tk 1531.84, 1264.09, 612.56 and 1027.38 for those varieties respectively.

Razzaque *et al.* (1978) conducted an experiment at Rajshahi Sugarcane Mills farm, Hariana in 1975-76 with some intercrops such as watermelon, mustard, tomato, potato, wheat lentil, chick pea, seasame and cabbage for assessing their potentiality as intercrop with sugarcane. They reported that culturally mustard, tomato, lentil, potato and cabbage were perfectly compatible with sugarcane. The highest net returns (Taka 34439.24 per hectare) were earned from sugarcane + seasame combination.

Narwal *et al.* (1978) conducted an experiment in Haryana state about intercropping on the yield of spring planted sugarcane. He found that Mung intercropping gave significantly higher yields. It gives higher net return (Rs. 3871.95 per hectare) than the sole cane Tk 2876.00 per hectare.

Hossain (1979) conducted an economic study on the intercropping of tobacco, mustard, potato and onion with sugarcane of Shampur Sugar Mill Zone. He found that the per acre net returns from sugarcane + tobacco was the highest (Tk 9466.38), that from sugarcane with onion was the lowest (Tk 7516.44).

Razzaque (1981) conducted a study in an area of Rajshahi district on sugarcane production of high yielding varieties. In his study, he reported that, the per acre gross cost and per maund cost of producing sugarcane were Tk 4887.96 and Tk 10.33 respectively. Per acre yield sugarcane was Tk 454.53 maunds, the value of the value of the main products was Tk 5681.58 and the value of by-products was estimated at Tk 169.58. Thus the per acre gross return from sugarcane was calculated at Tk 5850.63 and the per acre net return was Tk 962.67. It is also found in his study that, per maund net return was Tk 2.12 and gross return per taka invested was Tk 1.20.

Imam *et al.* (1984) conducted an experiment at SRTI during 1980-81 taking some leguminous crops such as lentil, gram, khashari, sunhemp, groundnut, ground pea, mashkalai as intercrop. They reported that the sugarcane + sunhemp combination produced significantly highest yield of 76.90 ton/ha and sugarcane + garden pea combination produced the lowest yield (62.27).

Ali *et al.* (1986) conducted a survey at Rangpur Sugar Mills area. They found a strong negative relation between farm size and adoption of improve sugarcane production practices.

Kabir (1988) found in his study that, potato, mustard and gram were found as most compatible intercrops with sugarcane cultivation. He found that the highest return per hectare was obtained from sugarcane + potato (Tk 29774.01) followed by sugarcane + gram (Tk 16176.63), sugarcane + mustard (Tk 11754.56), sugarcane + lentil (Tk 5968.30) and sugarcane as a sole crop (Tk 5792.49). This means that the net return from every intercrop combination with sugarcane was higher than that of sugarcane as a sole crop.

Chougule *et al.* (1988) conducted a study among 240 sugarcane growers of Andhra Pradesh during 1981-82 and 1982-83. They reported that the net production cost (excluding land charge) of plant crop was Rs. 14350, Rs. 12921, and Rs. 12917 per hectare for Telengana, Rayalaseema and Coastal Andhra regions respectively. Cane yield were observed to be 85 to 86 to per hectare in Telengana and Rayalaseema and 76 ton per hectare in Coastal Andhra. Cane production costs for two years averaged Rs. 12900 to 14000 per hectare in all the three regions. In all the regions, manures and fertilizers attributed the highest proportion in total cost (17 to 30%) followed by seed and planting (13 to 17%). Harvesting and transportation though do not directly contribute to the yield accounted for 24-27% expenses.

Miah (1992) studied about intercropping of potato, mustard, onion and lentil with sugarcane at Jaipurhat Sugar Mall areas. He observed that farmers of the millzone areas preferred mustard as an intercrop with sugarcane. Although the sugarcane + potato combination produced the highest returns per hectare (Tk 34985.81), followed by sugarcane + mustard (Tk 19733.93), sugarcane + onion (Tk 18671.54) and sugarcane + lentil (Tk 18165.73).

Roy (1993) conducted a study on sugarcane cultivation with and without intercrops in Manikgonj district. He found that sugarcane cultivation with

intercrops was more profitable than sugarcane cultivation without intercrops, but a large number of farmers grew sugarcane without intercrops.

Rashid (1997) reported that the total per hectare cost of producing ISD 16 varieties of sugarcane was Tk 44759.98 and ISD 18 varieties of sugarcane was Tk 46259.68 and net returns from ISD-16 and ISD-18 varieties of sugarcane were Tk 26589.52 and Tk 29278.42 respectively. Among the used inputs, human labor was an important and largely used input in growing sugarcane. The study also indicates that there is a positive relationship between fertilizers used per hectare and yield of sugarcane.

Joarder (1998) studied that both sugarcane and alternative crops were profitable enterprises. But sugarcane was more profitable than alternative crops Aus paddy and Lentil combined. In the study areas per acre total costs of production of sugarcane and alternative crops were Tk 21,850.29 and Tk 11,890.68, while gross return and net return per acre were Tk 27,457.84 and Tk 14,667.21 and Tk 5067.55 and Tk 2776.54 respectively.

Khatuns, S. (1999) conducted a study on sugarcane production with intercrops in Thakurgaon district. She showed that sugarcane growing is a profitable farm business. The large farmers received the highest net returns. The average net returns of sugarcane production were Tk 12337.82, Tk14,804.00 and Tk 29246.70 per hectare and their corresponding BCRs were 1.29, 1.35 and 1.62 for small, medium and large farms respectively. The large farms used the highest amount of production cost (Tk 47262.00) followed by medium (Tk 42856.00) and small (Tk 42252.78) farms. Average net return of all farms was Tk 18793.57 per hectare and corresponding BCR was 1.43.

A careful survey of the relevant literatures suggested that the farmers group such as, small, medium and large who were involved with the production of sugarcane had distinct economic benefit upon each other. The aim of the present study is to determine the cost and returns of producing sugarcane under different categories of farms.

CHAPTER THREE

METHODOLOGY OF THE STUDY

METHODOLOGY OF THE STUDY

3.1 Introduction

Farm management study is based on field level primary data. The method of data collection depends on the purpose and aims of the study. There are several methods of collecting this basic information. This study is based on field level primary data collection from selected/individual farmers through farm survey method. As opposed to farm accounts, farm survey method was preferred because most of the farmers do not keep records and accounts of their farm operations. The word "survey" refers to a method of study in which an overall picture of a given universe is obtained by systematic collection of all available data on the subject. It is preferable to collect the data from the cooperating farmers as soon as possible after the farm year has ended. For the present study the survey method was used, because of;

a) Limitation of time: It is the most appropriate method through which necessary information can be obtained within the shortest possible time.
b) Financial limitation: The farm survey method required less expense than other methods.
c) Convenience: This method is easier to use for comprehensive coverage but one of the major defects of this method is that the investigator has to depend solely upon the memory of the farmers. This was however overcome by asking cross-question, making frequent visits. So that farmers can provide information more accurately.

3.2 Selection of the Study Area

Selection of the study area is an important step in a farm management study and it largely depends upon the objectives set for the study. The area in which a farm business survey is to made depends on the purposes of the survey and possible cooperations from the farmers.

In order to collect the required data, 3 Upazilas of Natore district were selected as the study area where sugarcane was grown by the farmers. The main criteria behind the selection of these Upazilas were:

a) Concentration of sugarcane cultivation in these areas with similar topography and soil type.
b) The Upazilas were a good sugarcane producing area.
c) The researcher was familiar with the language and other socioeconomic characteristics of the farmers of the selected Upazilas and the anticipated cooperation from the respondents was high so that reliable data would be obtained.
d) No study of this type was conducted previously in this area.
e) Easy accessibility and good communication system to the selected Upazilas.

3.3 Period of Study

Since farming is seasonal, information for a farm business survey should cover a whole crop year in order to have a complete sequence of crops. Based on cropping patterns, cultivation of sugarcane may be divided into two seasons: Kharif and Rabi. Kharif season covers summer months from April to September and Rabi season covers winter months, extending from October to March. Sugarcane is an annual crop. It is generally planted within October to December and harvested after 12-15 months of planting. However, the formal survey was conducted in May to August of 2003. A few more visits were done to collect the harvesting data.

3.4 Selection of Sample and Sampling Technique

The farm management study required some fundamental information in relation to the objective of the study. It was however, not possible to study all the farms in the working area due to limitation of time, efforts and funds. For this reason, reasonable sizes of sample to satisfy the objectives set in this study were taken into account. To achieve this objective 90 sugarcane growers were selected randomly. Data were collected from 9 villages of Natore district. Again theses samples were categorized on the basis of land holdings. These categories are as follows:

i) Small farms- owing 0.05 to 2.49 acres (0.02-1.0 ha) of land.
ii) Medium farms- owing 2.50 to 7.49 acres (1.01 to 3.03 ha) of land.
iii) Large farms-owing more than 7.5 acres (i.e. above 3.04 ha) and above.

Then the selected farmers were interviewed to achieve the objectives of the study.

3.5 Preparation of Survey Schedule

Before preparing the final schedule, a draft survey schedule was developed keeping in view the objectives of the research. The draft survey schedule was pre-tested in the study area by interviewing a few sugarcane growers. In this pre-testing, much attention was given to the information which was not designed to be asked. Thus some parts of the draft survey schedule, were improved, rearranged and modified in the light of the actual experiences gather in the pretest. After necessary adjustment of the survey schedule a final survey schedule was developed. The final survey schedules were divided into three categories. One of which was related to farmers socioeconomic condition, the other one was related to costs and returns aspects of sugarcane and the last one dealt with problems faced by the sugarcane growers and the advantages to grow these crops. The schedule was developed in a sample manner so that accurate information could be obtained.

3.6 Collection of Data

In this study area data were collected by the author herself though personal interviews with the 90 selected sugarcane growers. A survey schedule was used for collecting information. Before going to make actual interviews, the academic purpose of the study was clearly explained to the sample farmers. Initially, the farmers hesitated to answer the questions. But when they were assured that the study was purely an academic one and was not likely to have an adverse effect on them, they provided their cooperation to the researcher. At the time of interview, researcher asked the questions systematically and explained whenever it was felt necessary. In order to make the information reliable and to minimize error, data were collected in local units. The local units were later converted into international standard units.

3.7 Processing and Tabulating of Data

After collection, the data were computerized. In the case of local units given by the farmers, these were converted into standard units for the preparation of final tables. Mainly tabular technique was used for analyzing data. Functional analysis was also used to reveal the quantitative relationship among the variables.

3.8 Analytical Technique

Data were analysed with the purpose of achieving the objectives of the study. In order to arrive at a meaningful conclusion, tabular technique and statistical analysis were intensively used.

There are many techniques to determine the relationship between different factors of farm management e.g. tabular technique, correlation or regression analysis, farm budgeting etc. To explore the relationship between gross return and inputs used, Cobb-Douglas production function was used. The functional form of the estimated regression will be discussed latter. Interpretation and discussion of the findings were presented in simple terms.

