PROFITABILITY OF POTATO PRODUCTION: CASE OF VERMICOMPOST USERS AND NON-USERS IN NILPHAMARI DISTRICT

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This is to certify that the thesis entitled **"PROFITABILITY OF POTATO PRODUCTION: CASE OF VERMICOMPOST USERS AND NON-USERS IN NILPHAMARI DISTRICT"** submitted to the Departmental of Agricultural Economics, Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfillment of the requirements for the degree of **Master of Science (M.S.) in Agricultural Economics**, embodies the result of a piece of bona fide research work carried out by **ASHRAFUN NAHAR, Registration No. 12-05114** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by the Author.

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DEDICATED
TO
MY BELOVED
PARENTS

PROFITABILITY OF POTATO PRODUCTION: CASE OF VERMICOMPOST USERS AND NON-USERS IN NILPHAMARI DISTRICT

ABSTRACT

The present study was undertaken to compare the profitability of potato production between vermicompost users and non-users. For achieving the objectives, the study was conducted on 60 potato farmers of Domar and Jhaldhaka upazila under Nilphamari District, of which 30 were considered as vermicompost users and 30 as vermicompost non-users potato farmers. Tabular methods was used for analyzing the data. Vermicompost user's total variable cost was higher than vermicompost non-users. Per hectare total cost was found to be Tk. 189807 and Tk.180819 for vermicompost users and vermicompost non-users respectively. The gross return were found to be Tk. 366600 per hectare for vermicompost users and Tk. 313625 for vermicompost non-users. Vermicompost user's gross return was higher than vermicompost non-users. Gross margin was found to be Tk. 210078 for vermicompost users and Tk. 168541 per hectare for vermicompost non-users. Vermicompost user's gross margin was higher than vermicompost non-users. The net return was estimated as Tk. 176793 and Tk. 132806 per hectare for vermicompost users and non-users. Benefit cost ratio (BCR) was found to be 1.93 and 1.73 for vermicompost user and vermicompost non-user respectively. The study indicates that the vermicompost users received higher profit compared to vermicompost non-users. Informants replied that non-availability of seeds was the first constraints in the study areas for vermicompost users and lack of credit facilities was the most crucial problem for vermicompost non- users.

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The Author

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ABBREVIATIONS USED

BBS	Bangladesh Bureau of Statistics
SAARC	South Asian Association for Regional Cooperation
FAO	Food and Agriculture Organization
HYV	High Yielding Varieties
DAE	Department of Agriculture Extension
MT	Metric Tons
BADC	Bangladesh Agricultural Development Corporation
NGOs	Non-Governmental Organization
TCRC	Tuber Crop Research Centre
BARI	Bangladesh Agricultural Research Institute
SAAO	Sub-Assistant Agriculture Officer
TSP	Triple Super Phosphate
MP	Muriate of Potash
SPSS	Statistical Package For Social Sciences
STW	Shallow Tube Well
DTW	Deep Tube-Well
LUC	Land Used Cost
BCR	Benefit Cost Ratio
TVC	Total Variable Cost
NR	Net Return

CHAPTER I
INTRODUCTION

1.1 Problem Statement

Bangladesh is mainly an agricultural based country dominated by crop production. Agriculture is the main stay of the economy of Bangladesh. Our country has been famous for growing large variety of tropical crops particularly rice, wheat, potato, jute, pulses, oilseeds, sugarcane etc. Potato is one of the most important food crops grown in more than 100 countries in the world. Over one billion people consume potato worldwide and it is the staple diet of half a billion people in developing countries. Potato ranks fourth in the world and third in Bangladesh with respect to production (FAO, 2019). Because of the dry matter, edible energy and edible protein content, potato is considered nutritionally a superior vegetable as well as a versatile food item not only in our country but also throughout the world.

Potato was introduced in this subcontinent in the sixteenth century. It was grown then in small plots as a vegetable. Potatoes have been grown in Bangladesh since at least the 19th century. By the 1920s, the first commercial production of the crop was established in the country (Islam, 1983).

Potato has become one of the major food and cash crops in Bangladesh. In 2018-19 season, the cultivated land in potato production was 1180 thousands acres and total potato production was 9744 thousands metric tonnes (BBS 2019). Simultaneously export of potato is also increased sharply during this time. Considering the area coverage in the country, potato is the third major crop after paddy and wheat.

Bangladesh is now 14th among the world's potato producers and 4th largest in Asia. Potato is mostly consumed as vegetable in the households in Bangladesh. Though Bangladesh has become a major potato producer in the SAARC countries, the status of this crop has remained mainly as a vegetable in the country. The time has come now for all of us to understand and appreciate that potato can play an important role in the present

food situation of Bangladesh. Recently, the government has been trying to diversify food habits and encourage potato consumption to reduce pressure on rice. So, potato has become an important food item for food security in Bangladesh. Bangladesh experiences much progress in its potato production in the past decades as it has increased by 5 percent per annum (Islam et al., 2000).

Various types of fertilizer are needed for cultivation of potato. Vermicompost is one of them. It is one of the most useful organic fertilizer in which potato grown well. Vermicomposting is the science of producing compost from biodegradable organic matters through earthworms. Vermicompost contains significant quantities of nutrients, a large beneficial microbial population and biologically active metabolites, which can be applied alone or in combination with organic or inorganic fertilizers so as to get better yield and quality of diverse crops such as potato.

The organic manure could increase the fertility and productivity of the land and produce nutritive and safe food (Ramesh et al., 2005). On account of continuing world energy crisis and spiraling price of chemical fertilizer, the use of organic manure as a renewable source of plant nutrients is assuming importance (Devi et al., 2011). Ansari (2008) reported that applying vermicompost, there has been a significant improvement in the soil quality of plots and increase productivity of potato. Applying vermicompost to soil increases microbial biomass N and orthophosphate levels (Arancon et al., 2003) while improving seed germination, seedling growth and crop productivity in a variety of cereals, legumes, vegetables, fruits, ornamental and flowering plants grown in greenhouses and to a lesser extent in the field (Atiyeh et al., 2002). Umashankar et al. (2010) also reported that organic inputs have an edge over the conventional chemical fertilizer management practices on growth and yield of potato in Chhattisgarh in rice-potato cropping system. Many of potato growers of Nilphamari district are using vermicompost and adoption of this organic fertilizer has already created a wide range of impact in the study area which need to be evaluated. But there is a dearth of vigorous impact studies. Keeping these factors in consideration the present study is undertaken with the following specific objectives.

1.2. Objectives

i. To describe the socio-economic characteristics of potato producers in the study areas;

ii. To compare the profitability of potato production between vermicompost users and non-users;

iii. To identify the constraints of vermicompost users and non-users of potato cultivation.

CHAPTER II
REVIEW OF LITERATURE

The main purpose of this chapter is to review some related research works, studies which have been so far conducted in the recent past that are related to the present study. Several important studies on vermicompost user and non-user of potato production, which have been conducted in the recent past, are discussed below:

Akhter et al. (2001) conducted a survey on potato production in some selected areas of Bangladesh. This study showed that potato production is highly profitable and it could be provide cash money to farmers. In terms of profitability, potato production was more attractive than any other winter vegetables. Per unit yield and gross return of potato were found higher than other competitive crops.

Arif (1998) conducted a study on potato product on selected areas of Comilla district. He showed that the per hectare gross returns were TK. 101858.56 , 102358.56 and 101358.56; gross costs were TK. 64251.10, 65179.58 and 64741.42; net returns were Tk. 37607.46, 37178.98 and 366617.14 for small, medium and large categories of farmers respectively.

Barmon et al. (2019) conducted a study on impacts of vermicompost manure on modern varieties (MV) of paddy produced in Bangladesh and found that The yield of MV boro and the net profit of per hectare was significantly higher (about 1.91 times) in the farms that used vermicompost compared to those farmers who did not use it. The household income of the farmers who used vermicompost with irrigation has risen significantly. The farm area, seed, pesticide, irrigation, urea cost and vermicompost cost were the main factors that significantly affected the MV boro paddy production in farms that used vermicompost. Vermicompost normally retains the moisture as well as organic matter in topsoil. As a result, comparatively lesser amount of chemical fertilizers and irrigations are required for per hectare MV boro paddy production. There was inefficient and non-

optimal use of resources in both the farms which hindered production of maximum level of output in the study area.

Choudhary et al. (2010) a field experiment was conducted with potato (variety Kufri Jyoti) at the Experimental Farm of KVK, Sundernagar, and Himachal Pradesh in an acidic soil fertilized with vermicompost and bio-fertilizers independently or in combination. It was revealed that graded vermicompost doses @ 20 or 30 t ha^{-1} as well as biofertilizers alone or in combination with vermicompost increased plant height. Enhancements in potato tuber yield as well as gross and net returns were also observed. These results were obtained in the treatment comprising vermicompost @ 30 t/ha+phosphorus solubilizing bacteria (PSB)+*Azotobactor* followed by vermicompost application @ 30 t ha^{-1}+PSB+*Azotobactor* biofertilizers. Application of varying vermicompost levels alone or in combination with PSB or *Azotobactor* or their co-inoculation resulted in significant improvement in the available N, DTPA-exchangeable Fe, Mn and Cu in the soil. The highest magnitude of these nutrients noticed in the treatment comprising vermicompost @ 30 t ha^{-1}+PSB+*Azotobactor*, while the differences were non-significant for the attributes like soil pH, organic carbon, available P and K as well as DTPA-exchangeable Zn. Overall, vermicompost @ 30 t ha^{-1} along with co-inoculation of PSB and *Azotobactor* appeared to be the best treatment combination over other treatments to realize highest productivity, profitability as well as soil fertility in potato under organic production in north-western Himalayas.

Hakim (1993) conducted a comparative economic study on Cardinal and multi varieties of potatoes in Bogura district. He found that per hectare total costs were TK. 32097.25 and TK. 30818.50 for Cardinal and multi varieties respectively. The costs were estimated at TK. 15896.15 and 12701.60. Net returns per hectare on full costs basis were TK. 45196.65 and 451.65.

Mukul et al. (2013) conducted a study on Farmers profitability of Potato Cultivation at Rangpur district: the Socio-economic context of Bangladesh and found that per acre Cost of potato cultivation of Small, Medium and large farmers are shown. Total variable cost

include land preparation, seed cost, fertilizer, insecticides, irrigation, weeding & earthing up, harvesting, transportation, Marketing, others cost. Fixed cost includes land value. Total cost was the summation of total variable cost and total fixed cost. Total cost was highest for medium farmers (TK. 679260.). Followed by large farmers (TK.577650) and small farmers (TK. 93390).

