

*An Economic Analysis of Multiple Rabi Crops Cultivation
against Tobacco Production at Farm Level in Bangladesh*

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Abstract

The study was undertaken to examine agro-economic performance of multiple rabi crops cultivation by the different groups of farmers against tobacco production at farm level. Three major tobacco growing areas in Bangladesh namely Kushtia, Cox'sbazar and Bandarban districts were selected for conducting the study. Data related to multiple rabi crops cultivation and tobacco production were collected through structured questionnaires during 2010-11 crop season. Farmers under multiple cropping systems in the study areas were divided into three groups such as the Nayakrishi (N/K) farmers of UBINIG, the Newly involved (N/I) farmers and the Self motivated (S/M) farmers. Five multiple rabi crops combinations practiced by the different group of farmers at the study areas were selected purposively. A total of 90 respondents of multiple rabi crops (combination) growers and 60 commercial tobacco farmers were selected randomly for interviewed. The study unveiled that more human labour was used in tobacco production (372 man-days/ha) compared to multiple rabi crops cultivation (208 to 255 man-days/ha). Besides, they applied excessive doses of chemical fertilizers to their crop fields for getting higher yield of tobacco. On the other hand, all of the multiple rabi crops growers specially the N/K farmers used more manures to their crop fields. Moreover, the N/K farmers applied more seeds as well as manures from their owned sources compared to the N/I and the S/M farmers at the study areas. Among the different multiple rabi crops combinations, the total cost ranged from Tk.1,13,362/ha to Tk.1,33,241/ha whereas it was found Tk.2,29,604/ha in case of tobacco production. Though the tobacco farmers achieved the highest gross return (Tk.2,86,852/ha) compared to other group of farmers but they earned less net profit both on full cost (Tk.57,248/ha) and cash cost (Tk.1,36,162/ha) basis. The study revealed that the tobacco farmers obtained less amount of net profit with more amount of cash and non-cash investment. On the other hand, multiple rabi crops growers specially the N/K farmers of UBINIG achieved the highest profit (Tk.1,26,613/ha and Tk.2,18,230/ha on full and cash cost basis respectively) per hectare from their selected crop combinations with less cash investment. The study found that the different groups of farmers obtained more profit from their selected multiple rabi crops cultivation compared to tobacco production at farm level in Bangladesh.

Introduction

Acute shortage of required food crops has been prevailing in Bangladesh since long before. About 40 per cent of the population lives below the food consumption-based poverty line, lacking sufficient resources to afford diet of 2122 kilocalories (kcal) per person per day, along with other basic necessities (Hossain et al. 2005). Apart from the prevailing deficit in total calories intake, the normal diet of Bangladeshi people is seriously imbalanced, with inadequate consumption of protein, fat, oil and vitamin and with more than 80 per cent of calories derived from cereals. Women and children are especially vulnerable to their greater nutritional requirements. In Bangladesh, more than 30 thousands children under 2 years of age are estimated to suffer from vitamin A deficiency related eye problems (Bloem et al. 1996). It is also reported that vitamin C, iron and other mineral nutritional deficiency are widespread resulting in different types of diseases, hampering physical growth and retarding brain development.

Considering the above facts, a huge amount of food crops are imported every year in exchange of our hard-earned foreign currency. Therefore, it is imperative to increase the productivity of diversified food crops. Due to decrease of arable land (1%) every year, horizontal expansion of crop production is not possible. To increase the productivity different possible techniques have to be followed of which most important technique is the multiple cropping. Multiple cropping systems can contribute to the beneficiaries as risk aversion against sole cropping systems and increase agricultural production. In multiple cropping, two or more crops are grown in the same field during the same year either simultaneously (intercropping) or in sequence (sequential cropping). The philosophy of multiple cropping is maximizing crop production per unit areas of land with minimum soil deterioration.

In recent years, multiple cropping has been gaining importance as a system of more crop production in limited land area particularly in the countries with small farm holdings like Bangladesh, India, China, Taiwan, Srilanka, Malaysia, Hongkong, Vietnam, Africa and Latin America (Beet, 1977). By the practice of multiple cropping, people can improve their socio-economic condition by attaining substantially by the maximum use of resources available to farmers (Day and Singh, 1981). Research studies have been shown that small land holders especially with limited land holder farmers can be benefited to optimize production from small plot through multiple cropping and thus help farmers to cope with land shortage. Perhaps the most attractive aspect of multiple cropping to producers is that these systems can boost to yields and increase profits resulting in a balanced diet for the farm family (Cramer, C. and Cicero, K.1992).