3.9 Problems Faced in Collecting Data

There were some problems faced during the period of data collection. These problems are reported in the following way:

a) There farmers did not keep records of their farming activities. Therefore the author had to depend upon their memory. It was difficult to get information from recall memory.

b) Most of the farmers in the study area were illiterate and they had no idea about a research study and it was therefore difficult to explain the purpose of this research to convince them.

c) The farmers always had a tendency not to provide correct data relating to the size of their holdings and income received from different crops because they thought that new taxes would be imposed on them, if correct information was provided.

d) On many occasions farmers were not available at home and in such cases the author had to give extra effort and time to collect the information from them.

e) With respect to data on hectare, volume and quantity of production the respondents answered according to their local units. Managed data were later converted into standard international units of measurement.

3.10 Procedure for Computation of Cost and Returns

For financial analysis of different enterprises, it was necessary to compute costs of inputs. These were to be deducted from the value of output. The cost of any inputs for different enterprises plays a vital role. Farmers in this study used purchased as well as home supplied inputs. The cost of purchased inputs such as seed, fertilizers, insecticides, hired labour rates, during survey period or at the prices paid by the farmers. Farmers did not pay cash for some inputs such as family labour, home supplied animal labour, cow dung or manure, home supplied setts etc. So it is very difficult to calculate the cost of production of these inputs. For such home supplied inputs, opportunity cost principle was used. Opportunity cost of an input is defined as an income which it is capable of earning from alternative employment in or outside the farm.

In this study, in calculating the production cost i.e. gross expenses, the following components of cost were considered:

i) Setts/seeds.
ii) Human labour.
iii) Animal labour.
iv) Manures.
v) Fertilizers.
vi) Insecticides.
vii) Irrigation.
viii) Carrying and transport cost.
ix) Interest on operating capital.
x) Land use cost.

3.10.1 Cost of setts

In the study area, most of the farmers used purchased setts (settlings) of sugarcane. Home supplied setts were charged at the prevailing market rate and the costs of purchased setts (or setting) were calculated at the actual price. In the study area, the market price of setts was Tk 1.075 per kg of sugarcane.

3.10.2 Cost of human labour

Human labour was one of the most important inputs used in the production of sugarcane. It was broadly classified into two types i.e. family labour and hired labour. Family labour includes the operator himself, the adult male and female as well as children of a farmer's family and the permanently hired labour. To determine the costs of unpaid family labour, the opportunity cost concept was used. In this study, the opportunity cost of family labour was assumed to be the market wage rate, i.e., the wage rate which the farmers actually paid to the hired labours, working out the cost of annually hired labour , the total cash paid was added to the value of whatever was paid in kind. In computing the cost of daily hired labour actual wages paid were charged and in the case where the hired labours were provided with meals, the money value of such payment was added to the cash paid.

Eight adult male hours were equivalent to one-man-days. To standardise labour hours or man-days required for different operations all the labour units were converted into man equivalents. This was performed into follows:

1 adult = 1.5 adult women = 2 children.

The wage rate varied from Tk 50 to Tk 70, per man-day depending on the season and availability of day labour s in the study area. The average computed wage rate was Tk 60/man-day which was used to determine the human labour cost. To arrive at per hectare man-days used, all man-days used by an individual farmer was divided by the total area. These man-days were multiplied by the per-man day cost find out the total labour costs.

In producing sugarcane, human labour was used for the following operations:

a) Sett preparation/settling raising
b) Land preparation and trench making
c) Sett/settlings plantation
d) Weeding
e) Top dressing
f) Earthing up
g) Pest control by mechanical means
h) Bamboo protection
i) Harvesting, clearing and birding

3.10.3 Cost of animal labour

The animal labour was mainly used in two operations, such as land preparation and carrying of sugarcane. An animal pair-day consists of 8 working hours of day. For computing animal labour cost, the cost of human labour was deducted, because the cost of attendant was included in the human labour. The home supplied animal labour was calculated based on the opportunity cost principle. On the other hand the cost of hired animal power was calculated by prevailing market prices that was actually paid by the farmers. The wage rate of animal power was different in the study area. But the average fixed wage rate amounted Tk 60.00 per pair-day was used. To compute per hectare animal

power of production, all pair-days of individual farmers were summed up and divided by the total hectare. These pair days were multiplied by the average wage rate to arrive at the total animal labour cost.

3.10.4 Cost of manure

Most of the farmers used home supplied manure. A few farmers purchased some amount of manures. Farmers were found using cowdung ash and oilcake as manure. The value of home supplied and purchased cowdung and oilcake were calculated at the prevailing market price. The prices of cowdung differ from sample to sample, but they did not differ significantly. The average price of cowdung is Tk 0.375 per kg and that of oilcake is Tk 9 per kg.

3.10.5 Cost of fertilizers

Correct dose of fertilizer is a major requirement of sugarcane production. The farmers used four kinds of chemical fertilizers, i. e. urea, Triple Super Phosphate (TSP), Muriate of Potash (MP) and Gypsum in growing sugarcane. Fertilizer costs were charged according to the actual price paid by the farmers. However, costs were Tk 6.00, 14.00, 10.00 and 4.00 for urea, TSP, MP, and Gypsum respectively.

3.10.6 Cost of insecticide

Most of the sugarcane growers used furadan and a little amount of Heptachlor. The average price of heptachlore and furadan were Tk 70.00 and 80.00 per kg respectively.

3.10.7 Cost of irrigation

Almost all the farmers under study area have no facility to irrigate their cane field or to drain out the excess rain water from crop field. Few farmers had DTW facilities, some had STW and some had wells from which they irrigated their field. They used to pay for getting irrigation facilities from DTW and STW. Though they used their own fuel. The cost of irrigation included the rental charge of machine plus the costs of fuel.

3.10.8 Cost of marketing, carrying and transportation

The cost of marketing in the case of sugarcane involved mainly the cost of carrying the canes from farms to procurement centre/mill gate (Natore sugar mill). Sugarcane growers transported their canes to procurement center by bullock or buffalo carts, etc. The carrying cost per ton cane varied from Tk 30.00 to 40.00 depending on the distance of the farm from the cane procurement center.

3.10.9 Land use cost

In the study area, the land use cost per hectare was different from plot to plot depending on the location, fertility and topography of the land. In calculating land use cost, the average rental value of land per hectare for a particular year as reported by farmers was considered. The average land use cost was calculated at Tk 6000.00 per hectare for growing sugarcane.

3.10.11 Interest on operating capital

Interest on operating capital involved all costs excluding those for which interest had already been charged. Interest on operating capital was charged at the prevailing bank interest rate and it was 13 percent per annum. Most of the farmers borrow money for buying fertilizer, pesticide, etc from Natore Sugar Mill and interest was charged at the prevailing bank rate. For calculating interest on operating capital, the following formula was used:

$$\textit{Interest on operating capital} = \frac{\textit{Operating cost} \times \textit{rate of interest} \times \textit{length of time period}}{2}$$

This actually represented the average operating costs over the period because all costs were not incurred at the beginning or at any fixed time. The cost was charged for a period of 12 months at the rate of Tk 14.00 per annum.

3.11 Economic Returns

Per hectare returns from sugarcane were broadly classified into gross returns and net returns. The per hectare gross returns of sugarcane were

determined by the average farm prices. The value of the by-product was also added to estimate the gross returns. When by products not sold, its values were determined according to the farmers' assessment. Net returns were determined by deducting total expenses from the gross returns.

3.12 Production Function Analysis

To determine the effects of variable inputs, both linear and Cobb-Douglas production function models were initially estimated. The Cobb-Douglas models proved superior on theoretical and econometric grounds. Thus the Cobb-Douglas model was accepted.

Data were converted to per farm per hectare basis to facilitate the analysis.

The function was specified as:

$$Y = a \times_1^{b_1} \times_2^{b_2} \times_3^{b_3} \times_4^{b_4} \times_5^{b_5} \times_6^{b_6} e^{Ui}$$

The function was linearised by transforming it into the following double log or log linear form i,e.

$$InY = Ina + b_1 Inx_1 + b_2 Inx_2 + b_3 Inx_3 + b_4 Inx_4 + b_5 Inx_5 + b_6 Inx_6 + U_i$$

Where,

Y = Gross return (Tk/ha).

a = Constant or intercept value.

x_1 = Cost of setts (Tk/ha).

x_2 = Cost of human labour (Tk/ha).

x_3 = Cost of animal labour (Tk/ha).

x_4 = Cost of manures and fertilizers (Tk/ha).

x_5 = Cost of furadan & other insecticides (Tk/ha).

x_6 = Cost of irrigation (Tk/ha).

U_i = Stochastic disturbance term.

In = Natural logarithm.

b_1.....b_6 = Coefficients of respective variables.

From the analysis of the Cobb-Douglas production function, resource use efficiency may be studied and it was measured by the following formula:

$$\text{Resource use efficiency} = \frac{MVPx_i}{MFCx_i}$$

$$\text{Again, } MVP(x_i) = b_i \frac{\bar{Y}(GM)}{\bar{X}(GM)}$$

Where, Y = Mean value (GM) of gross return in Taka

X_i = Mean value (GM) of the variable input in Taka

i = 1, 2 6

GM = Geometric mean

And $\frac{dy}{dx_i}$ = Slope of the production function as well as MVP of the input.

MVP = Marginal value product = MPP × product price

MFC = Marginal factor cost = Input price.

CHAPTER FOUR

DESCRIPTION OF THE STUDY AREA AND SOCIO-ECONOMIC CHARACTERISTICS OF THE SAMPLE FARMERS

4.1 Introduction

This chapter of the present study gives a brief description of the study area and socio-economic characteristics of the sample farmers. Knowledge of the study area is essential to understand the agricultural activities, possible development opportunities of potentials. The description of the study area includes location, soil, climate, rainfall and temperature, area, population and households, agricultural and economic condition, industry, religions, culture and tradition, occupation of the people, transport, communication and marketing facilities.

4.2 Description of the Study Area

The study area includes villages under Natore Sadar Thana, Lalpur and Baraigram Thana of Natore district. The selected villages were Sultanpur, Parbisa, Gazolpur, Mollayat, Noagram, Chandi, Mirzapur, Pratappur, Rajapur. The areas were adjacent to each other. The district headquarter is 05 to 35 kilometers from the villages. Most of the farmers in those villages used to grow sugarcane. Some other considerations that led to the selection of this study area were:

I. The villages used to grow sugarcane abundantly.
II. No study of this type was done previously in this area.
III. It was easier for the author to establish communication with the farmers.

Table 4.1 Household and Population of Natore District.

Household No	Population		Total	Size of House hold	Sex Ratio Male/Female
	Male	Female			
337476	773833	747526	1521359	4.5	103.5

Source: BBS (2000).pg:21

4.2.1 Soil and topography

Sugarcane can be grown in various kinds of soil, i.e. from sandy to loamy and clay. It is grown well where P^H of the soil is slightly acidic to alkaline, i.e. 6.5 to 8.5. The sugarcane plants can grow on water logged soils but submergence for several weeks destroyed sugarcane due to prevalence of red rot in the low level area followed by absence of proper drainage system, which actually reduced sugar percentage of the plant. Situation aggravated due to heavy down pour in rainy season.

The topography of the land should be high to medium high. The soil, moisture and temperature in Bangladesh are suitable for sugarcane cultivation. *Doash* and *Etel* soils are dominant in the studied area.

