International Journal of Agriculture and Environmental Research

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

DOES TULSI PLANT (*Ocimum* spp.) CULTIVATION PAY OFF ?

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ABSTRACT

Tulsi plant (*Ocimum* spp.) cultivation is a recent land use practice in Bangladesh. The rural people have shown an increasing interest and convert their land use practice for the expansion of Tulsi plant as tea production in Northern part of the country. Expected higher financial return is one of the main drivers of its acceptance and expansion. This study analyzed the financial returns of Tulsi plant production as an alternative land use option compared to three common agriculture crop production (Potato, Tobacco and Banana) at Rangpur district in Bangladesh. Net revenue was highest for Tulsi cultivation and lowest for Banana and Tobacco but the Potato based revenue was intermediate. Furthermore, the revenues from the agriculture production were more sensitive to a range of uncertainties than the Tulsi plant cultivation. This research shows that, Tulsi plant production is financially competitive with the studied commercial crop options and offers returns of better reliability. The hypothesis assumed and which supported our results is that the Tulsi based revenues is more are higher than other crops. Therefore, the continued expansion of the Tulsi plant can be explained by higher returns and good market demands as Tulsi tea product in the study area.

Keywords: Land use practice, Tulsi Tea, Financial profitability, Crop production, Bangladesh

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

1. INTRODUCTION

The livelihood of rural people in Bangladesh is dependent largely on agricultural activities (Mondal, 2008). Agricultural activities are subsistence mainly depend on rice cultivation based on large scale to small holder farming systems (Shelley et al., 2016). The area of land under cultivation for agricultural production is not proportional to the increasing population in the country. This justified by the fact that total agricultural land over the periods in the past has not increased although population has increased significantly (Jaim and Begum, 2003). It implies that, land availability for crop cultivations decreases substantially which will have serious implication on agricultural production (Faroque et al., 2011) in the near future. It is also postulated that the main reason for the high pressure on agricultural land particular common agricultural crops production provides better in come to farmer than land use management for cash crops such as Tulsi plant. Modern agricultural research also shows that, the common crops cultivation such as paddy, white, maize, fibers, vegetables etc. are reducing their profitability due to decreasing soil fertility (Chakraborty and Mistri, 2015) as the same crops are cultivate again and again in same land. In this circumstances, huge population with declining land fertility we should concentrate on alternative crops like Tulsi plant that have a vast opportunity to get more benefit for farmers. Tulsi plant is one of the most prominent cash crops that could boost up rural economy as well as play significant role in poverty alleviation (Shahin, 2009). It used as a cash crop that can generate good income for the local farmers. It has been used as a drink as tea made from its leaves. Few companies are currently harvesting varieties of Tulsi plant in Bangladesh and mixing them to achieve the healthiest results for their customers (Marc, 2014).

The northern part of Bangladesh has been suffering every years from starvation for a certain period of time locally known as “Monga” results from acute shortage of water which causes massive failure in cereal crops production (Zug, 2006). To rescue our local farmers from this situation, Tulsi plant could play the most prominent role as it has also the capacity to grow under water shortage condition (Dash, 2009). Taking this as an advantage, different organizations have been working on wider Tulsi plant cultivation in the country. So far, government initiatives are not very much worthy but NGOs have been working on a massive scale to explore its full potentiality (Shohel, 2009). At the same time, to meet the millennium development goals and to mitigate and adapt the climate change, Bangladesh has to explore all potentiality in every sector by analyzing all alternatives (MGD, 2015), just to bring sustainable rural developments. In this regards, Tulsi plant has emerged as one of that prospect to boost up the rural economic and as well as adapting the globally changing environmental condition. However, the economic profitability of Tulsi land use option has never been evaluated as compared the other land use options in Bangladesh at large. Thus in the present study we evaluate its financial feasibility as

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

an alternative land use options in our study area with other traditional agricultural cultivation particularly on Potato, Tobacco and Banana.