Rahman and Barmon (2019) conducted a study on Greening Modern Rice Farming Using Vermicompost and Its Impact on Productivity and Efficiency: An Empirical Analysis from Bangladesh and found that productivity is significantly higher and the use of chemicals is significantly lower for vermicompost users as expected. However, profitability gain is not significantly different mainly due to the high cost of vermicompost. Use of vermicompost significantly increases productivity along with other conventional inputs and its users are relatively more technically efficient.

Rashid (1994) conducted a study on the profitability of different cropping patterns with and without potatoes in two villages in Dinajpur district. The average yields per hectare were 15550 and 4720.54 kg for HYVs and LVs of potatoes, respectively and their respective values were TK. 46084.03 and 24574.82.He also observed that the HYVs of potatoes were more profitable than other crops.

Sujon et al. (2017) conducted a study on profitability and resource use efficiency of potato cultivation in Munshiganj district of Bangladesh and found that average gross return, gross margin and net return were found Tk. 3,47,200, Tk. 1,47,125 and Tk. 1,17,300, respectively. Benefit-cost ratio was found 1.51 and 1.74 on full cost and variable cost basis, respectively.

Above studies indicate that potato cultivation is profitable. Furthermore, suitable application of vermicompost can produce the highest yield of potato. But a very few research on the comparative profitability of vermicompost users and non-users were conducted. To reduce the gaps the present study was undertaken.

CHAPTER III
METHODOLOGY

A farm management study usually involves collection of information from individual farmers. There are various methods of collecting information from the farmers. For the present study farm survey method was adopted for collecting data.

There are three main methods through which farm survey data can be gathered. These are
1) Direct observation
2) Interviewing respondents
3) Records kept by the respondents.

Since the farmer of Bangladesh do not usually maintain records and accounts of their farm operations, the interviewing respondent's method was used to collect data from the potato growers. This chapter discusses about the selection of the study area, period of study, sampling technique and sample size, preparation of the survey schedule and data processing and analysis.

3.1 Selection of the Study Area

Nilphamari district was selected purposively as a study area because this district is one of the leading potato producing area of Bangladesh. Domar and Joldhaka upazila was selected randomly from the 7 upazila of Nilphamari District. A preliminary survey was conducted in some villages of Domar and Joldhaka upazila under Nilphamari district to gather primary knowledge about the potato production and profitability of the potato growers. After preliminary visit four village's namely Khanabari and Boroghaca from Sonarai union and Gholna and Majpara villages from Mirganj union were selected randomly as study area.

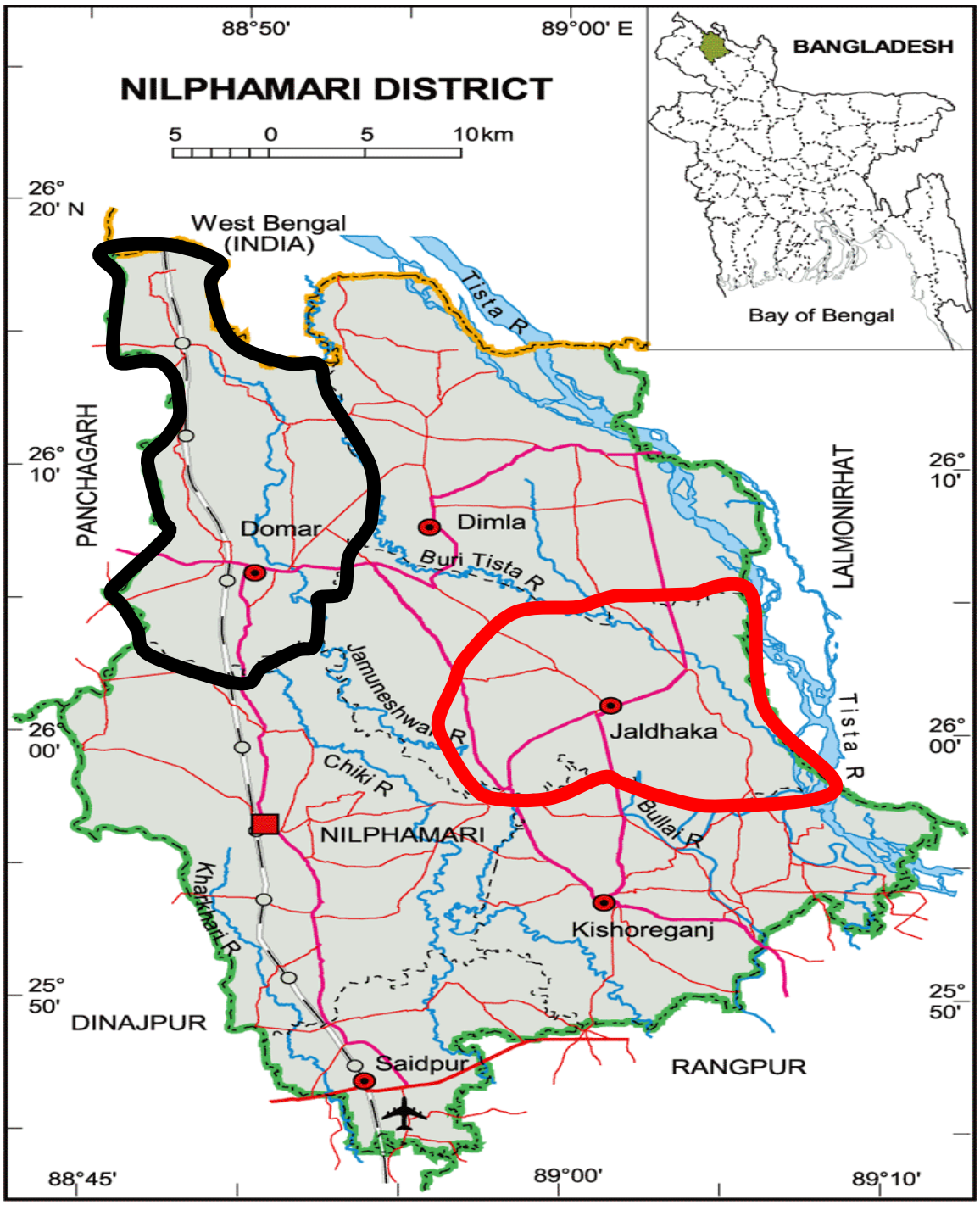


Figure 3.1 : Map of Nilphamari District showing the study areas

The main criteria behind the selection of the upazila were as follows:

- The selected upazila was a good potato producing area.
- The researcher is familiar with the language, living, believes, and other socio-economic characteristics of the villages of this upazila and
- Previously such type of study was not conducted in this area.

3.2 Selection of the sample and sampling techniques

A random sampling technique was applied for selecting sample. Through random sampling sixty (60) farmers were selected for the study. Among the sixty (60) farmers, thirty (30) were vermicompost users and thirty (30) were vermicompost non-users.

3.3 Preparation of the survey schedule

In conformity with the objectives of the study, a preliminary survey was designed for recording data from the farmers. After pretesting, the required corrections and modifications were made and then the interview schedule was finalized. The questions were arranged in logical sequences.

3.4 Methods of collecting data

The data for the present study were collected from both primary and secondary sources. Primary data were collected by the researcher herself through personal interview with the respondents. To attain accuracy and reliability of data, care and caution were taken in data collection. The researcher look all possible effort to establish a congenial relationship with the respondents so that the respondents do not feel hesitation or hostile to furnish correct data. Before interviewing, the aims and objectives of the study were explained to each and every owner of the potato growers, as a result they were convinced that the study was purely an academic one and was not likely to have an adverse effect on their business.

3.5 Processing and analysis of data

Collected data were scrutinized and summarized for the purpose of tabulation. Data were transferred to a master sheet and compiled with a view to facilitating classified. Analysis

was included socio-economic characteristics of potato farmers, classification of size of potato land, production practices, inputs used and returns of potato farmers. Enterprise costing and gross margin analysis technique was used for calculating costs and returns for potato cultivation.

3.6 Procedure for computation of costs

The farmers producing potato had to incur cost for different inputs used in the production process. The input items were valued at the prevailing market price and sometime at government price in the area during survey period, or at the priced at which farmers bought. Sometimes, the farmers purchased hired labor, seed, fertilizer, manure and insecticide from the market and it was easy to pricing these items. But, farmers did not pay cash for some input such as family labor, home supplied seed, cow dung etc. In this case opportunity cost principle was used. In calculating the production cost, the following components of cost were considered :

- ✓ Human labor
- ✓ Land preparation cost
- ✓ Seed
- ✓ Vermicompost
- ✓ Fertilizer
- ✓ Insecticides
- ✓ Irrigation
- ✓ Pesticides cost
- ✓ Land use.

3.6.1 Cost of human labor

Human labor cost was one of the most important and largest cost items of potato production in the study area. It is required for different farm operations like land preparation, planting, weeding, application of fertilizer and insecticide, harvesting and carrying etc. Mainly two types of human labor used in the study area; such as family labor and hired labor. Family labor includes the operator himself, the adult male and

female as well as children of a farmer's family and the permanently hired labor. To determine the costs of unpaid family labor, the opportunity cost concept was used. In this study the opportunity cost of family labor was assumed to be market wage rate, i.e., the wage rate that the farmers actually paid to the hired labor. The labor that was appointed permanently was considered as a family labor in this study. In computing the cost of hired labor, actual wages were paid and charged in case where the hired labors were provided with meals; the money value of such payment was added to the cash paid. The labor has been measured in a man-day unit, which usually consisted of 8 hours a day.

3.6.2 Cost of land preparation

Human labor and mechanical power were jointly used for ploughing and laddering. Cost of land preparation cost was the summation of hired and home supplied draft power and human labor. Hired ploughing and laddering cost were calculated by the prevailing market prices that were actually paid by the farmers. Home supplied mechanical power and human labor cost was estimated on the basis of opportunity cost principle.

3.6.3 Cost of seeds

Cost of seed was also estimated on the basis of home supplied and purchased seed. Home supplied seed were calculated at the prevailing market rate and the costs of purchased seed were calculated at the actual price.

3.6.4 Cost of vermicompost

Vermicompost may be used from home supplied or through purchased. The value of home supplied and purchased vermicompost was calculated at the prevailing market price.