Table 4.2 Area under different types of soil of Natore districts (in sq.kms)

District	High Land	Medium High Land	Medium Low Land	Low Land	Very Low Land	Total
Natore	123.7	948.7	364.5	374.0	0.0	1846.9

Source: BBS, 2000

4.2.2 Climate, temperature and rainfall

The temperature of the study area varied from 32.3^0C to 11.2^0C. Cold weather persists from November to January and hot temperature prevails during March to September. The average maximum temperature is the highest in April. The coldest month is January. Heavy rainfall occurs during the spell of monsoon (June, July and September). The highest rainfall occurs in July-August and the lowest in December and January. The Humidity percentages are higher during the months of June to September. There was no local arrangement for recording rainfall, temperature and such other climatic data. Therefore, available data of the district regarding rainfall and temperature were used. The average rainfall of study area is less than the district average since the study area is located near Lalpur which is one of the areas experiencing the lowest rainfall in the country.

Fig: Map of Natore District

4.2.3 Agricultural and economic condition

The system of agricultural production is largely traditional in the study area. The main agricultural crops grown in the study area are sugarcane, rice, wheat, jute, mug, cabbage, onion etc. Most of the crops are grown under non-irrigated conditions.

4.2.4 Transport, communication and marketing facilities

Transport, communication and marketing facilities are the main agricultural infrastructures which play an important role in agriculture as well as economic development of a country.

The communication with the villages of the study area with Natore Sadar Thana head quarters is very nice. The villages of the study area are adjacent to the Natore highway. The internal communication system of the village is also good. Therefore, the marketing facilities of the villages are reasonably developed. The growers often soled their products directly to the market. They carry their products by van, bus and truck into the market.

4.3 Socioeconomic Characteristics of the Sample Farmers

Socioeconomic characteristics of the farmers affect their production pattern. People differ from one another in many aspects. Socioeconomic aspects of the farmers can be viewed from different angles depending on a number of variables relating to their level of living, socioeconomic environment in which they live and the nature and extent of farmer's participation in national development programmes. Therefore, information regarding family size, level of education, occupation, age, allocation of land, size of land holdings was studied.

4.3.1 Family size and composition

In this study, family size was defined as total number of persons living together and taking meals from the same kitchen under the administration of the same head of the family. The term family includes wife, sons, unmarried daughter, father, mother, daughter-in-law, grandson etc.

One the basis of age group the average number of persons per family of small, medium and large farmers are on the basis of their age are presented in Table 4.3

Table 4.3 Family size and composition of the selected sugarcane growers

Farm household	Number of sample household	Family member, No.		Average number of family member			
		Male	Female	Less than 16 years	16-60 years (Working members)	above 60 years	All categories
Small farm	30	2.66	1.90	1.20	2.93	0.50	4.63
Medium farm	30	2.36	1.70	0.80	2.63	0.40	3.83
Large farm	30	3.96	2.36	1.80	4.56	0.83	7.19
All farmers	90	2.99	2.32	1.27	3.37	0.58	5.22

The age groups were considered as less than 16 years, 16-60 years (working members) and above 60 years. The average family size was found to be 4.63 for small farmers, 3.83 for medium farmers and 7.19 for large farmers. Average family size of all farms was 5.22 which is less than national average of 5.6 (BBS, 2001).

Table 4.4 Literacy status of the family members of the sugarcane growers

Level of education	Small farmers		Medium farmers		Large farmers		All farmers	
	Average number	Percent	Average number	Percent	Average number	Percent	Average number	Percent
Illiterate	1.033	15.44	1.00	13.05	0.6269	10.68	0.88	12.88
Primary	1.66	24.81	1.73	22.58	1.20	19.42	1.53	22.40
Secondary	1.66	24.81	2.24	29.24	2.567	41.68	2.15	31.48
Higher secondary	2.33	34.82	2.53	34.59	1.256	20.22	2.07	30.31
Bachelors and above	0.01	0.14	1.04	0.052	0.55	8.90	0.20	2.93
Total	**6.69**	**100.00**	**7.66**	**99.51**	**6.18**	**100.00**	**6.83**	**100.00**

4.3.2 Level of education

Education has an important impact on modernization of farm business operations. "Although education is not in itself a sufficient condition for development of agriculture, it is certainly a necessary condition" (Mellor, 1974). The government and many organizations have taken different programmes for improving literacy rate in the country. National literacy rate was 24.92 % (BBS, 2001) and that of Natore district was 20.95% percent during the Population Census 1991.

The education levels of the family members of the sample farmers are given in Table 4.4 The table shows that 15.45 percent small farmers are illiterate. The corresponding figures for medium and large farmers were 13.05 and 10.68 percent respectively. The highest percentage of primary education belongs to small farmers was 24.81 percent and the corresponding percentage of medium and large farmers were 22.58 and 19.42 percent. In Higher Secondary level education was higher in the case of small farms which were 34.82 percent and it was 34.59 and 20.22 percent for medium and large farmers. Only 0.14, 0.55 and 0.20 percent members of the small, medium and large farmers had education above degree level. In the case of all farm households, 12.88 percent members were illiterate, 22.40 had primary, 31.48 percent had secondary and 30.31 percent had higher secondary level education. Bachelor and above degree levels education were possessed by only 2.93 percent members.

Table 4.5 Area (ha) of sugarcane under different farm size groups

farm households	Number of farm households	Cultivated area (ha)	Area under sugarcane (ha)	Percentage of total cultivated area
Small farms	30	1.76	0.56	73.68
Medium farms	30	1.35	1.07	79.26
Large farms	30	4.65	3.99	85.81
All farmers	90	6.76	5.62	83.13

4.3.3 Distribution of area under sugarcane cultivation in relation to total cultivated land by farm size groups

The cultivated areas owned by small, medium and large farmers were 1.76, 1.35 and 4.65 ha respectively (Table 4.5). It is observed that area under sugarcane production by the small, medium and large farmers were 0.56, 1.07 and 3.99 hectare respectively. A positive relationship was found between cultivated area and sugarcane area. It was also found that proportions of total cultivated land and land under sugarcane were 73.68, 79.26 and 85.81 percent in the case of small, medium and large farmers respectively.

4.3.4 Occupation

Agriculture was the main occupation of the selected farmers in the study area. Besides agriculture, some farmers engaged in petty trading and others are employed in government, semi-government or private services. Thus the occupation of the farmers had been classified into two groups, main and subsidiary.

Table 4.6 Occupation of the sample farmers

Occupation		Small farmers		Medium farmers		Large farmers		All farmers	
		No.	%	No.	%	No.	%	No.	%
Main	Agriculture	17	56.67	27	90.00	25	83.33	69	76.60
	Business	2	6.66	2	6.66	4	13.33	8	08.88
	Services	11	36.67	1	3.33	1	03.33	13	14.44
	Total	30	100.00	30	100	30	100	90	100
Subsidiary	Agriculture	5	16.67	12	40	15	50.00	32	35.55
	Business	10	33.33	14	46.62	12	39.96	36	40.00
	Fishing	3	10.00	10	33.33	11	36.67	23	25.56
	Livestock	7	23.33	11	36.67	21	70.00	39	43.33
	Poultry	11	36.67	7	23.33	3	10.00	21	23.33
	Fruits	13	43.33	3	10	2	06.67	18	20.00
	Fisheries	2	6.66	9	30	15	50.00	26	28.89

Table 4.6 shows that in the case of sugarcane growers, 76.67 percent farmers were engaged in agriculture, 8.88 percent in business and 14.44 percent

in services as their main occupation. Business was the most important subsidiary occupation of sugarcane growers.

Table 4.7 Average land distributions of farm families (ha)

Ownership Pattern	Small farmers		Medium farmers		Large farmers		All farmers	
	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
Homestead area	0.02	2.79	0.054	2.05	0.08	1.17	0.051	0.28
Pond	0.01	1.12	0.098	3.71	0.104	1.42	0.71	9.54
Garden	0.004	0.56	0.034	1.28	0.048	0.60	0.28	0.611
Own cultivable land	0.68	94.41	2.44	92.42	7.10	96.74	3.407	95.19
Rented out	0	0	0	0	0	0	0	0
Rented in	0.010	1.18	0.022	0.83	0	0	0.016	0.158
Mortgaged out	0	0	0.0134	0.50	0	0	0.004	0.05
Mortgaged in	0	0	0	0	0	0	0	0
Total	0.72	100	2.64	100	7.34	100	3.56	100

Farm size = Homestead (including pond and garden) + Cultivable land + Rented in + Mortgaged in – (Rented out + Mortgaged out).

It appears from Table 4.7 that the average farm sizes of sugarcane growers were 0.72, 2.64 and 7.34 ha for small, medium and large farmers respectively. Owned cultivated land of sugarcane, of small, medium and large farmers were 94.41, 92.42 and 96.74 percent respectively, of their total cultivable land.

Table 4.8 Distribution of sugarcane grower according to source of credit

Categories of farmers	Debtor (No.)					Non debtor (No.)	Total (No.)
	Krishi Bank	Sugar mill	NGO (BRAC)	Friends and relatives	All		
Small farmers	2 (6.60)	21 (70.00)	0 (0)	2 (6.67)	25 (83.33)	5 (16.67)	30 (100)
Medium farmers	4 (13.33)	23 (76.66)	0 (0)	1 (3.3)	28 (93.33)	2 (6.67)	30 (100)
Large farmers	1 (3.33)	25 (83.35)	2 (6.67)	0 (0)	28 (93.33)	2 (6.67)	30 (100)
All farmers	7 (7.78)	69 (79.67)	0 (0)	3 (3.3)	81 (90)	9 (10)	90 (100)

4.3.5 Indebtedness of the farmers

Farmers were found to have taken loan in terms of both cash and kind. Table 4.8 shows that 90 percent of the farmers were in debts and most of them (76.67 percent) borrowed from the Natore sugar mill.

Table 4.10 shoes that most of the farmers (76.54) took loan for sugarcane production for purchasing fertilizers, while 3.70, 4.94 and 14.81 percent of farmers used their loans for family maintenance, agriculture and cow purchase respectively.

Table 4.9 Distribution of sugarcane growers according to the use of loan

Types of farmers	Sugarcane production (Number)	Family maintain (Number)	Agriculture (Number)	Cow purchased (Number)	Total (Number)
Small farmers	20 (80.00)	0 (0)	0 (0)	5 (20.00)	25
Medium farmers	19 (67.85)	3 (10.72)	2 (7.14)	4 (14.29)	28
Large farmers	23 (82.14)	0 (0)	2 (7.14)	3 (10.71)	28
All farmers	62 (76.54)	3 (3.70)	4 (4.94)	12 (14.81)	81

Figures in parenthesis indicate percentages of the total

4.3.6 Income level and sources of income

The level of income is one of the important socioeconomic characteristics. There are various sources of income i.e. income generating crops, fruits, livestock, poultry and fisheries and earning from business and service.