Multiple cropping is also practiced to obtain diversified types of crops, to increase the soil fertility and to sustain the farm profit (Mengping and Zhangjinsong, 2004). Due to the continuous population pressure, the increase in food production, especially, cereals have been given priority in Bangladesh. But due to the continuous production of cereals, the productivity of land is reduced due to nutrient mining. Legumes fix nitrogen from atmosphere and their seeds are also used as food by both human and livestock. So, incorporation of legumes into cereals has been tried to achieve increased food both for human and livestock and also for improved soil fertility (Nargis et al., 2004).

The objective of Nayakrishi is to extend bio-diversity based ecological agriculture among the farmers in Bangladesh. The Nayakrishi farmers will make best use of the local and traditional knowledge. They will grow crops with farm saved seeds. They will also abandon the use of pesticides/insecticides and gradually reduce the use of chemical fertilizer. The chemical fertilizer will be replaced by the use of compost and cow dung. Ultimately the environment will be better maintained including soil and water. The Nayakrishi farmers are cultivating different rabi crops either mixed or inter or relay crop combinations in their fields as a substitute of tobacco.

Tobacco cultivation was unknown to the farmers of Bangladesh. Originally it was the plant of the American continent and was introduced in Europe by captains and crews of the leading seafaring nations in the sixteenth century. It was introduced in Africa and India by the Portuguese (Alim, 1974). Bangladeshi farmers used to grow traditional variety of tobacco in small scale mainly to meet their home consumption. But tobacco production got a boost since 1973-74 through support from big cigarette manufacturing companies who introduced exotic commercial varieties like Virginia under forward contract farming system. Contract farming included cultivation of specific high yielding varieties, application of modern inputs such as chemical fertilizers, insecticides/pesticides, irrigation and fixed price of tobacco leaves (Afroze, 2000).

Tobacco is a cash crop and its cultivation is mostly concentrated in the districts of Rangpur, Dinajpur, Kushtia, Jhenaidah, Chuadanga and Meherpur. Recently production areas have been shifting from these areas to the Chittagong Hill Tracts areas mainly Cox'sbazar and Bandarban district. In Bangladesh, production and marketing of tobacco are largely influenced by Bangladesh Tobacco Company (BTC) which has now become British American Tobacco Bangladesh (BATB) and Department of Agricultural Extension (DAE). DAE is a government organization which performs functions mainly in respect of area regulation, grading, marketing, supervision and control over the agencies involved in the production and trade of tobacco.

Tobacco products have a large demand in Bangladesh. A large number of consumers in the rural society of Bangladesh use semi-processed tobacco, which is popularly known as ‘Tamak’ and ‘Jarda’. Cigarettes and Bidis of different brands are manufactured and consumed by both urban and rural consumers. Moreover, some fine qualities of cigarettes are imported also.

Area and production of tobacco has been increased tremendously during the last few years. During 2007-08, the cultivated area of tobacco was 29 thousand hectare whereas it has increased about 44 thousand hectare in 2008-09 which is about 52% higher than previous year. According to the statement of DAE, area of tobacco cultivation has increased about 74 thousand hectare in last year (2009-10) which is about 68% higher than previous year. This alarming condition is very risky for the national food security programme.

It is important to assess economic profitability of the investment in terms of land and other resources committed to tobacco farming. What the farmers could gain if they would not have produced tobacco will be attempted in this study. Tobacco products have been scientifically established to be seriously injurious to human health and it is time to surmise the opportunity cost of tobacco production. Therefore, the present study is a modest attempt to investigate agro-economic performance of multiple rabi crops cultivation by the different group of farmers at farm level against tobacco production.

Methodology

According to the objectives of the study, three important tobacco growing areas of Bangladesh namely Kushtia, Cox’sbazar and Bandarban districts were selected purposively. Four upazilas such as Mirpur and Daulatpur under Kushtia, Chakoria under Cox’sbazar and Lama under bandarban district were selected for carrying out the study. Primary data related to multiple rabi crops (combination) cultivation and tobacco production were collected from selected respondents by field visits using structured questionnaires. Farmers those were cultivating rabi crops (combination) under multiple cropping systems in the study areas were divided into three groups such as the Nayakrishi (N/K) farmers of UBINIG, the Newly involved (N/I) farmers (those were bound to cultivate other crops instead of tobacco production at “khas” land due to government restriction) and the Self motivated (S/M) farmers (recently those were shifted willingly from tobacco to other crops cultivation).