3.6.5 Cost of fertilizer

It is very important for potato cultivation to use the fertilizer in recommended dose. In the study area, farmers used mainly three types of chemical fertilizer i.e., Urea, TSP (Triple Super Phosphate), MP (Muriate of Potash) for growing potato cultivation. Fertilizer cost was calculated according to the actual price paid by the farmers.

3.6.6 Cost of insecticide

Most of the sample farmers used Dithane M-45, Thiovit 80wp and Rovral 50wp for potato. The cost of these insecticides was calculated by the prices paid by farmers.

3.6.7 Cost of irrigation

The cost of irrigation included the rental charge of machine plus the costs of fuel. Someone rent/borrow only water from the shallow tube well (STW) owners by paying some charge.

3.6.8 Land use cost

The price of land was different for different plots depending upon location and topography of the soil. The cost of land used was estimated by the cash rental value of land. In calculating land use cost, average rental value of land per hectare for a particular year was considered.

3.7 Profitability Analysis

Cost and return analysis is the most common method of determining and comparing the profitability of different farm household. In the present study, the profitability of potato is calculated by the following way-

3.7.1 Calculation of Gross Return

Per hectare gross return was calculated by multiplying the total amount of product and by-product by their respective per unit prices.

Gross Return= Quantity of the product × Price of the product

3.7.2 Calculation of Gross Margin

Gross margin is defined as the difference between gross return and variable costs. Generally, farmers want maximum return over variable cost of production. The argument for using the gross margin analysis is that the farmers are interested to get returns over variable cost. Gross margin was calculated on TVC basis. Per hectare gross margin was obtained by subtracting variable costs from gross return. That is,

Gross margin = Gross return – Variable cost.

3.7.3 Calculation of Net Return

Net return or profit was calculated by deducting the total production cost from the total return or gross return. That is,

Net return = Total return – Total production cost.

The following conventional profit equation was applied to examine farmer's profitability level of the potato farms in the study areas.

Net profit, $\pi = \Sigma P_m Q_m + \Sigma P_f Q_f - \Sigma (P_{xi} X_i) – TFC.$

Where, π = Net profit/Net return from potato (Tk/ha);

P_m = per unit price of potato (Tk/kg);

Q_m = Total quantity of the potato production (kg/ha);

P_f = per unit price of by products (Tk/kg);

Q_f = Total quantity of by products (kg/ha);

P_{xi} = Per unit price of i-th inputs (Tk);

X_i = Quantity of the i-th inputs (kg/ha);

TFC = Total fixed cost (Tk);

3.7.4 Undiscounted Benefit Cost Ratio (BCR)

Average return to each taka spent on production is an important criterion for measuring profitability. Undiscounted BCR was estimated as the ratio of total return to total cost per hectare.

BCR= Gross Return / Total Cost

CHAPTER IV
SOCIOECONOMIC CHARACTERISTICS OF THE POTATO FARMERS

4.1 Introduction

This chapter provides a brief description of the socioeconomic characteristics of potato farmers in the study areas. Decision making behavior of an individual is determined to a large extent by his socioeconomic characteristics. The socioeconomic characteristics considered in the present study were age, education, occupation, family size, land ownership, sources of family income, etc.

4.2 Age Distribution of potato farmers

Age distribution of potato farm owners is very important in maintaining profitable operation of a farm business. The selected potato farmers were grouped into three categories according to their ages. The different age groups of the potato farm owners are presented in Table 4.1. The age of the selected potato farmers was observed to be ranging from a minimum of 20 to a maximum of 55 years.

Table 4.1: Age distribution of the potato farmers

Age	Vermicompost users (%)	Avg. Age (yrs)	Vermicompost non-users (%)	Avg. Age (yrs)
20-30 years	3.3	49.1	21.7	46
31-50 years	66.7		71.6	
Above 50 years	30		6.7	
Total	100		100	

Source: Field survey, 2019

It is clear from the Table 4.1 that most of the vermicompost users were between 31-50 years of age (66.7%) followed by above 50 years. From the table it was found that most of the vermicompost non-users age between 31-50 years. It also indicates that the average age of vermicompost users is higher than non-users. However, average age of farmers in Bangladesh is 48 years , according to BBS-2019

4.3 Educational level of potato farmers

Education plays an important role for potato farmers and helps a farmer to have day-to-day information about the existing modern techniques together with changes in various management practices. It enables a man capable of managing scare resources and hence to earn maximum profit.

Table 4.2: Level of education of the potato farmers

Education	Vermicompost users (%)	Vermicompost non-users (%)
Illiterate	12.3	13.6
Primary (1-5)	25	31.7
Secondary (6-10)	30.3	23.3
Above secondary (>10)	32.4	31.4
Total	**100**	**100**

Source: Field survey, 2019

To examine the educational level of the potato farmers, education were classified into four categories such as illiterate, primary, secondary, and above higher secondary. Table 4.2 displays the educational level of the respondents. The table reveals that the highest 32.4 percent of the vermicompost user farmers attained above secondary education. The table also reveals that the highest 31.7 percent of the vermicompost non-user farmers attained primary education followed by 31.4 percent of the vermicompost non-user who attained above secondary education.

4.4 Experience of potato farmers

Experience distribution of potato farm owners is very important in maintaining profitable operation of a farm business. The selected potato farmers were grouped into three categories according to their experience. The different experience groups of the potato farm owners are presented in Table 4.3. The experience of the selected potato farmers was observed to be ranging from a minimum of 8 to a maximum of 46 years.

Table 4.3 Distribution of the farmers according to their experience

Experience	Vermicompost users (%)	Avg. Exp. (yrs)	Vermicompost non-users (%)	Avg. Exp. (yrs)
8-10 years	46.7	24.27	34.5	22.23
11-20 years	48.3		41.5	
Above 20 years	5		24	
Total	100		100	

Source: Field survey, 2019

It is clear from the table that 46.7 percent vermicompost users and 34.5 percent vermicompost non-users had 8-10 years of experience. 48.3 vermicompost users and 41.5 percent vermicompost non-users had 21-40 years of experience. Around 5 percent vermicompost users and 24 percent vermicompost non-users who had experience above 20 years. However, the average experience of farming of vermicompost users was found 24.27 years and non-users was 22.23 years. It indicates that the vermicompost users are more experienced than non-users.

4.5 Occupational status of the potato farmers

Occupation is one of the important attributes of socio-economic characteristics. The work in which a man is engaged throughout the year is known as his main occupation. In Bangladesh, rural people's occupations are increasingly diversified. About 50% of rural people do not own any land. They seek off-farm and non-farm income earning opportunities. In the selected area, the potato farmers were engaged in different occupations along with potato farming. Table 4.4 shows that among the vermicompost users, 78.3 percent farmers' occupation was agriculture, 11.7 percent was business, 6.5 percent was service holder and 3.5 percent did other types of jobs. On the other hand, among the non vermicompost users, 68.3 percent farmers' occupation was agriculture, 15.0 percent was business, 14.3 percent was service holder and 2.4 percent did other types of jobs.

Table 4.4: Occupational status of the potato farmers

Occupation	Vermicompost users (%)	Vermicompost non-users (%)
Agriculture	78.3	68.3
Business	11.7	15.0
Service	6.5	14.3
Others	3.5	2.4
Total	**100**	**100**

Source: Field survey, 2019

4.6 Social membership

It is evident that about 56.5 percent of the vermicompost user farmers had social membership and rest of the vermicompost users had no social membership. In case of vermicompost non-users, 51.7 percent had social membership and 48.3 percent had no social membership.

Table 4.5: Social membership of the potato farmers

Social membership	Vermicompost users (%)	Vermicompost non-users (%)
Yes	56.5	51.7
No	43.5	48.3
Total	**100**	**100**

Source: Field survey, 2019

4.7 Land ownership pattern of the potato farmers

Table 4.6 shows that there are four kinds of land ownership exist for both the vermicompost users and non-users such as own cultivated land, rented in, mortgaged in, mortgaged out. Among the vermicompost users, the average ownerships are 1.12 ha, 0.27 ha, 0.35 ha, 0.30 ha respectively. Among the vermicompost non-users, the average ownerships are 0.93 ha, 0.32 ha, 0.37 ha, 0.22 ha respectively.

Table 4.6: Land ownership pattern of potato farmers

Types of land users	Own cultivated land (Ha)	Rented in (Ha)	Mortgaged in (Ha)	Mortgaged out (Ha)
Vermicompost Non-users	0.93	0.32	0.37	0.22
Vermicompost Users	1.12	0.27	0.35	0.30

Source: Field survey, 2019

4.8 Family size of the potato farmers

In the study area, Different sizes of family of farmers had been found. In both cases (vermicompost users and non-users) the maximum percentage of family members lied between 5-6 persons. However, the average size of family of vermicompost users and

non-users were 4.67 members and 4.83 members respectively found in the study area, where as average family size nationally was 4.06 (BBS-2019).

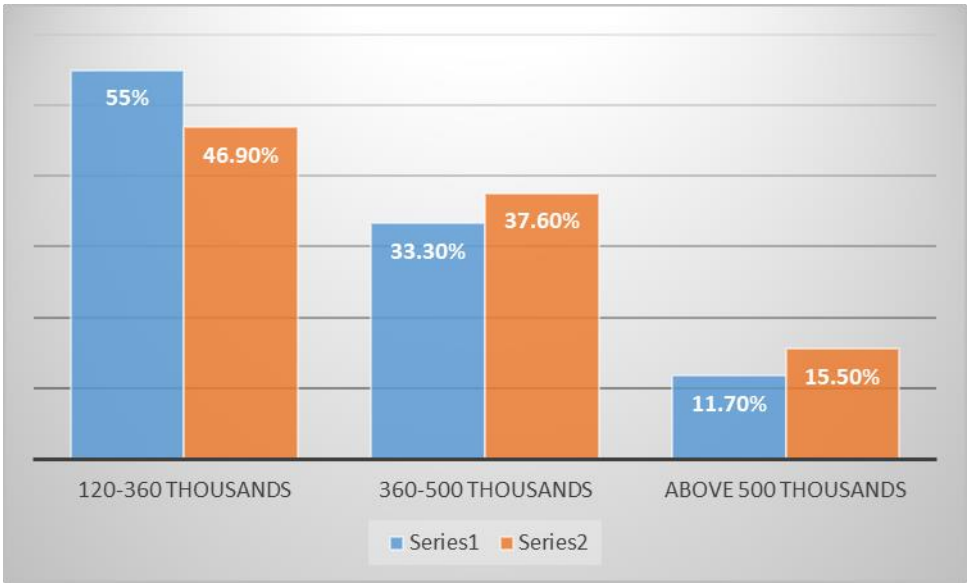
Table 4.7: Family size of potato farmers

Categories	Vermicompost users (%)	Avg. Size (members)	Vermicompost non-users (%)	Avg. Size (members)
2-4 members	26.5	4.67	43.3	4.83
5-6 members	45.4		51.7	
Above 6 members	28.1		5	
Total	100		100	

Source: Field Survey, 2019

4.9 Income level of the potato farmers

Family income of the farmers comprises several sectors. In the study area annual family income of potato cultivators came from potato farming, business, agriculture, service, etc.