Table 4.10 Average income composition of farm families from various sources

Sources	Small farmers		Medium farmers		Large farmers		All farmers	
	Amount (Tk.)	%	Amount (Tk.)	%	Amount (Tk.)	%	Amount (Tk.)	%
Crops production	16813.3	48.09	16160	61.54	47800	54.14	26924.43	54.02
Fruits	200	0.57	280	1.06	2647	2.99	1042.33	2.09
Livestock	2643.33	7.56	283.33	1.07	156.66	0.17	1027.77	2.06
Poultry	483.33	1.38	108.33	0.41	33.33	0.03	208.33	0.42
Fisheries	3350.00	9.58	2250	8.56	16470	18.65	7356.67	14.76
Business	7353.33	21.03	5848.33	22.27	11480	13.00	8227.22	16.51
Services	4114.80	11.77	1226.66	4.67	9500	10.76	4947.15	9.93
Total	34958.09	100	26256.65	100	88286.99	100	49833.91	100

It appears from Table 4.10 that crop production was the largest source of income of sugarcane growers which was Tk. 26924.42. Business and fisheries were other sources of income which occupied 16.51 and 14.76 percent of the total income for the sugarcane growers respectively.

4.4 Concluding Remarks

The average socioeconomic conditions of the selected farmers were comparatively better than the conditions of farmers in other part of the country. The level of income and literacy status of the sample farmers was found to be relatively high. The socioeconomic conditions of sugarcane growers were more or less the same in the study area. However, it was evident from the study that there were substantial differences in the socioeconomic status among the selected farmers depending on the farm size categories.

CHAPTER FIVE

COSTS AND RETURNS OF SUGARCANE PRODUCTION

5.1 Introduction

Farms in the study area were not maintained any written records of costs and returns of cultivation of sugarcane. However, it is presumed that they can reasonably recollect the costs incurred in connection with their farm business. In this chapter, an attempt has been made to quantify the cost and returns of sugarcane. For calculating costs and returns of sugarcane, enterprise costing technique was used that involves the information of different cost items incurred through various heads of expenditure in producing sugarcane. The net returns were calculated by subtracting the total costs from total returns. Costs of producing sugarcane included all the costs from land preparation to sale of sugarcane to the cane procurement centre. In doing this, the total cost items were classified into three major groups' e.g. labour costs, material costs and miscellaneous costs. In addition to these, two indirect costs, namely interest on operating capital and land use cost were considered to compute the total costs.

5.2 Per Hectare Production Cost of Sugarcane

Total costs of production involve all cost items incurred by the farmers in growing sugarcane from planting to selling to the cane procurement center. Table 5.6 shows that per hectare production cost of sugarcane were Tk 66915.00, 70418.00 and 86193.00 for small, medium and large farmers, respectively. Per hectare production cost of all farmers was Tk 74474.88. In the case of large farmers, per hectare production cost was higher than that of small and medium farmers. The large farmers used higher amount of human labour and inputs than that of small and medium farmers.

5.2.1 Labour cost

5.2.1.1 Cost of human labour

Human labour was the most important and largely used input. It was required for different operations for producing sugarcane from sowing to harvesting. To convert the physical data into financial terms the total man-days of human labour was multiplied by average wage rate of Tk 60.00 and then per hectare costs of human labour incurred for sugarcane was calculated.

In the case of small farmers for producing sugarcane, 228.01 man-days of family labour and 293.00 man-days of hired labour were used (Table 5.1) and per hectare cost was Tk 29160.00 which contributes 43.58 percent of the total cost (Table 5.6). Operation wise distribution of human labour shows that harvesting of sugarcane needed the largest amount of human labour which was 21.18 percent of the total labour cost followed by 17.37 percent in transportation (Table 5.1).

Table: 5.1 Per hectare operation wise distribution of human labour of sugarcane production of small farmers

Sl. No	Name of the operation	Human labour (man-days)			Total cost (Tk)	Percent of the total cost
		Family	Hired	Total		
1.	Sett/setting raising	20.00	22.00	42.00	2520	8.526
2.	Land preparation and trench making	25.00	30.00	55.00	3300	11.17
3.	Sett plantation	23.00	33.00	56.00	3360	11.37
4	Intercultural Operations					
	a) Weeding	20.00	23.00	43.00	2580	8.73
	b) Application of manure, fertilizers and insecticide	23.00	5.00	28.00	1680	5.68
	c) Earthing up	23.00	24.00	47.00	2820	9.54
	d) Bamboo protection	13.00	2.00	15.00	900	3.04
	e) Pest control	8.00	9.00	17.00	1020	3.45
5.	Harvesting and bundling cane	24.00	80.00	104.00	6240	21.11
6.	Transportation	14.00	65.00	79.00	5135	17.37
7.	Clearing of land	-	-	-	-	-
	Total	228.01	293.00	486.00	29160.00	100.00

In the case of medium farmers for producing sugarcane, 123.00 and 360.00 man-days of family and hired labour were used (Table 5.2). In total of 483.00 man-days were used per hectare for different operation which costed Tk 2898.00 and shared 41.15 percent of the total cost of production (Table 5.6). The highest percentage (28.44%) of human labour was used in harvesting followed by weeding 13.76% (Table 5.2).

Table: 5.2 Per hectare operation wise distribution of human labour for sugarcane production of medium farmers

Sl. No.	Name of the operation	Human labour (man-days)			Total cost (Tk)	Percent of the total cost
		Family	Hired	Total		
1.	Sett raising	13.00	15.00	28.00	1680.00	5.18
2.	Land preparation and trench making	17.00	30.00	47.00	2820.00	8.64
3.	Sett plantation	18.00	32.00	50.00	3000.00	9.17
4.	Intercultural operations					
	a) Weeding	15.00	60.00	75.00	4500.00	13.76
	b) Application of manure, fertilizers and insecticide	17.00	19.00	36.00	2160.00	6.61
	c) Earthing up	7.00	19.00	21.03	1260.00	3.85
	d) Bamboo protection	2.00	10.00	12.00	720.00	2.28
	e) Pest control	5.00	8.00	13.00	780.00	2.38
5.	Harvesting and bundling cane	6.00	90.00	96.00	5760.00	17.61
6.	Transportation	18.00	75.00	93.00	9300.00	28.44
7.	Clearing of land	10.00	2.00	12.00	720.00	2.20
	Total	123.00	360.00		28980.00	100.00

On the other hand, in the case of large farmers 120.00 man-days of family labour and 460.00 man-days of hired labour were used for per hectare production of sugarcane (Table 5.3). Thus in total 580.05 man-days were used costing Tk 34803.00 which covered 40.37 percent of the total cost (Table 5.6). In operation wise distribution, harvesting consumed the highest number of human labour which was 22.58 percent of the total human labour cost followed by 17.58 percent for transportation (Table 5.3).

Table: 5.3 Per hectare operation wise distribution of human labour for sugarcane production of large farmers

Sl. No.	Name of the operation	Human labour (man-days)			Total cost (Tk)	Percent of the total cost
		Family	Hired	Total		
1.	Sett/setting raising	14.00	12.00	26.00	1560	4.71
2.	Land preparation and trench making	5.0	28.00	33.00	1980	5.61
3.	Sett/sett plantation	35.00	55.00	90.00	5400	15.52
4.	Intercultural operation					
	a) Weeding	3.00	78.00	84.00	4860	13.96
	b) Application of manure, fertilizers and insecticide	20.00	25.00	45.00	2700	7.75
	c) Earthing up	2.00	29.00	31.00	1860	5.34
	d) Bamboo protection	0.69	8.91	9.60	576	1.65
	e) Pest control by mechanical	4.51	3.13	7.64	458.4	1.32
5.	Harvesting and bundling cane	3.00	128.00	131.00	7860	22.58
6.	Transportation	12.00	90.00	102.00	6120	17.58
7.	Clearing of land	20.81	3.00	23.81	1428.6	4.10
	Total	120.00	460.00	580.05	34803	100.00

It may be observed that in sugarcane production, large farms used the highest number of human labour and they also used highest number of hired labour than family labour. On the other hand, the small farms used higher number of home supplied human labour. All farms used 516.33 man-days, costing Tk 30980.00 per hectare which shared 41.59 percent of the total cost (Table 5.6). Human labour cost shared the major percentage of the total cost.

5.2.1.2 Cost of animal/mechanical power

Animal power was one of the most important and largely used inputs in producing sugarcane. In was required for different farm operations. It included both animal labour cost and power tiller cost. Animal power was mainly used for land preparation and carrying the sugarcane from farm to mill gate. It is clear

from Table 5.4 that animal power and mechanical power used for sugarcane were 101 pair days and 27.63 hours respectively.

Table: 5.4 Animal/Mechanical power cost of sugarcane

	Operation	Animal labour				Mechanical Power				Total cost (Tk)
		Own (pair-day)	Hired (pair-day)	Total (pair-day)	Cost (Tk)	Own (hour	Hired (hour)	Own (hour)	Cost (Tk)	
Small farmers	Land preparation and trench making	10.00	23.00	33.00	1980.00	3.00	4.00	7.00	420.00	2400.00
	Transportation	22.00	42.00	64.00	3840.00	2.00	6.00	10.00	600.00	4440.00
	Others	0	0	0	0	0	0	0	0	0
	Total	32.00	65.00	97.00	5820.00	7.00	10.00	17.00	1020.00	6840.00
Medium farmers	Land preparation and trench making	8.00	20	28.00	1680.00	4.30	4.00	8.30	498.00	2178.00
	Transportation	23.00	390	62.00	3720.00	6.00	10.00	16.00	960.00	4680.00
	Others	5.00	0	0	0	0	0	0	0	5
	Total	36.00	59	90.00	5400.00	10.30	14.00	24.30	1458.00	6863.00
Large farmers	Land preparation and trench making	12	30.00	42.00	2520.00	7.00	10.00	17.00	1020.00	3540.00
	Transportation	25	49.00	74.00	4440.00	9.00	15.00	25.00	1500.00	5940.00
	Others	0	0	0	0	0	0	0	0	0
	Total	37	79.00	116	6960.00	16.00	25.00	74.00	2520.00	9480.00
All farmers	Land preparation and trench making	10	24.09	33.99	20394.00	4.72	5.94	10.66	639.54	2678.94
	Transportation	23.10	42.90	66.00	4000.00	6.33	10.33	17	1020.00	5020.00
	Others	1.67	0	0	0	0	0	0	0	0
	Total	33.77	67.00	101	6060	11.1	16.33	27.63	1649.34	7050.39

Animal labour used for sugarcane were 97, 90, 116 and 101 pair-days in the case of small, medium, large and all farmers respectively and mechanical power used for per hectare were 17, 24.3, 74 and 27.63 hours in the case of small, medium, large and all farmers respectively and their respective total cost for animal power and mechanical power were Tk 6840.00, 6863.00, 9480.00 and 7050.39.