2. MATERIALS AND METHODS

2.1. Study area

The study was conducted at Ismailpur village at Rangpur district which has been selected purposively. The study villages have been selected purposively. It is located between 25.44′N and 89.15′E. The study area cover of 205 ha with an altitude of 32.6 m a.s.l.. The area receives a seasonal rainfall near about 2200 to 2500 mm, from June to September. Annual mean minimum and maximum temperatures are 10 0C and 35 0C respectively. The total population in the study area are about 2200. Out of that, males are constitute 44.55% and females 55.45%. In terms of religion, 98 % are Muslims, 2% are Hindus. Christians and Buddhists are not found in this village. Two ethnic groups; Shawtal and Ural are existed in this study area. The farming system in the study area is based on traditional agricultural crops particularly; Potato, Tobacco, Banana, Tomato, Maize, Tulsi and others. Among these crops, Potato, Tobacco, Banana and Tulsi plant are dominate and cover about 90% of the cultivated lands in the study villages.

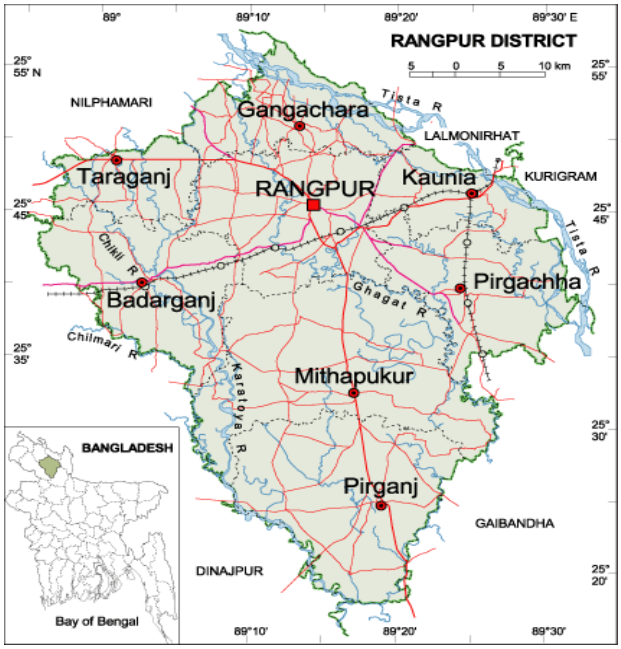

Figure (1): Map of Rangpur district showing the study area

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

2.2. Data collection

Economic revenue from the four alternative land uses practice was based on monetary values of the various physical inputs and outputs involved in their production systems. Data for the physical inputs and outputs and their prices were collected through a combination of socio-economic survey and field inventory (Dejene *et al.*, 2013). The socio-economic survey involved various data collection techniques such as informal discussion, household questionnaire survey and focus group discussion. For the household questionnaire survey, 60 sample households were purposively selected using the criteria of having farm land for Tulsi plant production in parallel with agricultural crop production mainly for Potato, Tobacco, and Banana.

A structured questionnaire was developed, pre-tested and used to interview the sample households. Reconnaissance survey and informal discussion was conducted to gather essential information to be incorporated into the structured questionnaire for the household interview. Based on the information gathered from the reconnaissance survey, the structured questionnaire was designed to capture information onfarm size, crop types cultivated, size of land used for each crop, amount of annual inputs and outputs for farm activities by crop type, costs and price of inputs and outputs. The questionnaire was pretested on 15 randomly selected households and the necessary adjustments were made before being used in the main data collection procedure. Interview was conducted by the researchers using the local language (Bangla). The focus group discussion (FGD) was conducted with two groups and each consisting of 6 to 8 individuals. The check list questionnaire used for the FGD also sought information related to labour cost, prices and amounts of inputs, work norms per hectare and others. The information obtained from the FGD was used to check and confirm the data collected through the household interview.

Secondary data has been extracted from various sources. Mainly the internet was a most important source to collect the information on Tulsi plant production. Furthermore, books, journals and newspaper were also surveyed simultaneously. To obtain reliable estimate of Potato, Tobacco, Banana and Tulsi annual yield per hectare, the farm plots of 60 sample households were surveyed and their respective area calculated using measuring tapes. The quantity of harvested yield (kg) was divided by the plot size (ha) to obtain estimate ofyield per ha and year.

For prices of inputs and outputs we used present market prices. Market price was determined by conducting a market survey in the nearby major town at Rangpur district. The types and quantities of inputs for the four land use practices were obtained from the information gathered through household survey and FGD. The year basis total monetary values of the outputs and inputs on per hectare land were computed with the corresponding unit price of each of the output and input respectively.