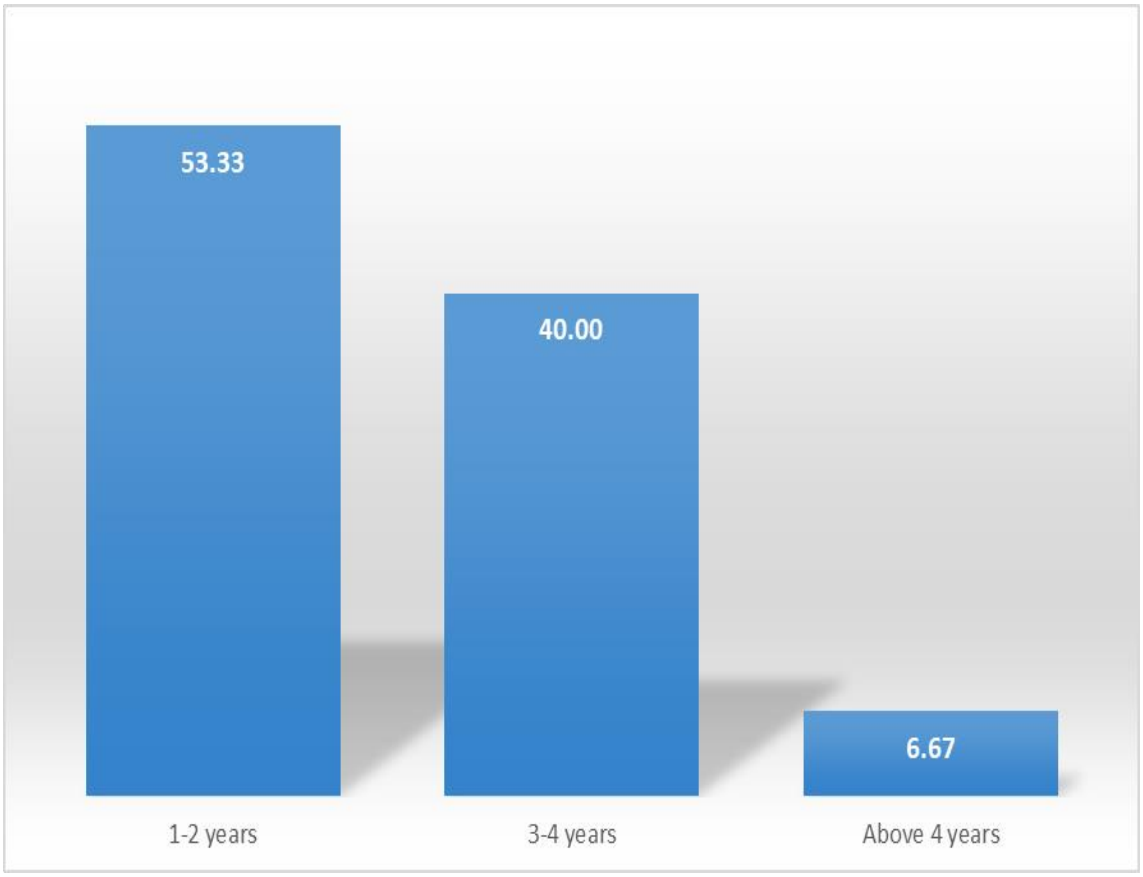
Source: Field survey, 2019

Figure 4.1: Income of the potato farmers

Annual family incomes of vermicompost user and vermicompost non-users are shown in Figure 4.1. The figure shows that 55 percent families of vermicompost users and 46.90 percent families of vermicompost non-users monthly income was Tk. 120-360 thousands annually. About 11.70 percent vermicompost users and 15.50 percent non-users monthly income was above Tk. 500 thousands annually.

4.10 Years of using vermicompost

Years of use of vermicompost of the farmers ranges between 1 to 5 years. Study shows that most of the users had a little experience of use of vermicompost. It was about 53.33 percent. However, 40 percent of the users had 3-4 years of experience and only 6.67 percent of the users had more than 4 years of experience.

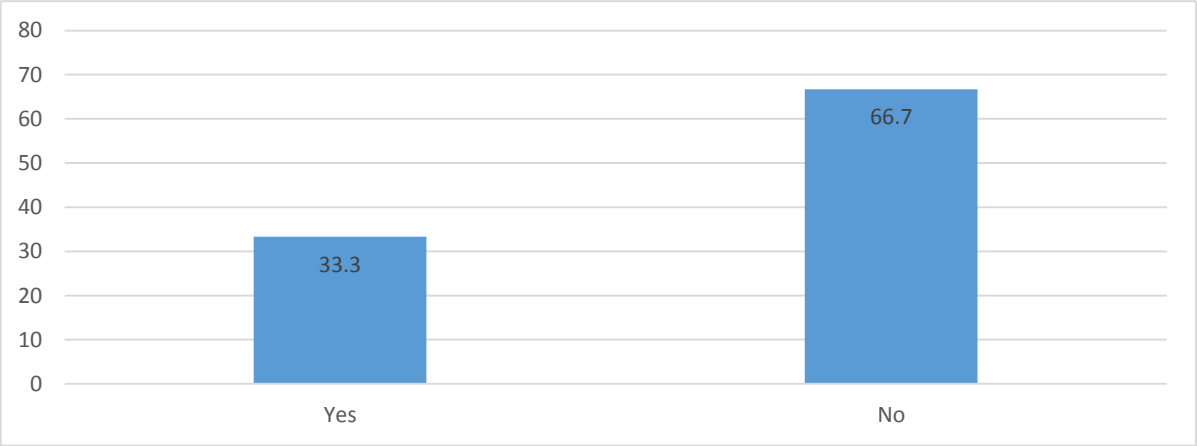


Source: Field survey, 2019

Figure 4.2 Years of vermicompost use

4.11 Training on vermicompost

According to the study, it was found that only 33.3 percent of the users had training on the use of vermicompost.

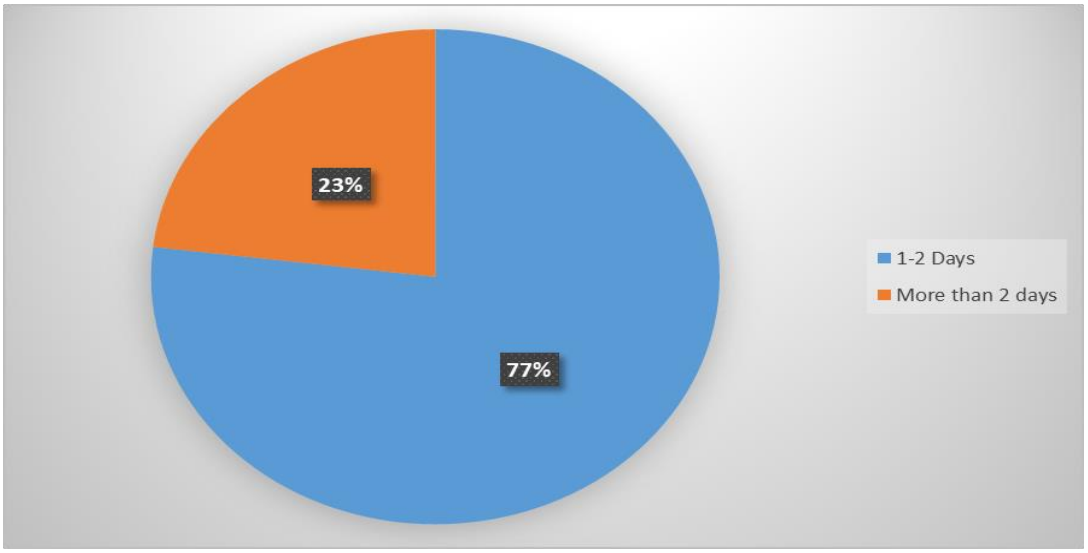


Source: Field survey, 2019

Figure 4.3 Training on vermicompost

4.12 Duration of training on vermicompost

Study shows that duration of training on vermicompost varies from 1-5 days. Most of the farmers had 1-2 days of training on vermicompost. Only 23 percent of users, who had training on the use of vermicompost, had training period more than 2 days.

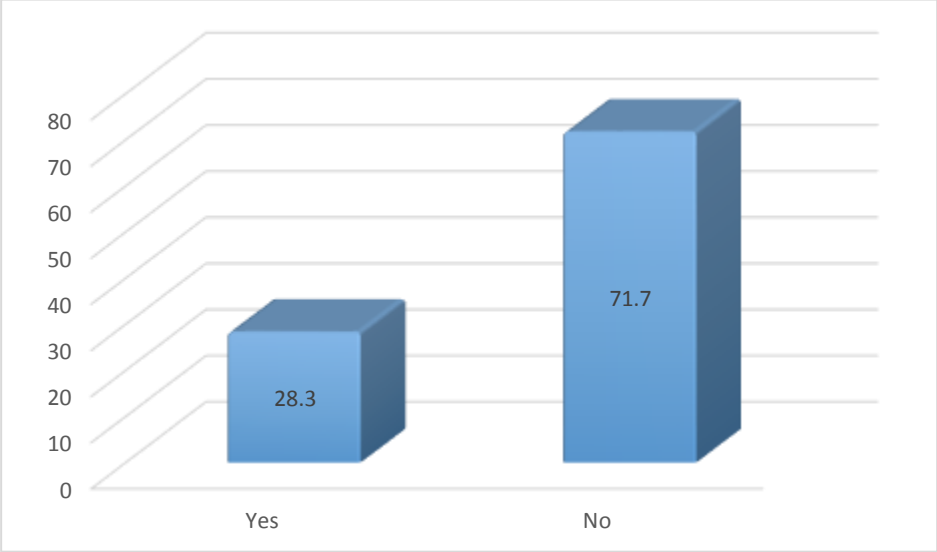


Source: Field survey, 2019

Figure 4.4: Duration of training on vermicompost

4.13 Advice from SAAOs

It was found that only 28.3 percent of the users of vermicompost took advice from SAAOs and 71.7 percent did not.