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Table: 5.4 Animal/Mechanical power cost of sugarcane

	Operation	Animal labour				Mechanical Power				Total cost (Tk)
		Own (pair-day)	Hired (pair-day)	Total (pair-day)	Cost (Tk)	Own (hour	Hired (hour)	Own (hour)	Cost (Tk)	
Small farmers	Land preparation and trench making	10.00	23.00	33.00	1980.00	3.00	4.00	7.00	420.00	2400.00
	Transportation	22.00	42.00	64.00	3840.00	2.00	6.00	10.00	600.00	4440.00
	Others	0	0	0	0	0	0	0	0	0
	Total	32.00	65.00	97.00	5820.00	7.00	10.00	17.00	1020.00	6840.00
Medium farmers	Land preparation and trench making	8.00	20	28.00	1680.00	4.30	4.00	8.30	498.00	2178.00
	Transportation	23.00	390	62.00	3720.00	6.00	10.00	16.00	960.00	4680.00
	Others	5.00	0	0	0	0	0	0	0	5
	Total	36.00	59	90.00	5400.00	10.30	14.00	24.30	1458.00	6863.00
Large farmers	Land preparation and trench making	12	30.00	42.00	2520.00	7.00	10.00	17.00	1020.00	3540.00
	Transportation	25	49.00	74.00	4440.00	9.00	15.00	25.00	1500.00	5940.00
	Others	0	0	0	0	0	0	0	0	0
	Total	37	79.00	116	6960.00	16.00	25.00	74.00	2520.00	9480.00
All farmers	Land preparation and trench making	10	24.09	33.99	20394.00	4.72	5.94	10.66	639.54	2678.94
	Transportation	23.10	42.90	66.00	4000.00	6.33	10.33	17	1020.00	5020.00
	Others	1.67	0	0	0	0	0	0	0	0
	Total	33.77	67.00	101	6060	11.1	16.33	27.63	1649.34	7050.39

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5.2.2 Material cost

Materials cost includes the cost of setts, manures and fertilizers, insecticides, oilcake, irrigation etc. These costs are discussed below:

5.2.2.1 Cost of setts

Cost of setts or seeds was the important factor of total material cost. Table 5.5 shows that per hectare 5200.00 kg, 7600.00 kg and 8000.00 kg of setts were used in small, medium and large farms respectively. Costs of setts in producing sugarcane were Tk 5590.00, 8170.00 and 8600.00 respectively. Cost of setts shared 28.41, 34.53 and 29.47 percent of total material cost respectively, (Table 5.5).

All farms used 6932 kg of setts per hectare which costed Tk 7453.33 and shared 10 percent of the total costs (Table 5.6). Cost of setts was Tk 1.075 per kg

5.2.2.2 Cost of manures

In this study, most of the farmers used cowdung and a few farmer used oilcake. The per hectare uses of manure were 4360, 4800 and 5200 kg in case of small, medium and large farmers, whose costs were Tk 1635.00, 1800.00 and 950.00, which contribute 8.31, 7.61 and 6.68 percent of the total material cost (Table 5.5). All farmers used 4786.8 kg manures which shares 2.41 percent of the total cost. It shows that 10.90 kg, 15 kg and 20 kg of oilcake was used per hectare by small, medium and large farmers respectively.

5.2.2.3 Cost of fertilizer:

Cost of fertilizers was one of the most important components of total cost. The farmers used Urea, Triple Super Phosphate (TSP), Muriate of Potash (MP) and Gypsum as fertilizers. For growing sugarcane, per hectare urea was used 220, 204 and 281 kg in the case of small, medium and large farms respectively (Table 5.5 and 5.6). The costs of Urea were Tk 1320.00, 1224.00 and 1686.00 which shared 6.71, 5.17 and 5.78 percent of the total material cost and 1.97, 1.74 and 1.95 percent of the total cost respectively. The uses of TSP were 180, 220

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and 300 kg by the small, medium and large farms which constituted 12.81, 13.02 and 14.39 percent of the total material cost and 3.77, 4.37 and 4.87 percent of the total cost respectively (Tables 5.5 and 5.6). Small, medium and large farms used MP at the rate of 264, 100 and 295 kg per hectare respectively. These cost amounted to Tk 2640.00, 1000.00 and 2950.00 comprising 13.42, 4.23 and 10.11 percent of the total material cost (Table 5.5). Gypsum was used at the rate of 102.58, 100.00 and 163.00 kg per hectare. The per hectare costs of gypsum were Tk 410.32, 400.00 and 652.00 which shared 2.09, 1.69 and 2.23 percent of the total material cost (Table 5.5) and 0.61, 0.56 and 0.75 percent of the total cost (Table 5.6) respectively.

5.2.2.4 Cost of insecticide

Farmers used insecticides to protect their crops from the attack of pests and diseases. They used furadan and heptachore for sugarcane. The total costs of furadan were Tk 3200.00, 4800.00 and 5600.00 for small, medium and large farms which shared 16.27, 20.29 and 19.19 percent of total material costs respectively and their respective costs of using of heptaclore were Tk 700.00, 1050.00 and 1260.00 (Table 5.5). It was observed that few farmers used heptaclore as insecticide because it was not available in the market.

5.2.2.5 Irrigation cost

Most of the sugarcane farmers used irrigation. Per hectare irrigation costs of sugarcane were Tk 1560.00, 2000.00 and 2100.00 for small, medium and large farmers respectively which shared 2.33, 2.84 and 2.43 percent of the total cost (Table 5.6).

Table: 5.5 Material cost of sugarcane production per hectare under different farm size groups

Sl. No.	Item of costs	Units	Small farmers			Medium farmers			Large farmers			All farmers		
			Quantity	Costs	Percent	Quantity	Costs	Percent	Quantity	Costs	Percent	Quantity	Costs	Perce
1.	**Setts**	**Kg**	**5200.00**	**5590.00**	**28.41**	**7600.00**	**8170.00**	**34.53**	**8000.00**	**8600**	**29.47**	**6933.2**	**7453.33**	**30.3**
2.	Fertilizers													
	Urea	Kg	220	1320.00	6.71	204.00	1224.00	5.17	281.00	1686.00	5.78	233.33	1410.00	5.7
	TSP	Kg	180	2520.00	12.81	220.00	3080.00	13.02	300.00	4200.00	14.39	219.67	3266.62	13.3
	MP	Kg	164	2640.00	13.42	100.00	1000.00	4.23	295.00	2950.00	10.11	121.86	2196.7	8.9
	Gypsum	Kg	102.58	410.32	2.09	100.00	4800.00	1.69	163.00	652.00	2.23	56.67	487.44	1.9
3.	Insecticides													
	Furadan	Kg	40.00	3200.00	16.27	60.00	1050.00	20.29	70.00	5600.00	19.19	14.33	4533.6	18.4
	Heptaclore	Kg	10.00	700.00	3.56	15.00	1800.00	4.44	18.00	1260.00	4.32	119.67	1003.1	4.09
4.	Manures													
	Cowdung	Kg	4360.00	1635	8.31	4800.00	1800.00	9.61	5200.00	1950.00	6.68	15.3	1795.05	7.31
	Oilcake	Kg	10.90	98.1	0.50	15.00	45.00	0.57	20.00	180.00	0.62	-	137.7	0.56
5.	Irrigation	Tk	-	1560.00	7.93	-	2000.00	8.45	-	2100.00	7.20	-	1886.67	7.69
	Total			19673.42	100.00	-	23659.00	100.00	-	297178.00	100.00	-	24368.33	100.00

Table 5.6 Per hectare total cost of sugarcane production under different farm size groups

Items of cost	Units	Average cost per farm size group											
		Small farmers			Medium farmers			Large farmers			All farmers		
		Quantity	Cost (Tk)	% of total cost	Quantity	Cost (Tk)	% of total cost	Quantity	Cost (Tk)	% of total cost	Quantity	Cost (Tk)	% of total cost
Human labor	Man-days	486	29160.00	43.58	483	28980.00	41.15	580	34800.00	40.37	516.33	30980.00	41.59
Animal labor & mechanical power	-	-	6840.00	10.22	-	6863.00	9.75	-	9480.00	10.99	-	7727.00	10.38
Sett	Kg	5200.00	5590.00	8.35	7600.00	8170.00	11.60	8000.00	8600.00	9.97	6933.2	7453.33	30.38
Fertilizer													
Urea	Kg	220.00	1320.00	1.97	204.00	1224.00	1.74	281.00	1686.00	1.95	233.33	1410.00	5.74
TSP	Kg	180.00	2520.00	3.77	220.00	3080.00	4.37	300.00	4200.00	4.87	219.67	3266.62	13.32
MP	Kg	164.00	2640.00	3.95	100.00	1000.00	1.42	295.00	2950.00	3.42	121.86	2196.7	8.96
Gypsum	Kg	102.58	410.32	0.61	100.00	400.00	0.56	163.00	652.00	0.75	56.67	487.44	1.99
Insecticides													
Furandan	Kg	40.00	3200.00	4.78	60.00	4800.00	6.82	70.00	5600.00	6.49	14.33	4533.6	18.48
Heptaclore	Kg	10.00	700.00	1.05	15.00	1050.00	1.49	18.00	1260.00	1.46	119.67	1003.1	4.09
Manure													
cowdung	kg	4360.0 0	1635.00	2.44	4800.00	1800.00	2.56	5200.00	1950.00	2.26	4786.66	1795.05	7.31
Oilcake	Kg	10	98.10	0.15	15.00	135.00	0.19	20.00	180.00	0.21	-	137.7	0.56
Irrigation	-	-	1560.00	2.33	-	2000.00	2.84	-	2100.00	2.43	-	1886.67	7.69
Transportation cost	-	-	3000.00	4.48	-	2420.00	3.44	-	4035.00	4.68	-	24368.33	100
Others	-	-	-	-	-	-	-	-	-	-	-	-	3.28
Interest on operating capital	-	-	2142.00	3.20	-	2496.00	3.54	-	2700.00	3.13	-	2446.00	8.01
Land use cost		-	6000.00	8.97	-	6000.00	8.52	-	6000.00	6.96	-	6000.00	-
Total		-	66915.00	100.00	-	70418.00	100.00	-	86193.00	100.00	-	74474.88	100.00

5.2.3 Miscellaneous costs

5.2.3.1 Transport cost

Transport cost was the cost of carrying cane from farmer's field to cane procurement center. Table 5.6 shows that the transport costs of small, medium and large farmers were Tk 3000.00, 2420.00 and 4035.00 which constituted 4.48, 3.44 and 4.68 percent of the total cost respectively (Table 5.6).

5.2.3.2 Interest on operating capital

As regards the production of sugarcane, the interest on operating capital of small, medium and large farmers were Tk 2142.00, 2496.00 and 2700.00 which shared 3.20, 3.54 and 3.13 percent of the total costs respectively. Average interest on operating capital of all farms was Tk 2446.00 which consumed 8.01 percent of the total cost (Table 5.6).

5.2.3.3 Land use cost

Land use cost was an important fixed cost for sugarcane production per hectare. Land use cost of sugarcane was Tk 6000.00 which constituted 8.97, 8.52 and 6.96 percent of the total costs of small, medium and large farmers respectively (Table 5.6). It was charged according to the rental value of one hectare of sugarcane land.