A total of 90 respondent farmers were interviewed in case of multiple rabi crops (combination) cultivation. Five multiple rabi crops combinations at the study areas were selected purposively.

These are Potato+maize+garlic+coriander, Potato+french bean+felson+radish and Potato+french bean+coriander+sweet gourd for the N/K farmers; Potato+french bean+felson and Potato+french bean+coriander for the N/I farmers and Lentil+mustard, Potato+french bean+felson+radish and Potato+french bean+coriander for the S/M farmers were selected. The Newly involved (N/I) farmers at Kushtia were not taken due to unavailability of farmers. Besides, a total of 60 commercial tobacco growers were selected randomly for interviewed.

The period of data collection covered the whole growing period of selected rabi crops (combination) as well as tobacco. The survey was conducted by the UBINIG research team and data were collected immediately after the harvest. The collected data were tabulated and analyzed in accordance with the objectives of the study. The data from primary sources were obtained in terms of the local units which were converted into hectare. In order to achieve a meaningful conclusion tabular analysis was used. Tabular technique was used because it was simple in calculation and easy to understand the relationship between various farm management factors. Interpretation and discussion of the findings were presented in simple terms such as average, percentages etc.

In enterprise costing, cost are primarily taken in physical terms and then these are translated into financial terms by multiplying the physical terms units by the wages/prices actually paid. Like wise, the returns are first taken in physical terms and then are multiplied by unit prices. In calculating total costs both variable and fixed costs were taken into consideration. Except interest on working capital and land use cost, all items are considered as variable cost items. Human labour was measured in terms of man-days, which was taken to consist of eight hours of work per day. Hired labour was priced at actual wage paid and the wage rate of the family labour was taken as the same rate of the hired labour.

Results and Discussions

Cost and Return of Multiple Rabi Crops Cultivation at Kushtia

Per hectare cost and return of multiple rabi crops cultivation under different type of farmers at Kushtia is presented in Table 1. It should be noted that there was no Newly involved (N/I) farmers at the study areas of Kushtia. It reveals from the table that the Nayakrishi (N/K) farmers under multiple cropping systems cultivated four crops at their fields in the rabi season. On the other hand, the Self motivated (S/M) farmers produced only two high value rabi crops at their fields. For that reason, per hectare human labour, seed and irrigation costs were observed

lower (Tk.25,800, Tk.3,087 and Tk.488 respectively) in case of the S/M farmer's combination compared to the N/K farmer's combination (Tk.43,200, Tk.34,206 and Tk.5589 respectively).

The study found that the highest total cost (Tk.1,16,489/ha) was calculated for potato+maize+garlic+coriander cultivation whereas it was Tk.65,814/ha for lentil+mustard cultivation. It reveals from the table that the N/K farmers achieved 63% higher return (Tk.2,05,898/ha) from their crops combination compared to the S/M farmer's (Tk.1,26,082/ha) combination (lentil+mustard). Both on full and cash cost basis, the N/K farmers earned the highest net profit (Tk.89,409/ha and Tk.1,65,903/ha respectively) from potato+maize+garlic+coriander combination than lentil+mustard combination (Tk.60,268/ha and Tk.1,07,845/ha respectively) cultivated by the S/M farmers. But the S/M farmers achieved more return per taka investment both on full (1.92) and cash cost (6.91) basis because of only two less cost involvement crop selection. It is obviously seen from the table that the N/K and the S/M farmers achieved more return per taka investment from multiple rabi crops cultivation at farm level in Kushtia.

Cost and Return of Multiple Rabi Crops Cultivation at Cox'sbazar

Table 2 shows per hectare cost and return of multiple rabi crops cultivation at Cox'sbazar. The highest human labour cost was estimated Tk.55,000/ha for potato+french bean+felon+radish cultivation by the S/M farmers at the study areas. It reveals from the table that the N/K farmers used more owned sources of seeds and manures in their crop fields according to the principles of Nayakrishi. Besides, they did not use any chemical fertilizers and insecticides/pesticides as like as the N/I and the S/M farmers at Cox'sbazar (Table 2).