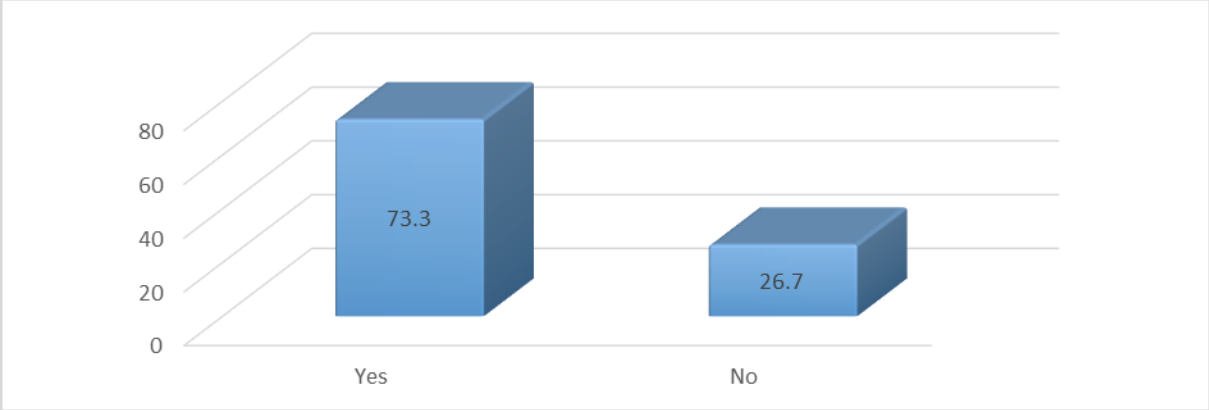
Source: Field survey, 2019

Figure 4.5: Advice from SAAO on vermicompost use.

4.14 Perception about vermicompost use

4.14.1 Environment friendly

In my study, it is found that 73.3 percent of the users agreed that the use of vermicompost is environment friendly and 26.7 percent disagreed.

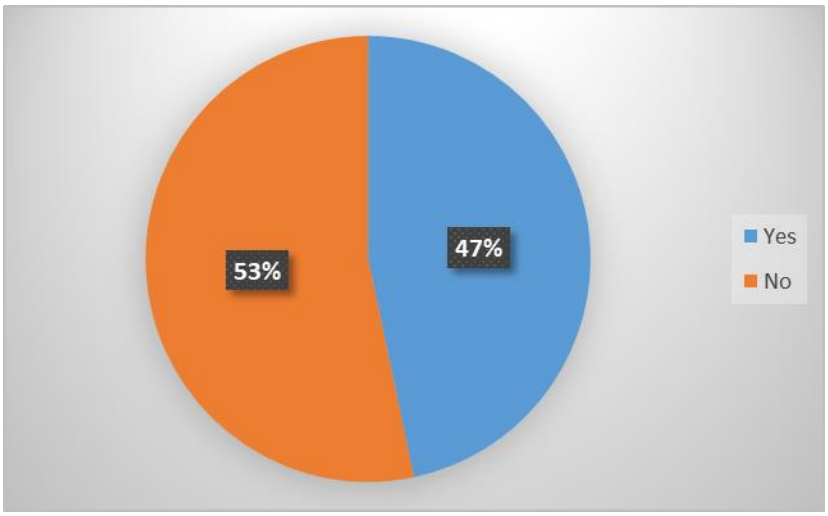


Source: Field survey, 2019

Figure 4.6 Environment friendly perception

4.14.2 Vermicompost can be integrated with chemical fertilizer

Figure 4.7 shows that 53.0 percent of the users thought that vermicompost can be integrated with chemical fertilizer and 47.0 percent did not.

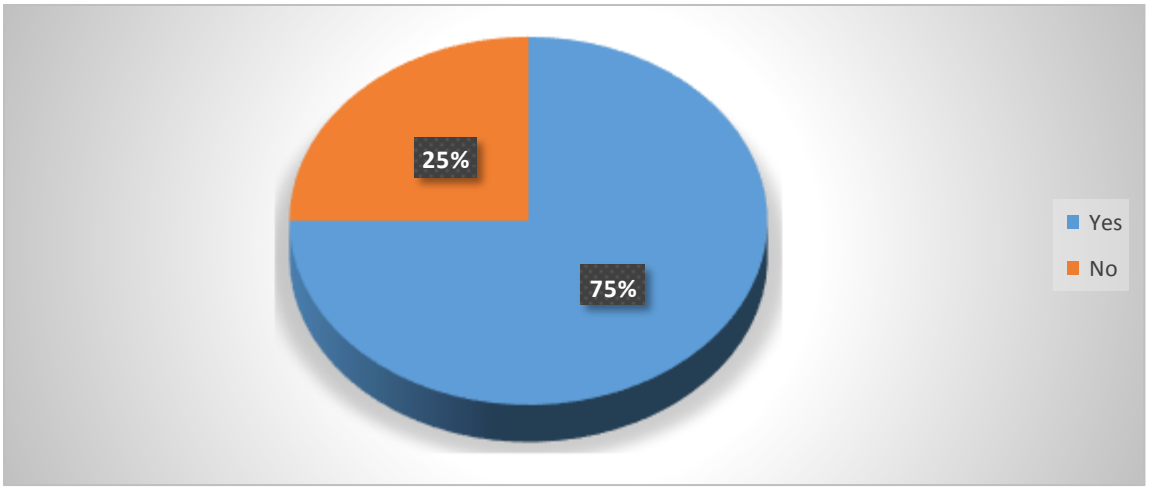


Source: Field survey, 2019

Figure 4.7 Vermicompost can be integrated with chemical fertilizer.

4.14.3 Vermicompost use reduces soil borne disease

Figure 4.8 shows that 75.0 percent of the users thought that use of vermicompost reduces soil borne diseases and 25.0 percent did not.

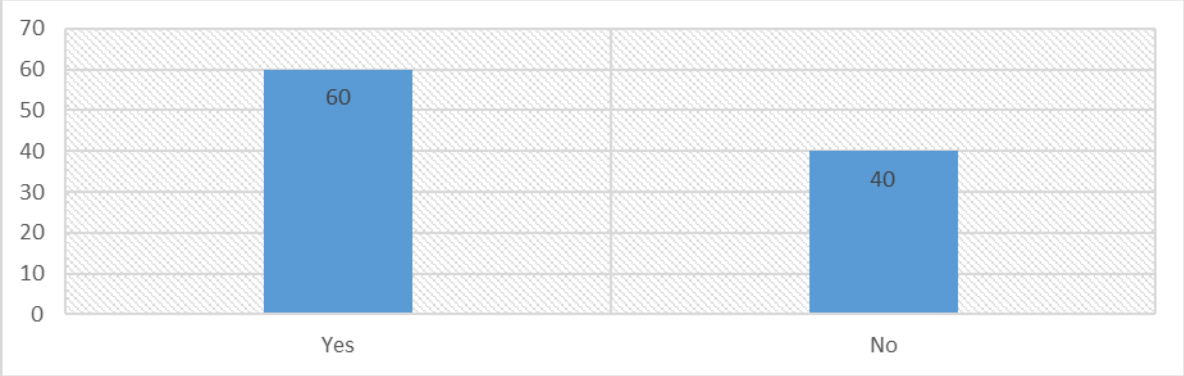


Source: Field survey, 2019

Figure 4.8 Vermicompost reduces soil borne diseases

4.14.4 Vermicompost use increases profitability

Figure 4.9 shows that 60.0 percent of the vermicompost users thought that use of vermicompost increases profitability and 40.0 percent did not.

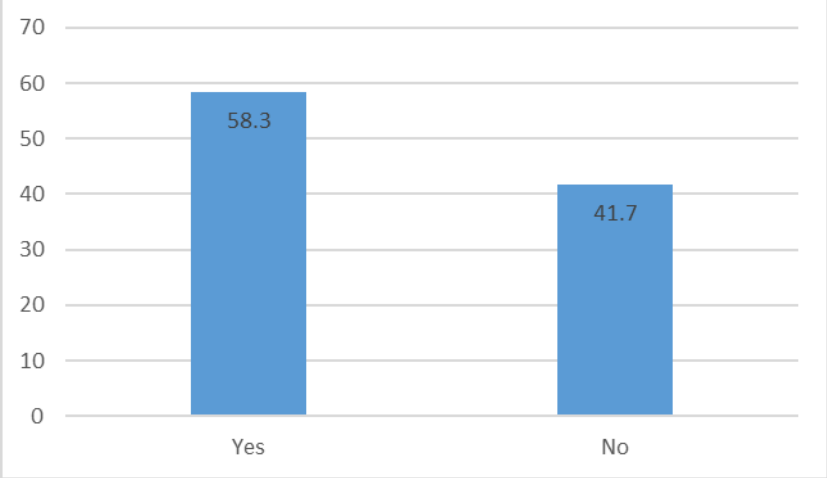


Source: Field survey, 2019

Figure 4.9 Vermicompost use increases profitability

4.14.5 Vermicompost increases yield

Figure 4.10 shows that 58.3 percent of the vermicompost users thought that use of vermicompost increases yield and 41.7 percent did not.

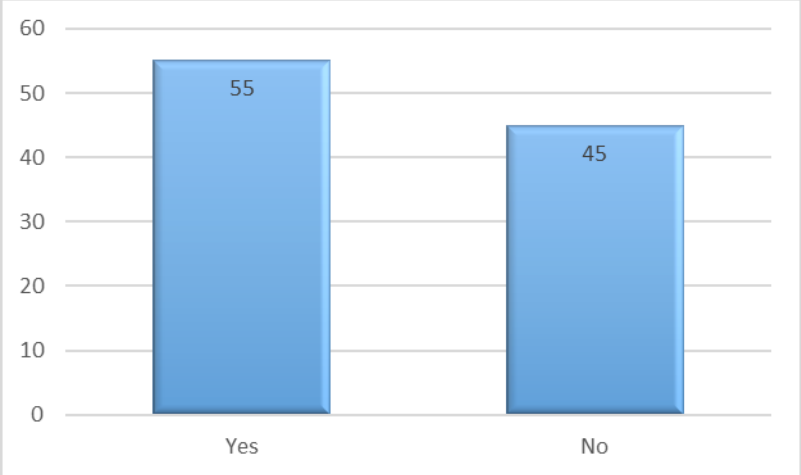


Source: Field survey, 2019

Figure 4.10 Vermicompost use increases yield

4.14.6 Vermicompost reduces pesticide application

Figure 4.11 shows that 55 percent of the vermicompost users thought that use of vermicompost reduces pesticide application and 45 percent did not.