5.3 Returns from Sugarcane Production

5.3.1 Yield and gross returns of sugarcane production

Per hectare yield of sugarcane was estimated at 78, 83 and 95 ton cane per hectare (TCH) under small, medium and large farms respectively and average yield of all farms was 83 TCH (Table 5.7). On the other hand, the farms obtained large volume of byproducts. It is very difficult to estimate the value of by-products and in most cases the guess of estimation of farmers was used for valuing the by products. However, the average values of by-products per hectare were Tk 2280, 1820 and 2070 for small, medium and large farms respectively (Table 5.7). Gross return per hectare consisted of the value of the

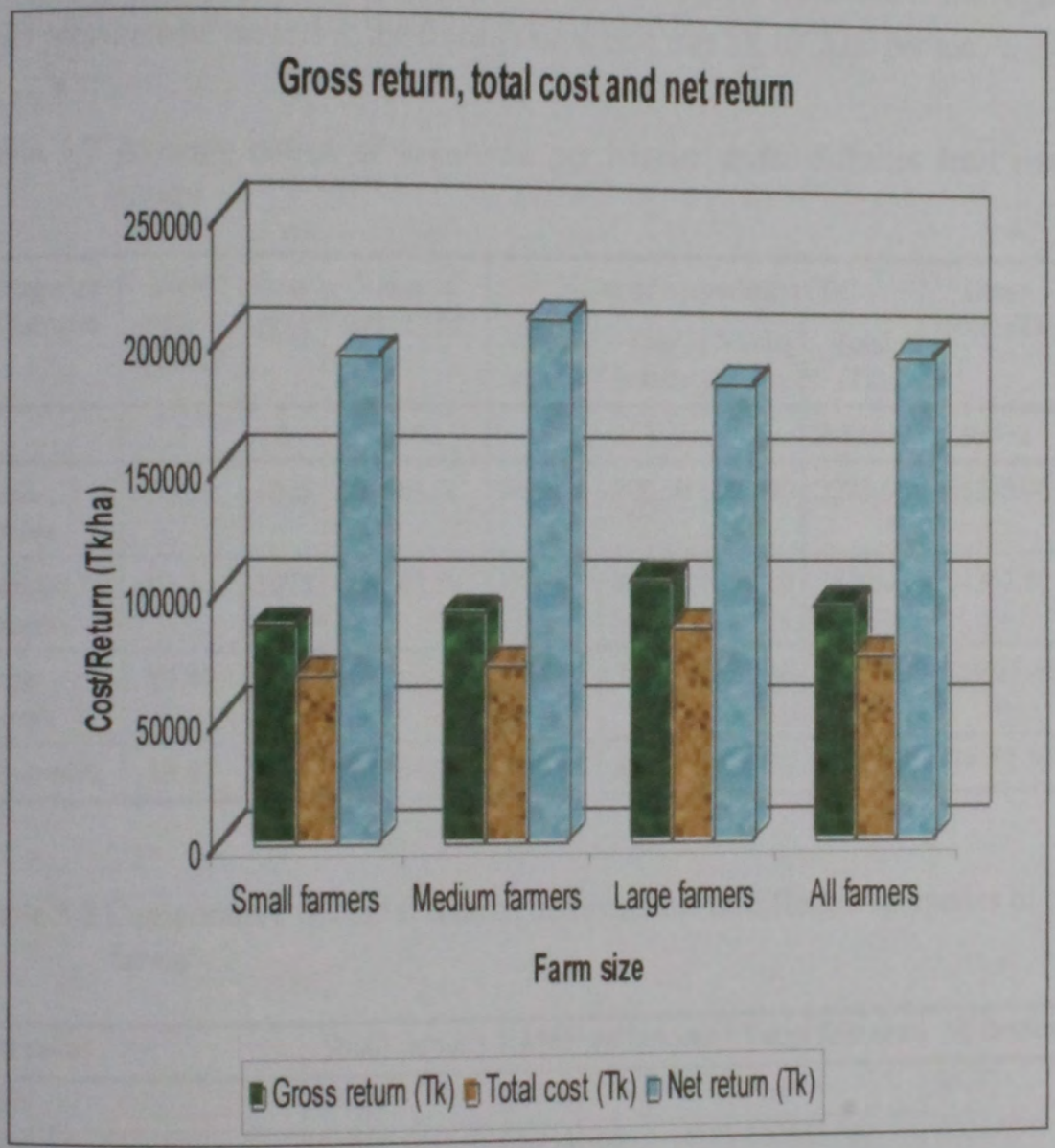

Figure: 7

Histogram showing per hectare gross return, total cost and net return of different categories of farms

main product and the by-product. The per hectare returns of main product was calculated by multiplying the total amount of products by the prevailing market prices. It may be noted that, the sample farmers sold their sugarcane to the sugar mills procurement centers at the fixed price which was Tk 1075.00 per ton.

Table 5.7 Average output of sugarcane per hectare under different farm size groups

Categories of farmers	Yield return (TCH)	Price (Tk)	Value of output (Tk)	Value of by-products (Tk)				Gross return (Tk)
				Green leaves	Dry leaves	Mutha	Total (Tk)	
1	2	3	4=2*3	5	6	7	8=5+6+7	9=4+8
Small farmers	78.20	1075	84065.00	880.00	900.00	500.00	2280.00	86345.00
Medium farmers	83.30	1075	89547.50	690.00	850.00	280.00	1820.00	91367.50
Large farmers	95.40	1075	102555.00	800.00	720.00	550.00	2070.00	104625.00
All farmers	83.97	1075	90264.75	790.00	823.33	443.33	2056.67	94112.50

Table 5.8 Comparative financial returns of sugarcane of different categories of farms

Particulars	Small farmers	Medium farmers	Large farmers	All farmers
Yield	78.20	83.30	95.40	83.97
Value of output (Tk)	84065.50	89547.00	102555.00	90264.16
Value of by-products (Tk)	2280.00	1820.00	2070.00	2056.67
Gross return (Tk)	86345.00	91367.50	104625.00	94112.50
Total cost (Tk)	66915.00	70418.00	86193.00	74474.00
Net return (Tk)	19430.00	20949.50	18432.00	19638.50
Benefit cost ratio(BCR)	1.29	1.30	1.21	1.26

Source: Table 5.6 and 5.7

The per hectare value of main product of sugarcane were Tk 84065.50, 89547.50 and 102555.00 for small, medium and large farmers respectively. The average output value of main products of all farmers was Tk 90264.75 and the

average value of by products was Tk 2056.67. In the case of small, medium and large farmers gross returns of sugarcane were Tk 86345.00, 91367.50 and 104625.00 respectively. The average per hectare gross return was Tk 94112.50 (Table 5.8 and Fig. 7). Yield, gross return and total cost are the highest in the case of large farms because they used higher amount of inputs.

5.3.2 Net return

Net return was determined by deducting all costs from gross return. The per hectare total costs of production of sugarcane were Tk 66915.00, 70418.00 and 86193.00 for small, medium and large farms respectively. On the other hand, per hectare gross return of those three categories of farmers were Tk 86345.00, 91367.50 and 104625.00. Per hectare net returns of three categories of farmers were Tk 19430.00, 20949.00 and 18432.00 respectively. The average net return of all farmers was Tk 19638.50 (Table 5.8) per hectare. It is seen that the highest net return of sugarcane was earned by medium farmers because their cost of production was lower than large farmers as they used inputs appropriately and took care intensively. Small farmers also had small amount of cultivable land and took care more intensively but could not purchase required amount of inputs.

5.3.3 Benefit cost ratio (BCR)

Benefit cost ratio (undiscounted) for sugarcane was calculated as a ratio of gross return to total cost. Table 5.8 shows that the BCRs of sugarcane of small, medium and large farms were 1.29, 1.30 and 1.21 respectively which indicate that the medium farmers possess the highest BCR which is higher than the average BCR of all farms 1.26 (Table 5.8).

EFFECTS OF INPUTS ON GROSS RETURNS AND EFFICIENCY OF RESOURCE USE

6.1 Introduction

In the preceding chapter the tabular method was employed to estimate the gross return and net return of sugarcane production. The focus of the present chapter is to make a quantitative analysis of sugarcane production in the framework of production function analysis. Cobb-Douglas production function was used to determine the effects of inputs used on gross return of sugarcane production.

6.2 Factor Affecting Gross Return of Sugarcane Production

There are many factors that can affect sugarcane production as well as gross returns such as setts, human labour, animal labour, manures and fertilizers, furadan, irrigation costs etc. These variables were considered as prior explanatory variables responsible for variation in sugarcane production as well as gross returns or income. The individual effect of these inputs or factors can be explained to a certain degree by multiple regression analysis.

Management factor was not included in the model though it has importance as an input. Specification and measurement of management factor is difficult to estimate particularly in the peasant agriculture where a farm operator is both a labour and a manager and the farm and the household constitute an inseparable complex (Heady and Dillion, 1966), other independent variables which might affect farm income substantially like land quality, soil condition, time of sowing, period of harvesting etc. were excluded in the method.

6.3 Methods of Estimation

To determine the effects of variable inputs both linear and Cobb-Douglas production function models were initially estimated. The Cobb-Douglas models

proved superior on theoretical and econometric grounds. Thus the Cobb-Douglas model was accepted. Moreover the special advantage of using Cobb-Douglas production function was that the regression under ordinary least squares (OLS) in logarithm yields coefficients which represent production elasticities and if all the inputs related to the production are taken into account as the independent variables the sum of the production elasticities indicates whether the production process as a whole yields increasing, constant or decreasing returns to scale.

Cobb-Douglas production analysis was done taking the total of 90 farmers together. It would be more justifiable if the analysis could be done for each of the three categories separately. Since the sample size was not very large, an aggregate analysis was performed taking all the sugarcane farms into account. Therefore the regression analysis was performed on the sugarcane farms only taking all the samples together. Data were converted to per farm per hectare basis to facilitate the analysis.

The function was specified as:

$$Y = a x_1^{b_1} x_2^{b_2} x_3^{b_3} x_4^{b_4} x_5^{b_5} x_6^{b_6} e^{Ui}$$

The function was linearised by transforming it into the following double log or log linear form i,e.

$$\ln Y = \ln a + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 \ln x_6 + U_i$$

Where,

Y = Gross return (Tk./ha).

a = Constant or intercept value.

x_1 = Cost of setts (Tk./ha).

x_2 = Cost of human labour (Tk./ha).

x_3 = Cost of animal labour (Tk./ha).

x_4 = Cost of manures and fertilizers (Tk./ha).

x_5 = Cost of furadan & other insecticides (Tk./ha).

x_6 = Cost of irrigation (Tk./ha).

U_i = Stochastic disturbance term.

In = Natural logarithm.

b_1.....b_6 = Coefficients of respective variables.

6.4 Discussion of Results from the Model

Estimated production functions for sugarcane production are presented in Table 6.1

Major characteristics of the models are noted below:

i) Goodness of fit for different types of inputs was measured by F-values.

ii) Total variations of the output were measured by coefficient of multiple determinations.

iii) For testing the significance level of individual coefficients which have sufficient degrees of freedom, 1 percent, and 10 percent probabilities were used.

iv) Stages of production were measured by returns to scale which were the summation of all the production elasticity coefficients of various inputs.

6.5 Interpretation of Results

Estimated values of the coefficients are related statistics of Cobb-Douglas production function for the sample farmers producing sugarcane is presented in Table 6.1. The result indicates that the Cobb-Douglas production function fitted well as evidenced by F-value and R^2 of sugarcane production.

Table-6.1 Estimated value of coefficient and related statistics of log-linear function model of sugarcane production

Explanatory variables	Coefficients
Intercept	– 2.97
Setts (x_1)	0.50*
	(0.181)
Human labour (x_2)	0.170***
	(0.105)
Animal labour (x_3)	0.306
	(0.102)
Manure & fertilizers (x_4)	0.246***
	(0.148)
Furadan (x_5) and other insecticides	0.281*
	(0.091)
Irrigation (x_6)	0.226***
	(0.138)
R^2	0.832
R^2(adjusted)	0.820
N	90
F	68.74*
E_i (Returns to scale)	0.555

Figures in the parentheses indicate standard error.

* Significant at 1 percent level.