On an average the highest total cost was calculated Tk.1,46,789/ha for the S/M farmer's combination followed by the N/K (Tk.1,37,461/ha) and the N/I farmers (Tk.1,31,851/ha) combination. It is obviously seen in the table that the N/K farmers invested less cash (Tk.41,181) per hectare compared to the N/I (Tk.66,278) and the S/M farmers (Tk.80,187) for multiple rabi crops cultivation. The highest gross return (Tk.2,95,923/ha) was achieved from potaro+french bean+felon+radish combination cultivated by the N/K farmers than other group of farmers (Table 2). Therefore, the highest per hectare net profit was earned by the N/K farmers both on full and cash cost basis followed by the N/I and the S/M farmers. Though, there was a variation in the amount of net profit earned by the different group of farmers but all of the combinations were seen in the table as more profitable crops combination at the study areas

Cost and Return of Multiple Rabi Crops Cultivation at Bandarban

Per hectare cost and return of multiple rabi crops cultivation at Bandarban is presented in Table 3. It reveals that the N/K farmers at the study areas included sweet gourd as additional crop in their selected combination than the N/I and the S/M farmers. The highest human labour cost was observed in potato+french bean+coriander+sweet gourd combination (Tk.57,400/ha) cultivated by the N/K farmers followed by the N/I (Tk.52,800/ha) and the S/M farmers (Tk.47,200/ha). Table also shows that the N/K farmers used more home supplied labour, seeds, manures and did not use any chemical fertilizers or insecticides/pesticides to their crop fields.

The highest total cost was calculated in potato+french bean+coriander+sweet gourd combination cultivated by the N/K farmers (Tk.1,45,773/ha) compared to the N/I (Tk.1,32,682/ha) and the S/M farmers (Tk.1,27,484/ha). But in case of total cash cost, it was observed the lowest in the N/K farmer's combination (Tk.43,695/ha) than other group of farmer's combination (Table 3). In other words, the N/K farmers used more home supplied inputs for cultivation of multiple rabi crops at the study areas. The highest per hectare gross return was achieved by the N/K farmers (Tk.2,77,742) followed by the N/I (Tk.2,36,420) and the S/M farmers (Tk.2,25,399). Though it is seen from the table that the N/K farmers earned the highest per hectare net profit both on full and cash cost basis but also the N/I and the S/M farmers achieved remarkable net profit from their multiple rabi crops combination at Bandarban (Table 3). Return per taka investment both on full and cash cost basis was more or less similar in case of the N/I and the S/M farmer's combination. But in case of the N/K farmer's combination (potato+french bean+coriander+sweet gourd) it was found 1.91 on full cost and 6.36 on cash cost basis. Therefore, it can be deduced that the N/K farmers at Bandarban obtained more return per taka investment from their selected multiple rabi crops combination compared to the N/I and the S/M farmers.

Cost and Return of Tobacco Production at Farm Level

Item wise cost and return per hectare of tobacco production at different locations is presented in Table 4. It reveals that the highest human labour cost was calculated at Cox'sbazar (Tk.84,150/ha) and the lowest at Kushtia (Tk.70,400/ha). Average fertilizer cost of tobacco production was estimated Tk.39,757/ha which is more than 26% of the total cash cost. The study found that the insecticides/pesticides and irrigation cost was the highest at Cox'sbazar (Tk.6,885/ha and Tk.8,982/ha respectively) and the lowest at Kushtia (Tk.4,775/ha and Tk.6,984/ha respectively).

Table 4 shows that an average drying/curing cost was calculated Tk.32,195/ha which is about 21% of the total cash cost. Per hectare average total cost of tobacco production was estimated Tk.2,29,604 and observed the highest at Cox'sbazar (Tk.2,42,562) and the lowest at Kushtia (Tk.2,05,628). It is obviously seen in the table that an average total cash cost of tobacco production was calculated Tk.1,50,690/ha which is about 66% of the total cost. It reveals that tobacco is more cash cost intensive crop at the study areas. Per hectare yield of tobacco leaves was found the highest at Bandarban (3133 kg) and the lowest at Kushtia (2994 kg). Due to the lower yield and price of tobacco at Kushtia, the gross return was estimated Tk.2,77,235/ha which is the lowest compared to Cox'sbazar (Tk.2,96,470/ha) and Bandarban (Tk.3,02,734/ha). But net profit both on full and cash cost basis was observed the highest at Kushtia (Tk.71,607/ha and Tk.1,45,445/ha respectively) due to lower cost of tobacco production compared to other locations. Though average net profit on cash cost basis was found Tk.1,36,162/ha but it was only Tk.57,248/ha on full cost basis (Table 4). Average return per taka investment was estimated 1.25 and 1.90 on full and cash cost basis respectively. From the above findings it can be concluded that the tobacco farmers at the study areas achieved less profit with more cash and non cash investment.