Source: Field survey, 2019

Figure 4.11 Vermicompost reduces application of pesticides

The result shows that according to farmers perspective vermicompost use is environmental friendly. It can be integrated with chemical fertilizer. Vermicompost is also less costly and it reduces soil borne diseases and pesticide application.

CHAPTER V
COMPARATIVE PROFITABILITY OF POTATO PRODUCTION

5.1 Introduction

Profitability is a major criterion to make decision for producing potato at farm level. It can be measured based on net return, gross margin and ratio of return to total cost. The costs of all items were calculated to identify the total cost of production. The returns from the crops have potato estimated based on the value of main products and by-products.

5.2 Profitability of potato production for users and non-users

5.2.1 Variable Costs

5.2.1.1 Human Labor Cost

Labor cost is an important component in potato production and this has implication for income and employment generation. In calculating the cost of farm operation, the services of both hired and family labor were taken into consideration. Family labor includes the operator himself and other working members of the family. However, the hired labor includes permanent hired labor, and labor employed on daily contract basis. The cost of family labor was estimated on the basis of the principle of opportunity cost. It is revealed from Table 5.1 that per labor cost Tk. 350 for both vermicompost users and non-users. 150 men is required for per hectare in case of vermicompost users and 125 for non-users. The cost of hired labor per hectare became Tk. 52500 for vermicompost users and Tk. 43750 for vermicompost non-users respectively. Vermicompost users hired labor cost was higher than vermicompost non-users.

5.2.1.2 Cost of Land Preparation

Land preparation is needed to make the soil suitable for potato cultivation. The average land preparation cost of potato production was found Tk. 8188 for vermicompost users and Tk. 8443 for vermicompost non-users, respectively. Vermicompost users' land preparation cost was lesser than vermicompost non-users (Table 5.1).

5.2.1.3 Cost of Manure

Manure is very important fertilizer which is needed to hold moisture of the soil particle in the land for potato cultivation. The average manure cost for potato production was found Tk. 1420 for vermicompost users and Tk. 1560 for vermicompost non-users respectively. Vermicompost users' manure cost was lesser than vermicompost non-users (Table 5.1).

5.2.1.4 Cost of Seed

Cost of seed varied widely depending on its quality and availability. It is found from table 5.1 that cost of seed was Tk. 20 per kg for vermicompost users and Tk. 21 for non-users. In case of vermicompost users 2578 kg seed was needed per hectare and in case of vermicompost non-users 2761 kg for non-users. Total cost of seed for potato production was estimated to be Tk. 51560 per hectare for vermicompost users and Tk. 57981 for vermicompost non-users respectively. Cost of seed of vermicompost users was lesser than vermicompost non-users .

5.2.1.5 Cost of Urea

In the study area, farmers used different types of fertilizers to cultivate potato. On an average, cost of urea was Tk. 16 per kg for both vermicompost users and non-users. In case of vermicompost users 337 kg urea was needed per hectare and in case of vermicompost non-users 339 kg for non-users. Total cost of urea for potato production was estimated to be Tk. 5392 per hectare for vermicompost users and Tk. 5424 for vermicompost non-users respectively. Cost of urea of vermicompost users was lesser than vermicompost non-users.

5.2.1.6 Cost of TSP

It is found from Table 5.1 that cost of TSP was Tk. 25 per kg for vermicompost users and Tk. 26 for non-users. In case of vermicompost users 418 kg TSP was needed per hectare and in case of vermicompost non-users 401 kg for non-users. Total cost of TSP for potato production was estimated to be Tk. 10450 per hectare for vermicompost users and Tk. 10426 for vermicompost non-users respectively. Cost of TSP of vermicompost users was higher than vermicompost non-users .

5.2.1.7 Cost of MoP

It is found that cost of MoP was Tk. 16 per kg for vermicompost users and Tk. 17 for non-users. In case of vermicompost users 369 kg MoP was needed per hectare and in case of vermicompost non-users 368 kg for non-users. Total cost of MoP for potato production was estimated to be Tk. 5904 per hectare for vermicompost users and Tk. 6256 for vermicompost non-users respectively. Cost of MoP of vermicompost users was lesser than vermicompost non-users (Table 5.1) .

5.2.1.8 Cost of Gypsum

It is found from table 5.1 that cost of Gypsum was Tk. 10 per kg for both the vermicompost users and for non-users. In case of vermicompost users 116 kg Gypsum was needed per hectare and in case of vermicompost non-users 163 kg for non-users. Total cost of Gypsum for potato production was estimated to be Tk. 1160 per hectare for vermicompost users and Tk. 1630 for vermicompost non-users respectively. Cost of Gypsum of vermicompost users was lesser than vermicompost non-users .

5.2.1.9 Cost of Zinc

Cost of Zinc was Tk. 14 per kg for both the vermicompost users and non-users. In case of vermicompost users 190 kg Zinc was needed per hectare and in case of vermicompost non-users 154 kg for non-users. Total cost of Zinc for potato production was estimated to be Tk. 2660 per hectare for vermicompost users and Tk. 2156 for vermicompost non-users respectively. Cost of Zinc of vermicompost users was higher than vermicompost non-users (Table 5.1) .

5.2.1.10 Cost of Irrigation

Irrigation was a leading input for potato production. The total irrigation cost for potato farmers was Tk. 2148 per hectare for vermicompost users and Tk. 2993 for vermicompost non-users. Hence, the cost for vermicompost non-users for irrigation was higher than vermicompost users (Table 5.1).

5.2.1.11 Cost of Pesticides

Farmers used different kinds of pesticides to control pests and diseases so that they can get higher yield of potato cultivation. The average cost of pesticides was Tk. 6650 per hectare for vermicompost users and Tk. 4465 for vermicompost non-users respectively. Vermicompost users pesticides cost was higher than vermicompost non-users (Table 5.1).

5.2.1.12 Cost of Vermicompost

Farmers use vermicompost in their field for higher production of potato. Cost of vermicompost was Tk. 06 per kg and 1415 kg vermicompost was needed per hectare. Total cost of vermicompost for potato production was estimated to be Tk. 8490 per hectare (Table 5.1) .

5.2.1.13 Total Variable Cost

Therefore, from the above different cost items it was clear that the total variable cost of potato production was Tk. 156522 and Tk. 145084 per hectare for vermicompost users and vermicompost non-users for potato cultivation respectively. Vermicompost users' total variable cost was higher than vermicompost non-users' (Table 5.1).

5.2.2 Fixed Cost

5.2.2.1 Own labor cost

For potato production, own labor cost is one of the important cost of the production. Own labor cost was Tk. 350 per man for both the vermicompost users and non-users. In case of vermicompost users 21 man was needed per hectare and in case of vermicompost non-users 28 man for non-users. Total own labor cost for potato production was estimated to be Tk. 7350 per hectare for vermicompost users and Tk. 9800 for vermicompost non-users respectively. Own labor cost of vermicompost users was lesser than vermicompost non-users (Table 5.1).

5.2.2.2 Land use cost

Land use cost is the another important cost for the production. Table 5.1 shows that total land use cost was Tk. 25935 per hectare per year for both vermicompost users and vermicompost non-users.

Table 5.1: Per hectare cost of potato cultivation

Variable cost items	Unit	Vermicompost user			Vermicompost non-user		
		Unit Price	Quantity (kg/ha)	Total cost	Price	Quantity (kg/ha)	Total cost
Human labor cost	Man days/ha	350	150	52500	350	125	43750
Land preparation cost	Tk/ha			8188			8443
Manure Cost	Tk/ha			1420			1560
Seed cost	Tk/ha	20	2578	51560	21	2761	57981
Urea cost	Tk/ha	16	337	5392	16	339	5424
TSP cost	Tk/ha	25	418	10450	26	401	10426
MP cost	Tk/ha	16	369	5904	17	368	6256
Gypsum cost	Tk/ha	10	116	1160	10	163	1630
Zinc cost	Tk/ha	14	190	2660	14	154	2156
Irrigation cost	Tk/ha			2148			2993
Pesticides cost	Tk/ha			6650			4465
Vermicompost cost	Tk/ha	6	1415	8490			
Total variable cost	Tk/ha			**156522**			**145084**
Own labor	Man days/ha	350	21	7350	350	28	9800
Land use cost	Tk/ha			25935			25935
Total fixed cost	Tk/ha			33285			35735
Total cost	Tk/ha			**189807**			**180819**

Source: Field survey, 2019

5.2.3 Total cost of potato production

Total cost was calculated by adding all the cost of variable and fixed inputs. In this study total cost of potato production per years was found to be Tk. 189807 per hectare for vermicompost users and Tk. 180819 per hectre for vermicompost non-users for potato cultivation. Vermicompost users' total potato production cost was higher than vermicompost non-users (Table 5.1). In case of vermicompost users variables like seed

cost, urea cost, MoP cost, gypsum cost, irrigation cost were found to be less than vermicompost non-users. But variables like TSP cost, Zinc cost, pesticides cost were found to be higher than non-users. With these, additional cost of vermicompost made the total cost higher for vermicompost users than non-users.

5.2.4 Return of potato production

5.2.4.1 Total Yield

Yield of potato was found to be higher (29328 kg/ha) for vermicompost users compared to non-users (25090 kg/ha) in the study area. However, Bangladesh produced a record high of 1.09 crore tonnes in 2019 , according to the Department of Agricultural Extension (DAE).

5.2.4.2 Gross Return

Return per hectare of potato production is shown in Table 5.3. Per hectare gross return was calculated by multiplying the total amount of product with respective per unit price and then adding the value of by-product. Therefore, the gross return were found to be Tk. 366600 per hectare for vermicompost users and Tk. 313625 for vermicompost non-users. Vermicompost user's gross return was higher than vermicompost non-users. Gross return of users was 16.89 percent higher compared to non-users.

5.2.4.3 Gross Margin

Gross margin was calculated by deducting the total variable cost from the gross return. On the basis of the data, gross margin was found to be Tk. 210078 for vermicompost users and Tk. 168541 per hectare for vermicompost non-users. Vermicompost user's gross margin was higher than vermicompost non-users. Gross margin of users was 33.12 percent higher compared to non-users(Table 5.3).

5.2.4.4 Net Return

Net return or profit was calculated by deducting the total production cost from the gross return. On the basis of the data the net return was estimated as Tk. 176793 and Tk. 132806 per hectare for vermicompost users and non-users. Vermicompost user's net

return was higher than vermicompost non-users. Gross margin of users was 33.12 percent higher compared to non-users(Table 5.3).