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

2.3. Data analysis and decision criteria

The financial efficiency of each land use practice was evaluated using Equation (1), followed by Godoy et al. (1993) and Dejene *et al.* (2013). The year based estimated net revenue (NR) of per-hectare land was calculated by adopting the formula of Dejene *et al.* (2013). The total cost was estimated using the equation (2) (Dewett, 2004) and outputs of each option were annual.

NR = (Q*P) - C . . . . . Equation (1)

Where, NR = Net Revenue, Q = quantity of products harvested, P = unit price of the products (in TAKA), C = total cost of production (in TAKA) all on a hectare base, where

C=f(a + b+ c+ d+ e+ f+ g+ h). . . . . Equation (2)

Here, C = Cost function, a= seed or seedling cost per/acre, b= Ploughing Per/ acre, c= Irrigation Per/ acre, e= Pesticide per /acre, f= Labour per/acre g= storage and transportation per/acre, h=Fancying per/acre

Sensitivity analyses were accompanied to evaluate the reliability of the net revenues from the four cultivated crops and using those variables that are likely to have greater influence on their net returns. The selected variables were yield, prices of products and costs of input. The study compared to the base year according to Dejene *et al*. (2013), where the costs of inputs could increase up to 80%, prices of products could decrease up to 50%, and sale prices of products could decrease up to 50%.

3. RESULTS

3.1. Socio-economic characteristics of the respondents

All the respondents were farmers and practicing agriculture activities both in crop and livestock productions. The average landholding was 8 ha (hectare) per household. In terms of land allocation, on average a respondent spend for example, 1.13 ha of land for Tulsi, 2.66 ha for Potato, 2.23 ha for Tobacco and 1.60 ha for Banana production respectively. All of the respondents (100%) were native to the study area, and the average family size was 5, that range between 2 to 6. About 44.4% of the respondent was illiterate. Majority of the respondents (85%), have no market access to sale their products mainly of the Tulsi leaves. They depend on the NGOs or other intimidators. Among the total respondents, about 81.5% were 23 to 50 years and 18.5% were older than 50 years of age.

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

3.2. Physical inputs and outputs of production

In the present study, the production cost found to be higher for Potato and the lowest was for Tulsi (Table 1). The other two land use options (Banana and Tobacco) showed average cost of production (Table 1). In terms of inputs requirements, Potato production found the most labour intensive while Tulsi is the lowest. Estimated yields of Potato, Tobacco, Banana and Tulsi were10170, 2009, 781and 733kg/ha/yr, respectively (Table 2). Production inputs and outputs for thefourland use options are presented in Tables 1 and 2.

The labour cost is the same for peak and slack season. Cost for one man-day is 300 Taka. This amount is the same for all land use options in the study area as the respondents put this amount when reporting the annual cost of labour per ha and year for the allland use options.

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

Table (1): Production inputs, their quantity per hectare and year, unit price and total cost for the four land use options in Rangpur, Bangladesh (1$ equivalent to 80 Taka)

Land Use	Inputs	Units	Quantity/ ha/yr	Cost (Taka)/unit	Total cost/ ha/yr (Taka)
Potato	Seeds	Kg	320	15.00	4800.00
	Labor				
	Land preparation	No. of Farmers per day	4	300.00	1200.00
	Plantation		13	300.00	3900.00
	Irrigation		1	350.00	350.00
	Weeding		3	300.00	900.00
	Harvesting		2	250.00	500.00
	Fertilizer		18	800.00	14400.00
	Pesticide	Liter	2	300.00	600.00
	Fencing	Price	4	650.00	2600.00
	Bag	Number	2	300.00	600.00
Tobacco	Seeds	Kg	5	85.00	425.00
	Labor				
	Land preparation	No. of Farmers per day	8	300.00	2400.00
	Plantation		13	300.00	3900.00
	Irrigation		1	400.00	400.00

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

Land Use	Inputs	Units	Quantity/ ha/yr	Cost (Taka)/unit	Total cost/ ha/yr (Taka)
	Weeding		3	300.00	900.00
	Harvesting		2	600.00	600.00
	Fertilizer		20	750.00	15000.00
	Pesticide	Liter	2	300.00	600.00
	Fencing	Price	4	650.00	2600.00
	Storage	Price	0	-	-
Banana	Seedlings	Number	330	10.00	3300.00
	Labor				
	Land preparation		1	300.00	300.00
	Plantation		3	300.00	900.00
	Irrigation	No. of Farmers per day	2	350.00	700.00
	Weeding		3	300.00	900.00
	Harvesting		3	350.00	1050.00
	Fertilizer		2	750.00	1500.00
	Pesticide	Liter	2	300.00	600.00
	Fencing	Price	0	-	-
	Storage	Price	2	350.00	700.00
Tulsi	Seeds	Gm	100	0.10	10.00