*** Significant at 10 percent level.

$$\sum Ei = \frac{\sum MPPi}{\sum APPi}$$

The coefficient of multiple determination R^2 is 0.83 for sugarcane production which means that the explanatory variables included in the model accounted for 83 percent of the variation in crop yield as well as gross returns.

The F-value of sugarcane production was highly significant at 1 percent level of confidence. Highly significant F-value implies that all the included variables are important for explaining the variations of crop yield as well as gross returns. Therefore t-values of the individual input coefficients should be expected to be significant. In Table 6.1 there are six coefficients of which three coefficients are significant at 1 percent level of confidence and three at 10 percent level of confidence.

From Table 6.1 it is observed that one percent increase of one input could increase gross returns at the rate of the value of the respective coefficients. Exception was found in the case of animal labour and insecticides where the sign of coefficients were negative. The positive signs of the coefficients of the explanatory variables indicate that return is positively related with the inputs used and the negative signs indicate that the variable contributes the gross returns negatively.

Sett cost (x_1)

It is observed from the results of the regression model specified in the log linear form that the regression coefficient of sett cost (x_1) was positive and significant. This revealed that an increase in 1 percent of setts cost, keeping other factors constant, would increase gross returns by 0.5 percent (Table 6.1).

Human labour cost (x_2)

The regression coefficient of human labour was positive for sugarcane production. It was significant at 10 percent level (Table 6.1). This indicates that an increase in 1 percent in human labour cost keeping other factors constant, gross returns would increase by 0.17 percent.

Usually human labour is found to be overused in agricultural operations in the less developed countries (LDCs) and the coefficient of human labour X_2 is expected to be negative because a large quantum of human labour consists of family supplied labour in field crops which are the most often heavily used. Here in the case of sugarcane production the coefficient of human labour (X_2) was found to be positive which deserves explanation because farmers taken less intensive care than crops. So farmers can increase production of sugarcane by using labour intensively.

Sugarcane is a long duration and large size crop. It requires a huge amount of human labour for different management practices i.e. sett preparation, land preparation, plantation, top dressing, weeding, earthing up, bamboo protection, harvesting, transportation, clearing of land etc. Due to labour scarcity

and financial involvement, farmers used less amount of human labour. There is cope for farmers to increase profit by employing more human labour.

Animal labour and power tillers cost (x_3)

The regression coefficient of animal labour and power tiller was negative and significant at 1 percent level. It indicates that an increase in 1 percent of animal labour and power tiller cost, keeping other factors constant, would result in a decrease of gross return by 0.31 percent (Table 6.1). A negative coefficient of animal labour and power tillers (X_3) is not expected. Farmers probably make extra use of animal power to make the land better prepared which was not productive for sugarcane. However many farmers was not use the animal labour.

Manure and fertilizers (x_4)

The regression coefficient of manures and fertilizers (x_4) was positive and significant at 10 percent. It indicates that an increase of manures and fertilizers cost by 1 percent would lead to increase gross return by 0.25 percent, keeping all other factors constant (Table 6.1).

Furadan and other insecticides cost (x_5)

The regression coefficient of furadan and other insecticides cost (x_5) was negative and highly significant at 1 percent level. It indicates that an increase in 1 percent of this factor, keeping other factors constant, would result in a decrease of gross returns by 0.28 percent (Table 6.1). Farmers might have used insecticides not in proper time.

Irrigation cost (x_6)

The coefficient of this variable (X_6) was 0.226 which implies that by spending an additional of 1 percent money value on irrigation, the farmers would be able to increase returns by 0.22 percent from sugarcane, other things remaining the same. If irrigation cost is increased, there is scope to increase the production of sugarcane.

6.6 Returns to Scale

The concept "elasticity" can be applied to the production function to determine the stages of production in which farmers were allocating their resources. The elasticity of production refers to the percentage increase in output compared to the percentage increase in input.

In the present study, the returns to scale of sugarcane production were the sum of regression coefficients of all inputs. The sum of elasticities of all inputs was (0.56) which implies that if all the inputs specified in the production function were increased simultaneously by 10 percent the gross returns would increase by 5.6 percent. This indicates that the production function exhibits decreasing returns to scale and the farmers allocated their resources in the rational stage of production (stage II).

6.7 Resource Use Efficiency

From the analysis of the regression equation, the ability of farmers to allocate their resources in the production of sugarcane enterprises can be examined.

To attain the goal of profit maximization i.e. for efficient resource allocation, one should use more of the resource so long as the value of the added product is greater than the cost of the added amount of the resources in producing it. The resources are considered to be efficiently used as well as profit will be maximized when the ratio of MVP to MFC approaches to one, or in other works MVP and MFC for input are equal when the marginal physical product (MPP) is measured in monetary terms (MPP × product price), it is called marginal value product (MVP). Marginal factor cost (MFC) is the price of one unit of input.

The standard way to examine such efficiency is to compare marginal value product (MVP) with marginal factor cost (MFC) of each variable input. The optimum use of a particular input would be indicated by the condition of equality of MVP and MFC i.e.

$$\frac{MVPx_i}{MFCx_i}$$

The MVP of a particular resource represents the addition to gross returns in value terms caused by an addition of one unit of that resource while other inputs are held constant. The most reliable perhaps the most useful estimate of MVP is obtained by taking resources (x_i) as well as gross return (Y) and their geometric means (Dhowan and Bansal, 1977). Since all the variables of the regression model were measured in monetary value, the slope coefficients of the independent variables were the marginal value products (Appendix A). The marginal value products which were computed by multiplying the production coefficient of given resources with the ratio of geometric mean (GM) of gross return to the geometric mean (GM) of the given resource, i.e.

$$InY = Ina + b_i Inx_i$$

$$\frac{dy}{dx_i} = b_i \frac{y}{x_i}$$

$$\text{Therefore, MVP } (x_i) = b_i \frac{\bar{Y}(GM)}{\bar{X}(GM)}$$

Where, Y = Mean value (GM) of gross return in Taka

X_i = Mean value (GM) of the ith variable input in Taka

i = 1, 2 6

GM = Geometric mean

and $\frac{dy}{dx_i}$ = Slope of the production function as well as MVP of the input.

In order to identify the status of resource use efficiency, it was considered that a ratio equal to unity indicates the optimum use of that factor, a ratio more than unity indicates that the gross return could be increased by using more of that resource and value of less than unity indicates the unprofitable level of resource use which should be decreased to minimize the losses. The estimated MVPs of different inputs are presented in Table 6.2 and the process of calculation of MVPs is shown in Appendix A.

Table-6.2 Marginal value products (MVPs) of different resource of Cobb-Douglas production function of sugarcane

Resources	MVP (Taka)
Setts (x_1)	0.31
Human labour (x_2)	0.52
Animal labour (x_3)	– 3.72
Manure & fertilizers (x_4)	2.32
Furadan (x_5) and other insecticides	– 4.79
Irrigation (x_6)	75.17

It appears from Table 6.2 that the manures and fertilizers (x_4) and irrigation (x_6) have high productivity. It can be observed that the ratio of MVP and MFC of all the variables such as manures and fertilizers (x_4), and irrigation cost (x_6) were greater than one with positive signs and indicate that more profit can be obtained by increasing the use of these factors.

The ratio of MVPs and MFC of setts (x_1) and human labour (x_2) were positive but less than one which indicate that these factors were used excessively and hence their uses need to be adjusted to bring them closer to unity or more than unity. The ratio of animal labour (x_3) and furadan (x_5) were greater than one but negative which indicates the indiscriminate and excessive use of the resource resulting in inefficiency.

Finally, considering the sugarcane production it appears that the farmers in the study area have scope to attain full efficiency by reallocating the resources.

Thus the use of the resources is to be adjusted to unity depending upon the ratio to achieve full efficiency.

Table-6.3 Marginal productivity and resource use efficiency of sugarcane

Particular	Setts (x_1)	Human labour (x_2)	Animal labour (x_3)	Manures & fertilizers (x_4)	Furadan (x_5)	Irrigation (x_6)
MVP	0.31	0.52	- 3.72	2.632	- 4.79	75.17
MFC	1.00	1.00	1.00	1.00	1.00	1.00
MVP/MFC	0.31	0.52	- 3.72	2.32	- 4.79	75.17

Note: MVP = Marginal value product = MPP × product price

MFC = Marginal factor cost = Input price.

PROBLEMS AND CONSTRAINTS OF SUGARCANE PRODUCTION

7.1 Introduction

Experience has shown that farmers in Bangladesh do not get the required quantity of setts, fertilizer, pesticides, technical support and finally the optimum price of their products. They are economically not very capable of investing the required fund for producing crops due to their subsistence level of living and low capital base. In this chapter, an attempt has been made to identify and analyze the major problems and constraint faced by the farmers in producing sugarcane. The potentials of sugarcane cultivation were identified on the basis of opinions of the farmers. For the sake of analytical conveniences, the problems and constraints categorized into four general groups.

7.2 Problems and Constraints of Sugarcane

Four categories of problems and constraints were observed i.e. (i) Technical (ii) Economic (iii) Marketing and (iv) Social.

7.2.1 Technical problem and constraints

Technical constraints are related to production techniques and technologies such as lack of certified setts, pest and disease problems, irregular supply of fertilizer and insecticides, non-availability of tractors, high risk, lack of irrigation facilities, appropriate drainage system, long duration etc.

Sett is a main factor of any production system. Table 7.1 shows that 30 percent farmers faced lack of certified setts, pest and diseases problems are the most important problems of sugarcane production. Pest and disease can damage the whole crop. Control of pest and disease is the precondition for optimal production. Table 7.1 shows that 100 percent of the sugarcane farmers faced problems relating to pest and disease attack. Seventy six percent farmers reported irregular supply of fertilizers and insecticides as a problem. For a good

needed for this purposes. Many cane growers are found interested to plough their lands with power tiller. Table 7.1 also shows that 22 percent of the sugarcane growers reported about non-availability of power tiller.

Sugarcane is a long duration crop. It creates problems for marginal cane growers. Most of the marginal cane growers can earn their livelihood by growing food crops on their small pieces of land. But when their lands were used for sugarcane cultivation they faced problems like want of food and money in between the time of planting and harvesting. About 60 percent of the farmers mentioned the above problems. Sugarcane farmers faced many adverse situations all over the year. Twenty seven percent of the cane growers mentioned sugarcane as a high-risk crop. Irrigation is an important factor of sugarcane production. It is noted from Table 7.1 that 25 percent farmers identified lack of proper irrigation facility as the most severe problem. As such irrigation is a crucial factor in the area particularly in the dry winter months.

7.2.2 Economic problems

Economic problems and constraints are related to the financial difficulties. The problems are lack of adequate operating capital, high price of input, low product price, labour scarcity etc.

The farmers did not have enough money to produce sugarcane due to its long gestation period. It was observed in the study area that most of the farmers were not able to get sufficient capital. It is evident from the Table 7.1 that 35 percent of the farmers in the study area reported it as an acute problem in the way of practicing sugarcane production.

Today's modern technology of agriculture is based on modern inputs. Here modern input means fertilizer, irrigation, insecticides, high quality sett etc. It was reported by 33 percent of the farmers that price of fertilizers and insecticides were a problem. About 45 percent of the farmers reported that the product price, i.e. the price of cane (Tk. 1075.00 per ton) is not sufficient. They

said the product price should be increased. Labour scarcity at the production period was a problem as mentioned by 60 percent of the cane growers.