Table 5.2: Per hectare return of potato production

Items	Vermicompost user			Vermicompost non-user		
	Quantity (kg/ha)	Price (Tk/kg)	**Total (Tk/ha)**	Quantity (kg/ha)	Price (Tk/kg)	**Total (Tk/ha)**
Potato	29328	12.5	366600	25090	12.5	313625

Source: Field Survey, 2019

Table 5.3 Comparative profitability of potato production

Sl. No.	Items	Vermicompost user	Vermicompost non-user	% of High/Low
A.	Gross return (GR)	366600	313625	16.89
B.	Total variable costs (TVC)	156522	145084	7.88
C.	Total costs (TVC+TFC)	189807	180819	4.97
D.	Gross margin (GR-TVC)	210078	168541	24.65
E.	Net return (GR-TC)	176793	132806	33.12
F.	Benefit-cost ratio (BCR) = GR/TC	1.93	1.73	11.56

Source: Field Survey, 2019

5.2.4.5 Benefit Cost Ratio (undiscounted)

Benefit cost ratio (BCR) was found to be 1.93 and 1.73 for vermicompost user and vermicompost non-user respectively which implies that investment of Tk 1 in potato production generated Tk. 1.93 and Tk. 1.73 for vermicompost users and non-users respectively. BCR of vermicompost users was 11.56 percent higher compared to non-users (Table 5.3).

From this chapter we found that total cost of production was higher for users compared to non-users due to high labor cost. But in case of vermicompost users, seed cost, urea cost, MoP cost, gypsum cost, irrigation cost were found to be lesser than vermicompost non-users. However, profitability analysis shows that the BCR of vermicompost users was higher compared to non-users due to higher yield and gross return.

CHAPTER VI

CONSTRAINTS OF VERMICOMPOST USERS AND NON-USERS OF POTATO CULTIVATION

6. Constraints

There may be some constraints for potato cultivation in the existing socio-economic context of Bangladesh. Therefore, an attempt was made to identify the major constraints and constraints of potato cultivation in the study area and to discuss the solutions of these constraints so that the owners of the potato cultivation can obtain better economic gain from potato cultivation.

6.1 Constraints for vermicompost users

6.1.1 Non-availability of fertilizer

Fertilizer is one of the most important items for potato cultivation. Table 6.1 clearly indicates that all of the potato cultivation in the study area faced the problem for non-availability of fertilizer in proper time. In the study area 56.67 percent of vermicompost non-users farmers mentioned this problem.

6.1.2 Less availability of vermicompost

It is found that study area faced the problem of less availability of vermicompost. In local markets, sometimes farmers did not find vermicompost in proper time. Around 42.7 percent of vermicompost users faced this problem (Table 6.1).

6.1.3 Non-availability of seeds

Non-availability of adequate number of seeds was another major problem for the owners of the potato farm. In the study area all the owners of the potato farms faced the problem of non-availability of seeds. There is limited number of seeds farms in our country which are insufficient to meet up the requirement of seeds in proper time. Each of the potato farm owners had to spend a substantial time and energy for purchasing the seeds. In most

cases, advance payments were necessary to purchase seeds, but there was no certainty of getting back their seeds. Sometimes, the farm owners may had to wait 1 to 2 months. In the study area 64.5 percent of vermicompost users mentioned this problem (Table 6.1).

6.1.4 Lack of knowledge of use of vermicompost

It is found that study area faced the problem of lack of knowledge of use of vermicompost. There is a little availability of training of use of vermicompost. Around 55 percent of vermicompost users have no knowledge of use of vermicompost (Table 6.1).

6.1.5 Lack of credit facilities

Money is the most essential thing to run any production smoothly. It is also true in case of potato cultivation. Inadequate institutional credit is one of the most crucial constraints for the development of potato cultivation in our country. Moreover, in Bangladesh, bank credit disbursement system is very lengthy and most of the time corruption is occured. In the study area 72.4 percent of vermicompost users mentioned this problem (Table 6.1).

6.1.6 Irregular fluctuation of potato prices

Most of the owners complained that they did not have actual price of potato compared to their cost. Lower price of potato is one of the most important marketing problem. Farmers complained that they were not getting reasonable price. In the study area 51.6 percent of vermicompost users mentioned this problem (Table 6.1).

Table 6.1: Constraints faced by vermicompost users for potato production in the study area

Nature of Constraints	Vermicompost users %
Non -availability of fertilizers	56.67
Less availability of vermicompost	42.70
Non availability of seeds	64.50
Lack of knowledge of use of vermicompost	55.00
Lack of credit facilities	72.40
Irregular fluctuation of potato price	51.60

6.2 Constraints for vermicompost non-users

6.2.1 Non-availability of fertilizer

Fertilizer is one of the most important items for potato cultivation. Table 6.2 clearly indicates that all of the potato cultivation in the study area faced the problem for non-availability of fertilizer in proper time. In the study area 45.8 percent of vermicompost user's farmers mentioned this problem.

6.2.2 Non-availability of seeds

Non-availability of adequate number of seeds was another major problem for the owners of the potato farm. In the study area all the owners of the potato farms faced the problem of non-availability of seeds. There is limited number of seeds farms in our country which are insufficient to meet up the requirement of seeds in proper time. Each of the potato farm owners had to spend a substantial time and energy for purchasing the seeds. In most cases, advance payments were necessary to purchase seeds, but there was no certainty of getting back their seeds. Sometimes, the farm owners may had to wait 1 to 2 months. In the study area 66.67 percent of vermicompost non-users farmers mentioned this problem (Table 6.2).

6.2.3 Diseases and pests attacks

Outbreak of diseases and pests attack is one of the major problem in the study area. In the study area 48.33 percent of vermicompost non-users farmers mentioned this problem (Table 6.2).

6.2.4 Lack of credit facilities

Money is the most essential thing to run any production smoothly. It is also true in case of potato cultivation. Inadequate institutional credit is one of the most crucial constraints for the development of potato cultivation in our country. Moreover, in Bangladesh, bank credit disbursement system is very lengthy and most of the time corruption is occured. In the study area 61.66 percent of vermicompost non-users farmers mentioned this problem (Table 6.2).

6.2.5 Irregular fluctuation of potato prices

Most of the owners complained that they did not have actual price of potato compared to their cost. Lower price of potato is one of the most important marketing problem. Farmers complained that they were not getting reasonable price. In the study area 41.67 percent of vermicompost non-users farmers mentioned this problem (Table 6.2).

Table 6.2: Constraints faced by vermicompost users for potato production in the study area

Nature of Constraints	Vermicompost non-users %
Non -availability of fertilizers	45.80
Non availability of seeds	66.67
Diseases and pest attack	48.33
Lack of credit facilities	61.66
Irregular fluctuation of potato price	41.67

CHAPTER VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary

Nilphamari district was selected purposively as a study area because this district is one of the leading potato producing districts of Bangladesh. Domar and Joldhaka upazila was selected randomly from the 7 upazila of Nilphamari District. After preliminary visit four village's namely Khanabari and Boroghaca from Shonarai union and Gholna and Mazapara villages from Mirganj union under Joldakha upazila were selected randomly as the study area. Data for the study were collected from 60 randomly selected farmers. Among those 30 was vermicompost users and 30 was vermicompost non-users potato cultivators. The study was undertaken with the following specific objectives.

i. To describe the socio-economic characteristics of potato producers in the study areas;
ii. To compare the profitability of potato production between vermicompost users and non-users;
iii. To identify the constraints of vermicompost users and non-users of potato cultivation;

From the socio-economic view, it was found that highest 66.7 percent vermicompost users age between 31-50 years. There was 30 percent vermicompost users age above 50 years. Vermicompost non-users age between 31-50 years was 71.6 percent of the total sampled. However, the average age of vermicompost users was found as 49.1 years and non-users was 46 years. The findings reveals that the highest 32.4 percent of the vermicompost users attained above secondary education. The result also reveals that the highest 31.7 percent of the vermicompost non-user farmers attained primary education and 31.4 percent of the vermicompost non-user farmers attained above secondary education. It is clear from the study that 46.7 percent vermicompost users and 34.5 percent vermicompost non-users had 8-10 years of experience. 48.3 vermicompost users and 41.5 percent vermicompost non-users had 21-40 years of experience. However, the

average experience of farming of vermicompost users was found 24.27 years and non-users was 22.23 years. Findings shows that among the vermicompost users, 78.3 percent farmers' occupation was agriculture, 11.7 percent was business, 6.5 percent was service holder and 3.5 percent did other types of jobs. On the other hand, among the non vermicompost users, 68.3 percent farmers' occupation was agriculture, 15.0 percent was business, 14.3 percent was service holder and 2.4 percent did other types of jobs. It is found from the study that about 56.5 percent of the vermicompost users had social membership and rest of the vermicompost users had no social membership. In case of vermicompost non-users, 51.7 percent had social membership and 48.3 percent had no social membership. Results show that different sizes of family of farmers had been found. In both cases (vermicompost users and non-users) the maximum percentage of family members lied between 5-6 persons. However, the average size of family of vermicompost users and non-users were 4.67 members and 4.83 members respectively. Family income of the farmers comprises several sectors. In the study area annual family income of potato cultivators came from potato farming, business, agriculture, service,etc. Findings show that 55 percent families of vermicompost users and 46.90 percent families of vermicompost non-users monthly income was Tk. 120-360 thousands annually. About 11.70 percent vermicompost users and 15.50 percent non-users monthly income was above Tk. 500 thousands annually. Study show that years of use of vermicompost of the farmers ranges between 1 to 5 years. Findings show that most of the users had a little experience of use of vermicompost. It was about 53.33 percent. However, 40 percent of the users had 3-4 years of experience and only 6.67 percent of the users had more than 4 years of experience. According to the study, it was found that only 33.3 percent of the users had training on the use of vermicompost.