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

Land Use	Inputs	Units	Quantity/ ha/yr	Cost (Taka)/unit	Total cost/ ha/yr (Taka)
	Labor				
	Land preparation	No. of Farmers per day	1	300.00	300.00
	Plantation		1	150.00	150.00
	Irrigation		2	300.00	600.00
	Weeding		1	300.00	300.00
	Harvesting		4	325.00	1300.00
	Fertilizer		1	500.00	500.00
	Pesticide	Liter	0	-	-
	Fencing	Price	0	-	-
	Storage	Price	2	230.00	560.00

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

Table (2): Types of outputs and their unit price (in Taka) at nearby market for the four land use options in Rangpur, Bangladesh (1$ equivalent to 80 Taka).

Product type	Unit of measurement	Mean annual yield per ha (Average)	Market price in Taka in kg
Potato	Kg	10170	18.00
Tobacco	Kg	2009	85.00
Banana	Chori/ Kandi*	781	210.00
Tulsi	Kg	733	225.00

* Local name of Banana bunches

3.3. Financial comparisons of the land-use options

The market prices showed differences for the four crops. The estimated annualized net revenue showed that Tulsi production yielded the highest revenues per hectare as compared to the others while Tobaccois the lowest. Banana and Potato land use options yielded a net revenue in-between the two extremes productions (Table 3).

Table (3): Revenue generable for the four land use options in Rangpur, Bangladesh (values are in Taka/ha/year) (1$ equivalent to 80 Taka).

Land use option	Gross revenue	Total cost of production	Net revenue
Tulsi	164925.00	3,720.00	161,205.00
Potato	188145.00	29,850.00	158,295.00
Banana	164010.00	9,950.00	154,141.00
Tobacco	170765.00	26,825.00	143,940.00

3.4. Reliability of the revenues

The net revenue of the four land use options is sensitive to changes in yield of annual production (Figure 1), which is differ among other land use practice. Banana showed the maximum decrease followed by Tobacco and Potato in net revenue (Figure 1). A 50% reduction in yield of products

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

may reduce the net revenue by 59.42%, 59.32%, 56.49% and 51.15% for the Potato, Tobacco Banana, and Tulsiuses respectively (Figure 1).

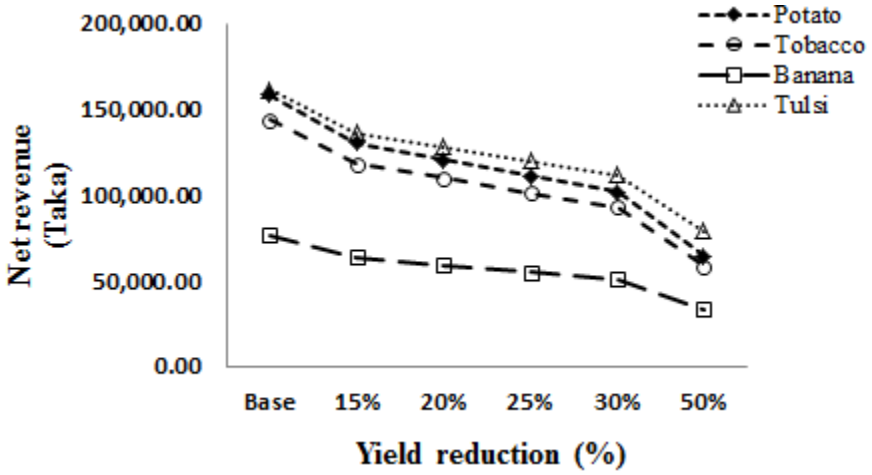

Figure (2): Sensitivity of the net revenue from the four alternative land use options under reduction in yield (up to 50% over the base year) at Ismailpur village, Rangpur in Bangladesh.