7.2.3 Marketing problems

Marketing problems and constraints, scarcity of labour at harvest period, corruption with *Purzi* distribution (sugarcane supply order from the sugar mill authority), and low supply of Purzi are the major problems of cane sugar production in the observed area.

Farmers claimed that they do not get *Purzi* in time and in sufficient numbers even when the sugarcane was fully matured. Finally percentage of sugar reduced followed by delay harvesting. They further added that *Purzi* was always available to the socially or economically prominent and influential persons. They were highly dissatisfied with the leaders of *Purzi* committee for their selfishness and corruption. The majority of the farmers complained against the authority for their reluctance of purzi delivery in time. Fictitious cane growers or brokers collected *Purzi* from them and receive the value of sugarcane with the help of cashier. Ninety eight percent of them reported about corruption of *Purzi* distribution, 96 percent of the cane growers reported absence of payment in due time.

7.2.4 Social problems

Social problems are related to theft of sugarcane, top cutting, and damages by the foxes. Sugarcane is an attractive and tasty crop. People specially children are generally attracted to it. Chewing of cane was one of the major social problems reported by 71 percent of sugarcane growers in the study area. Forty four percent of farmers reported that the villagers were habituated to cut the top the plant for fodder and fuel (Table 7.1). Forty two percent of the farmers reported damage caused by foxes.

Table: 7.1 Problems and constraints in sugarcane cultivation:

Categories of problems and constraints	No. of respondents	Percent of the total respondent	Ranking
a. Technical problems:			
i) Lack of certified seed	22	24	6
ii) Pest and disease	90	100	1
iii) Irregular supply of fertilizer and insecticides	68	76	2
iv) Non-availability of tractors	20	22	7
v) High risky	24	27	5
vi) Lack of irrigation facilities	25	28	4
vii) Long durable	55	61	3
b. Economic problems:			
i) Lack of adequate operating capital	31	34	1
ii) High price of inputs	30	33	4
iii) Low product price	39	43	2
iv) Labour scarcity	50	51	1
c. Marketing problems:			
i) Scarcity of purzi	88	98	1
ii) Scarcity of labour at harvest period	59	65	4
iii) Corruption of purzi distribution	72	80	3
iv) Lack of payment in time	82	91	2
d. Social problems:			
i) Theft of sugarcane	64	71	1
ii) Top plant cutting	40	44	2
iii) Damages by fox	38	42	3

7.3 Concluding Remarks

As concluding remarks it may be noted that sugarcane can play a crucial role in our national economy as well as in meeting the nutritional requirements of the people of Bangladesh. It was however, observed that the farmers are facing some acute problems and constraints in producing sugarcane. It can therefore be concluded that per hectare yield as well as net sugarcane production could possibly be increased with the solving of the associated problems of the respective farmers.

CHAPTER EIGHT

SUMMARY AND CONCLUSIONS

8.1 Summary of the Study

Bangladesh is one of the developing countries of the world. Its economy is based on traditional agricultural system. Agriculture plays a vital role in the growth and stability of the country's economy as is indicated by its share in GDP, employment and export earnings. At present, it accounts for about one-third of GDP and employs about two-thirds of the labour force. The role of agriculture is unique for food security and nutritional status of people. Agriculture contributes about 25 per cent to the Gross Domestic Product (GDP) and employs 66 percent of the civilian labour force.

Sugarcane is one of the most important cash crops in the country. It has an important bearing on employment. Sugarcane farming, sugarcane trade and sugar industries employ a large number of people. Sugarcane, as well as, Sugar Mills contribute to GDP and provide employments to the rural people.

However, sugarcane being a long duration crop, it occupies the land for 10-14 months from planting to harvesting. Most of the small and medium farmers who are mainly share-croppers can not afford to keep their land engaged for such a long period for a single crop. Due to their poor financial conditions as well as higher demand for food and vegetables they reduce cane cultivation.

The present study was undertaken with a view to analyzing the profitability and efficiency of sugarcane cultivation in the socioeconomic context of rural Bangladesh. Accordingly, the study was designed with the aim of achieving the following objectives:

1. To identify the socioeconomic characteristics of the farmers cultivating sugarcane.

2. To determine the cost and returns of producing sugarcane under different categories of farms.
3. To determine the factors responsible for variations of yield and economic return of sugarcane.
4. To identify the major problems faced by the farmers producing sugarcane.

Keeping in view the objectives, the present study was conducted in 9 villages namely, Sultanpur, Lalpur, Gobalpur, Nallayat, Noagram, Chandi, Mirzapur, Talso and Baraigram of Natore district. Survey method was applied to collect primary data for the study. Ninety farmers were selected by purposive random sampling. Out 0f 90 samples, 30 were small farms, 30 medium farmers and 30 farmers were large farmers

Data were collected through direct interview method by the researcher herself during May to August, 2003. The collected data were then summarized to meet the objectives of the study. Finally, tabular and functional analyses were done to fulfill the objectives of the study.

Economics of sugarcane production is examined in Chapter 5. For calculating costs and returns of sugarcane, enterprise costing technique was used that involves the information of different cost items incurred through various heads of expenditure. Cost of production included the cost of uses human labour, animal labour, used material inputs. All these costs were considered for one production year (2002-03). Per hectare costs of producing sugarcane were Tk 66915.00, Tk 70418.00 and 86193.00 in the case of small, medium and large farms respectively. In the case of large farms, per hectare production cost was higher than those of small and medium farms. Average production cost of all farmers of sugarcane was Tk 74474.88.

Among the cost items, per hectare total costs of human labour were Tk 29160, 28980.00 and 34800.00 for small, medium and large farmers respectively. Large farmers used the highest number of hired labour while small farms used the highest number of home supplied labour.

Per hectare animal labour and power tiller costs were Tk 6840.00, 6863.00 and 9480.00 for the small, medium and large farmers respectively. Animal labour used was 97 pair days for small farmers, 90 pair days for medium farmers and 116 pair-days for large farmers.

The material cost includes the cost of setts, manures and fertilizers, insecticides, oilcake, irrigation etc. Per hectare material costs of small, medium and large farms were Tk 19673.42, 23659.00 and 29178.00 respectively. The large farmers used the highest amount of material cost.

Per hectare yields of sugarcane were 78.20, 83.30 and 95.40 tons for small, medium and large farmers respectively. The corresponding gross returns were Tk 86345.00, 91367.50 and 104625.00; and those of net returns were Tk 19430.00, 20949.50 and 18432.00 respectively. However the benefit cost ratios (undiscounted) were 1.29, 1.30 and 1.21 in the small, medium and large farms respectively.

Considering all farmers per hectare total costs, gross returns and net returns of sugarcane were Tk 74474.00, 94112.50 and 19638.50 respectively. Benefit cost ratio of all farms (undiscounted) was only 1.26.

In this study, resource use efficiency of factors was also examined. Cobb-Douglas production function analysis was carried out to determine the effects of variable inputs used.

Six explanatory variables were employed to explain the variation of production as well as gross return of sugarcane. The model used was fitted well. Animal labour, insecticides and setts costs are significant at 1 percent level and human labour, manures and fertilizer and irrigation costs were significant at 10 per cent level. Animal labour and insecticides were significant at 1 percent but negative. It means that farmers made excessive use of animal labour and insecticides.

The summation of elasticities of different inputs was greater than one, implying that the production functions exhibited increasing returns to scale and farmers allocated their rational stage of production (Stage I). Considering the ratio of MVPs and MFCs of the inputs, manure and fertilizers and irrigation were positive and more than one which indicates that more profit could be obtained by increasing these inputs. The corresponding ratio of human labour was positive but less than one which indicates that these factors were used excessively and hence their uses need to be adjusted to bring them closer to unity. The ratio of animal labour and insecticide were greater than one but negative which indicates the indiscriminate and excessive use of resource resulting in inefficiency.

The present study identified some problems and constraints associated with sugarcane production and introducing intercropping with sugarcane. These were categorized into technical, economic, marketing and social. The technical problems included lack of certified seed, pest and diseases problems, irregular supply of fertilizer and insecticides, non-availability of tractors, high risk, lack of irrigation facilities, long duration etc. Economic problems and constraints are related to the financial difficulties mainly, lack of adequate operating capital, high price of inputs, low product price etc. Marketing problems and constraints include scarcity of "Purzi", scarcity of labour at harvest period, corruption with purzi distribution. Social problems include theft sugarcane, top plant cutting, damages by foxes etc.

8.2 Conclusions

One peculiar feature of sugarcane production was that it was a long duration crop. It was observed that the large farmers invested large amount and they received higher gross returns but medium farmers received higher net returns. The small farmers could not afford such large amount of investment for a long period. So, intercropping with sugarcane should be practiced in large scale for financial support, especially for the small farmers in the interim period. If modern inputs and production technology could be made available to farmers in time, yield and production of this crop would be increased.

Some farmers were interested to increase their sugarcane areas but they are not able to practice it in a large scale due to associated problems and constraints. Therefore, in order to promote sugarcane production, government and other related organizations must encourage farmers to produce sugarcane. This will enable the farmers to earn the higher net returns.

8.3 Policy Implication/Recommendations

Recommendations based on the findings and conclusions of the study are presented bellow:

i) Capital shortage was one of the severe problems faced by the farmers. So institutional credit facilities should be made available to the farmers on easy terms and conditions.

ii) Mill's authority should make available the certified setts in time.

iii) Regular supply of fertilizer and insecticides should be ensured.

iv) Irrigation facilities should be made available to the producers.

v) Crop insurance provision should be introduced for such a long duration crop.

vi) Product price should be increased and input price should be decreased.

vii) Pest and diseases resistant variety should be developed.

viii) The farmers should be offered training for sugarcane cultivation by the concerned sugar mills authority or concerned department of the Government.

ix) "*Purzi*" distribution system should be changed so that the appropriate farmers can get it in due time. This may increase sugarcane production.

8.4 Limitation of the Study

The present study provides some useful information for farmers, decision makers as well as for extension workers. However, the study suffered from a number of limitations such as:

i) Most of the farmers in our country being illiterate, it is very difficult to obtain reliable information as they do not keep any records of their farm business transactions. The accuracy of data

fully, therefore, relied upon the memories and sincerity. So, dependence on farmers' memory is not likely to give the reliable data.

ii) The necessary data were collected from a limited area covering very small number of samples. Thus the scope of generalization from the collected data was limited.

iii) The research might provide more meaningful results if it could cover a more number of areas under varying agro-ecological zones.

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Appendix-A

The method of calculation of marginal value products (MVP) from the specified Cobb-Douglas Production Function is mentioned below:

$$MVP\ (x_i) = b_i \frac{\bar{Y}(GM)}{\bar{X}(GM)}$$

Variables	Geometric Mean (Anti log)	Co-efficients	MVPs
Returns (Y)	94112.50		
Setts(X_1)	7953.33	0.246	0.31
Human labor (X_2)	30980.00	0.170	0.52
Animal Labor (X_3)	7727.00	0.306	-3.72
Manure & Fertilizers X_4)	9155.81	226	2.32
Furadan (X_5)	5536.70	-282	-4.79
Irrigation (X_6)	1886.67	1.507	75.17