Study shows that duration of training on vermicompost varies from 1-5 days. Result shows that only 28.3 percent of the users of vermicompost took advice from SAAOs and 71.7 percent did not. In this study, it is found that 73.3 percent of the users agreed that the use of vermicompost is environment friendly and 26.7 percent disagreed. Finding shows that 61.7 percent of the users said that vermicompost is less costly and 38.3 percent said costly. Result shows that 53.0 percent of the users thought that

vermicompost can be integrated with chemical fertilizer and 47.0 percent did not. In this study it is found that 75.0 percent of the users thought that use of vermicompost reduces soil borne diseases and 25.0 percent did not. Findings show that 60.0 percent of the vermicompost users thought that use of vermicompost increases profitability and 40.0 percent did not. Result shows that 60.0 percent of the vermicompost users thought that use of vermicompost increases profitability and 40.0 percent did not. In this study it is found that 58.3 percent of the vermicompost users thought that use of vermicompost increases yield and 41.7 percent did not. Finding shows that 55 percent of the vermicompost users thought that use of vermicompost reduces pesticide application and 45 percent did not. The above findings from the study show that vermicompost is environmental friendly. It can be integrated with chemical fertilizer too. Vermicompost is less costly and it reduces soil borne diseases and pesticide application. Both the profitability and yield increase if we use vermicompost.

Profitability depends on the costs involved in production and returns from its product and byproduct. In calculating cost, both cash cost and non-cash cost were considered. The cost items were cost of human labor, land preparation, seed cost, urea cost, TSP, MoP, gypsum, zinc cost, irrigations and pesticides cost. The cost of family labor was estimated on the basis of the principle of opportunity cost. It is revealed from the study that per labor cost Tk. 350 for both vermicompost users and non-users. 150 men is required for per hectare in case of vermicompost users and 125 for non-users. The cost of hired labor per hectare became Tk. 52500 for vermicompost users and Tk. 43750 for vermicompost non-users respectively. The average land preparation cost of potato production was found Tk. 8188 for vermicompost users and Tk. 8443 for vermicompost non-users, respectively. The average manure cost for potato production was found Tk. 1420 for vermicompost users and Tk. 1560 for vermicompost non-users respectively. Findings show that cost of seed was Tk. 20 per kg for vermicompost users and Tk. 21 for non-users. In case of vermicompost users 2578 kg seed was needed per hectare and in case of vermicompost non-users 2761 kg for non-users. Total cost of seed for potato production was estimated to be Tk. 51560 per hectare for vermicompost users and Tk. 57981 for vermicompost non-users respectively. On an average, cost of urea was Tk. 16 per kg for both

vermicompost users and non-users. In case of vemricompost users 337 kg urea was needed per hectare and in case of vermicompost non-users 339 kg for non-users. Total cost of urea for potato production was estimated to be Tk. 5392 per hectare for vermicompost users and Tk. 5424 for vermicompost non-users respectively. Study shows that cost of TSP was Tk. 25 per kg for vermicompost users and Tk. 26 for non-users. In case of vermicompost users 418 kg TSP was needed per hectare and in case of vermicompost non-users 401 kg for non-users. Total cost of TSP for potato production was estimated to be Tk. 10450 per hectare for vermicompost users and Tk. 10426 for vermicompost non-users respectively. Findings shows that cost of MoP was Tk. 16 per kg for vermicompost users and Tk. 17 for non-users. In case of vermicompost users 369 kg MoP was needed per hectare and in case of vermicompost non-users 368 kg for non-users. Total cost of MoP for potato production was estimated to be Tk. 5904 per hectare for vermicompost users and Tk. 6256 for vermicompost non-users respectively. In the study it is found that cost of Gypsum was Tk. 10 per kg for both the vermicompost users and for non-users. In case of vermicompost users 116 kg Gypsum was needed per hectare and in case of vermicompost non-users 163 kg for non-users. Total cost of Gypsum for potato production was estimated to be Tk. 1160 per hectare for vermicompost users and Tk. 1630 for vermicompost non-users respectively. Again it is found that cost of Zinc was Tk. 14 per kg for both the vermicompost users and non-users. In case of vermicompost users 190 kg Zinc was needed per hectare and in case of vermicompost non-users 154 kg for non-users. Total cost of Zinc for potato production was estimated to be Tk. 2660 per hectare for vermicompost users and Tk. 2156 for vermicompost non-users respectively. The total irrigation cost for potato farmers was found Tk. 2148 per hectare for vermicompost users and Tk. 2993 for vermicompost non-users. The average cost of pesticides was Tk. 6650 per hectare for vermicompost users and Tk. 4465 for vermicompost non-users respectively. Findings show that cost of vermicompost was Tk. 06 per kg and 1415 kg vermicompost was needed per hectare. Total cost of vermicompost for potato production was estimated to be Tk. 8490 per hectare. Findings shows that the total variable cost of potato production was Tk. 156522 and Tk. 145084 per hectare for vermicompost users and vermicompost non-users for potato cultivation respectively. Own labor cost was Tk. 350 per man for both the vermicompost users and

non-users. In case of vermicompost users 21 man was needed per hectare and in case of vermicompost non-users 28 man for non-users. Total own labor cost for potato production was estimated to be Tk. 7350 per hectare for vermicompost users and Tk. 9800 for vermicompost non-users respectively. Result shows that total land use cost was Tk. 25935 per hectare per year for both vermicompost users and vermicompost non-users. In this study total cost of potato production per years was found to be Tk. 189807 per hectare for vermicompost users and Tk. 180819 per hectare for vermicompost non-users for potato cultivation. Total yield of potato was found to be 29328 kg per hectare and 25090 kg per hectare for vermicompost users and non-users respectively. Average price of potato was found to be Tk. 12.5 per kg. So the total yield became Tk. 366600 per hectare for vermicompost users and Tk. 313625 per hectare for non-users. Findings show that return per hectare of potato production is shown in Table 5.3. Per hectare gross return was calculated by multiplying the total amount of product with respective per unit price and then adding the value of by-product. Therefore, the gross return were found to be Tk. 366600 per hectare for vermicompost users and Tk. 313625 for vermicompost non-users. Vermicompost user's gross return was higher than vermicompost non-users. Gross return of users was 16.89 percent higher compared to non-users. On the basis of the data, gross margin was found to be Tk. 210078 for vermicompost users and Tk. 168541 per hectare for vermicompost non-users. Vermicompost user's gross margin was higher than vermicompost non-users. Gross margin of users was 33.12 percent higher compared to non-users. Study shows that the net return was estimated as Tk. 176793 and Tk. 132806 per hectare for vermicompost users and non-users. Gross margin of users was 33.12 percent higher compared to non-users. Benefit cost ratio (BCR) was found to be 1.93 and 1.73 for vermicompost user and vermicompost non-user respectively which implies that investment of Tk 1 in potato production generated Tk. 1.93 and Tk. 1.73 for vermicompost users and non-users respectively. BCR of vermicompost users was 11.56 percent higher compared to non-users.

7.2 Conclusions

Potato sub-sector can play a vital role for the economic development of a country. The results of the study clearly indicates that potato farming is a profitable business. Among all farm categories, vermicompost users received more profit compared to vermicompost non-users. Therefore, there was a chance to increase gross returns by changing available inputs used. Benefit cost ratio was higher for vermicompost users (1.93) than non-users (1.73). The performance of vermicompost users was superior in terms of profitability and economic return in comparison with the vermicompost non-users. The government should take necessary steps to overcome these constraints for the use of vermicompost and to expand the production of potato in different parts of Bangladesh. It is also revealed from the study that the potato cultivations using vermicompost can be more profitable if the constraints, related to it, can be solved.

7.3 Recommendations

On the basis of analysis presented above, the following recommendations may be advanced as broad guidelines for successful operation of potato farming in the study area as well as all over the country:

- ✓ Less availability of vermicompost is one of the major problems found in the study area. So the supply of vermicompost must be increased.
- ✓ Free seminars, trainings need to be arranged in the rural areas about the use, benefit etc. of vermicompost so that farmer can gather knowledge about the advantage of vermicompost.
- ✓ Govt. and non-govt. organizations, banks, financial institutions, NGOs should come forward to help financially to the vermicompost users to overcome credit deficiency.

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An Interview Schedule on

Adoption and profitability of potato production : case of vermicopost users and non users in Nilphamari district.

Sample no.

User		Non user	

a. Socio-Economic Characteristics:

Respondent	Relationship	Age	Education (Years)	Farm's Experience	Occupation	Societal Membership (Yes/No)
1						
2						
3						
4						
5						
6						
7						

Occupation: 1=Agriculture, 2=Business,3=Service,4=Others

b. Total Family Members:

Male:

Female:

Total working members:

c. Farm size:

Types of land	Area (Ha)
a. own cultivated land	
b. rented in	

c. rented out	
d. mortgaged in	
e. mortgaged out	
Total=(a+b+c+d+e)	

3. Annual Income:

Occupation		Amount (Tk)
Agriculture	Crops	
	Livestock	
	Fisheries	
	Forestry	
Non-agriculture	Business	
	Service	
	Others	

4. Cost and return:
   a. Total area of potato cultivation _____ha
   b. Total area of survey land_____ha
   c. Human Labor requirement (man/day)_____

Name of items	Potato		Wage rate
	No. of labor		
	Own	Hired	
Land preparation			
Manure and Fertilizer			
Irrigation			
Pest Management			
Harvesting			
Carrying and Storing			
Sunning and Drying			

Total			

d. Materials inputs used:

Inputs	Unit price (Tk/kg)	Amount (kg/survey plot)	TK/Survey plot
Seed			
Manure			
Fertilizer			
a. Urea			
b. TSP			
c. MP			
d. Gypsum			
e. Zinc			
f. Vermicompost			
Pesticide			
Irrigation			
Others			
Total=			

5. Amount of Potato Production:

Please mention about potato production.

Potato Production	Total Production (mounds)	Unit Price (TK)	Total Taka
1	2	3	4

6. Basic Information on Vermicompost Use:

i. From when you use vermicompost?_____yrs

ii. Did you receive any training on vermicompost use? Yes/No

If yes, How many nos._____:

Total duration of training:_____days

iii. Did you receive any training of agriculture?

Yes/No If yes,How many days?_____

iv. Did you receive any advice from SAAO on vermicompost use? Yes/No

If yes, How many times in last year_____nos.

v. Do you think vermicompost use is environmental friendly? Yes/No

vi. Do you think vermicompost is less costly? Yes/No

vii. Do you think vermicompost can be integrated with chemical fertilizer ?Yes/No

viii. Do you think use of vermicompost reduce soil borne disease?Yes/No

ix. Do you think vermicompost increase profitability? Yes/No

x. Do you think vermicompost increase yield? Yes/No

xi. Do you think vermicompost reduce pesticide application? Yes/No

7. Please mention the problem faced regarding vemicompost use:

a)

b)

c)

d)

e)

8. What are your suggestions to overcome the above problems?

a)

b)

c)

d)

e)

Thank you for your kind co-operation.

Dated……. Signature of the interviewer