Also an a total of 85% increase in production cost (costs of inputs) may reduce the net revenue of Potato, Tobacco, Banana, and Tulsi options with 16%, 15%, 10% and 2% respectively (Figure 3a). Reduction in the prices of outputs similarly affects the net revenue for all the crops, again the Banana crop showing the highest decrease (Figure 3b). A 50% reduction in the prices of the products, the base year may reduce the net revenue by 59.42%, 59.32%, 56.49% and 51.15% for Potato, Tobacco Banana, and Tulsi options, respectively (Figure 3b). Hence, under all assumptions the net revenue of the Banana, Potato and Tobacco crops is the most sensitive, while the net revenue of Tulsi plant showed very least sensitive.

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

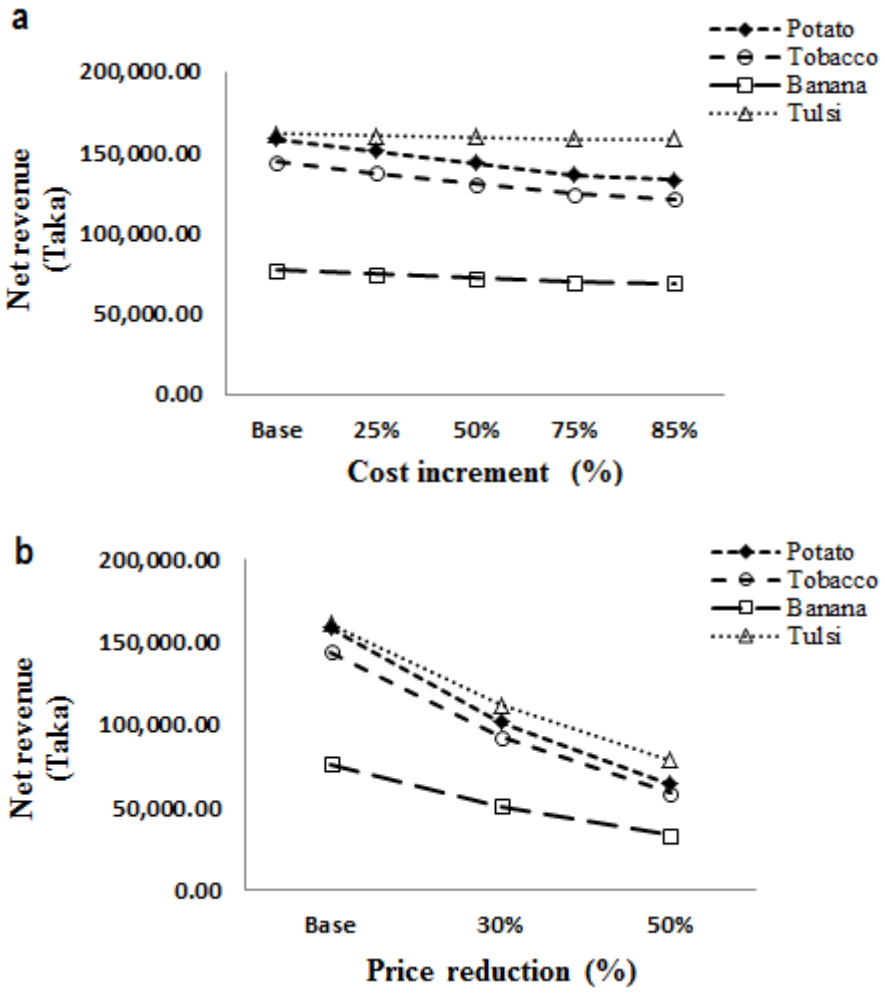

Figure (3): Sensitivity of the net revenue from the four alternative land use options under increasing cost of inputs (3a) and decreasing prices of outputs (3b) at Ismailpur village, Rangpur in Bangladesh.

4. DISCUSSION

This study showes that Tulsi could provide higher income in terms with other cash crops like Potato, Tobacco and Banana cultivation that makes it financially competent in Bangladesh. From our economic analysis Tulsi provided the highest net revenue which is estimated 161205 Taka followed by the Potato and Tobacco (Table 3). The smallest Net revenue was obtained from the Banana which is considered the most labor intensive and high production costs (Table 1 and 3). Thus, the Tulsi plant cultivation act as rapid conversion of land uses and economic return in our study area.

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

Following factors that may contribute for the decision to Tulsi plant cultivation in the study area includes; its less coast of production, no fertilizer and pesticides uses, no need of fencing and few amount of irrigation water is required (Shohel, 2009, Dash, 2009, and Shahin, 2009). Moreover, the short rotation of the crop that allows farmers to harvest Tulsi at least three times in a year provided more economic return than other studied (Potato, Tobacco, Banana) agricultural crops. These elements in general reflected the fact that rural developments in Bangladesh preoccupy the political agenda through 'market oriented agricultural based rural development and poverty reduction' (MDG, 2015). This agenda has led the local people to focused on those marketable crops into agri-business whereby contributing towards the rural development program of the country.

In spite of these, the economic returns attached to Tulsi production is not directly enjoyed by the farmers. This is because, most local farmers are supply their products by way of the NGO`s and other Tulsi tea producing organization. Then after, the NGO`s and other tea producing organization directly sale the product at the market and converted it into cash for the farmer. In this transaction the local farmers have to rely on them to be able to use the product and some amount of money will go to the retailer indicating the full profits from Tulsi would not be enjoyed by the local farmers. However, Tulsi production still could offer the local farmer to reduce the problem "Monga" that usually happened during the winter. Monga is a Bengali term referring to the yearly cyclical phenomenon of poverty and hunger in Bangladesh. It is also called "Mora Kartik," which means "months of death and disaster" that could happen two times per year, from September–November and from March–April (Ansari, *et al.*, 2014). In this regard, Tulsi could act as a vital role for the farmers that would be cultivate for sale to supplement the household food scarcity. On the other hand, in this study area most of the farmers are used dry stem of Tulsi plant as medicine and energy for their house hold activities.

Most interestingly, the present study shows that the Tulsi based income was less sensitive to increases in cost, and decreases in prices and yield of the produce than the agriculture crops based incomes. Tulsi based investments are thus less risky, which should attract farmers into sustainable incomes from their traditional farming activities. Additionally, Tulsi provides several profits other than the competing agricultural crops that are directly traded on regular product-based markets by the local farmers. Leaf, root, steam, whole Tulsi plant are use as fertilizer. Root of Tulsi plant produce nodule and fix nitrogen into the soil. These benefits are part of the environmental services that contribute to their wellbeing. Some of the environmental services include reducing air pollution, increasing soil fertility, maintain the content of soil water and nutrients, and protect the other crops from agricultural pest, carbon storage, cultural, spiritual values and human health care (Marc, 2014). Most of these environmental services are not directly traded or marketed, impeding the easy translation of their values through traditional

ISSN: 2455-6939

Volume:03, Issue:03 "May-June 2017"

market assessment techniques into the monetary systems (Kareiva *et al.*, 2011). Although this study were not valuation of these additional services, that otherwise could have increased the total economic value of the Tulsi land use practice by several fold to make it much higher than the total economic values expected from agricultural land uses (Dejene *et al.*, 2014). Recently, most economic decisions did not take these Environmental services, and their values, into account, but increasingly this aspect of nature are getting the attention it deserves (e.g. Bishop, 1999; Campbell and Luckert, 2002; and MA, 2005). Therefore, the study argue that the total economic return of the Tulsi production option in fact is much higher than other examined crops.

5. CONCLUSION

In the present study, we found that Tulsi plant cultivation is the most profitable as compared to the other agriculture land uses. Even, in the term of sensitivity to various risk analysis, Tulsi plant cultivation found to be more resilience and profitable as compared to the other crops. However, the profit from the sector would not directly go to the local farmers due to the absence of proper marketing channel. In this regards, the government and NGOs should work together to engaged the local farmers directly to the marketing system and sale their own products. Furthermore, Tulsi plant is found to be more productive in a small portion of lands and the management is found to be easier that needs not much care as compared to the other crops. Thus intensifying its production system rather than competing with other land use options would provide higher benefits to the local farmers and thus improve the livelihoods.

ACKNOWLEDGEMENT

We are grateful to A. T. M. Mizanur Rahman, Agriculturist, Ismailpur village at Rangpur district and Talha Jubayer, Electrical Engineer, Eastern University, Dhaka for their logistic support during the data collection from fields and markets. We are also thankful immensely to Monowara Talukdar, Founder Director of Polly bodhu kalayan Sangstha NGO, Gaibandha as a pioneer of commercial Tulsi Plant cultivator to produce Tulsi tea at the northern part in Bangladesh.

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ISSN: 2455-6939

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