Cost and Return of Multiple Rabi Crops Cultivation by the Nayakrishi (N/K) Farmers

Per hectare cost and return of multiple rabi crops cultivation by the N/K farmers at different locations is presented in Table 5. It reveals that the N/K farmers of Cox'sbazar and Bandarban were cultivated four types of rabi crops under multiple cropping systems. Average human labour was observed the highest cost item (Tk.49,867/ha) which is more than 37% of the total cost of multiple rabi crops cultivation. Results show that the N/K farmers used more owned sources of seeds and manures according to the principles of Nayakrishi at all of the study areas.

It is seen from the table that the highest total cost incurred by the N/K farmers of Bandarban (Tk.1,45,773/ha) followed by Cox'sbazar (Tk.1,37,461/ha) and Kushtia (Tk.1,16,489/ha). An average total cash cost was estimated Tk.41,624/ha which is only 31% of the total cost (Tk.1,33,241/ha). The N/K farmers of Cox'sbazar achieved higher gross return (Tk.2,95,923/ha) compared to Kushtia (Tk.2,05,898/ha) and Bandarban (Tk.2,77,742/ha). Results show that the N/K farmers of the respective areas earned remarkable net profit per hectare both on full and cash cost basis. Moreover, the N/K farmers of Cox'sbazar achieved the highest return per taka investment both on full cost (2.51) and cash cost (7.18) basis from potato+french bean+felon+radish cultivation (Table 5). On an average, return per taka investment was estimated 1.95 on full cost basis and 6.24 on cash cost basis. From the above findings it can be

deduced that the N/K farmers of different study areas earned more profit from their selected multiple rabi crops (combination) cultivation with less cash investment.

Cost and Return of Multiple Rabi Crops Cultivation by the Newly Involved (N/I) Farmers

Table 6 shows per hectare cost and return of multiple rabi crops cultivation by the N/I farmers of different locations. Data related to multiple rabi crops cultivation by the N/I farmers at Kushtia is not presented in the table due to unavailability of the farmers. It reveals from the table that higher human labour cost was found Tk.52,800/ha for potato+french bean+coriander cultivation at Bandarban compared to potato+french bean+falon cultivation at Cox'sbazar. Average human labour cost was estimated Tk.47,600/ha for multiple rabi crops cultivation at the study areas which is 36% of the total cost. The N/I farmers of Cox'sbazar used more chemical fertilizers, manures, insecticides/pesticides and irrigation for potato+french bean+falon cultivation compared to the farmers of Bandarban for potato+french bean+coriander cultivation per hectare. Average total cash cost for multiple rabi crops cultivation was calculated Tk.71,094/ha which is about 54% of the total cost (Tk.1,32,267/ha). The study shows that the N/I farmers of Cox'sbazar achieved higher gross return (Tk.2,61,714/ha) from their crops combination than the farmers of Bandarban (Tk.2,36,420/ha). The highest net profit obtained by the N/I farmers from potato+french bean+falon cultivation both on full cost (Tk.2,29,863/ha) and cash cost (Tk.1,95,436/ha) basis. In other words, the N/I farmers of Cox'sbazar earned more profit with less cash and non-cash investment. An average return per taka investment was calculated 1.88 and 3.50 on the basis of full and cash cost respectively (Table 6). From the above findings it can be concluded here that the multiple rabi crops cultivation at the study areas found to be more profitable for the N/I farmers also.

Cost and Return of Multiple Rabi Crops Cultivation by the S/M Farmers

Item wise cost and return per hectare of multiple rabi crops cultivation by the S/M farmers is presented in Table 7. It reveals that the S/M farmers of Kushtia were cultivated only lentil and mustard in multiple cropping systems. On the other hand, the S/M farmers of Cox'sbazar and Bandarban were cultivated more rabi crops under multiple cropping systems. Therefore, the highest labour cost was observed at Cox'sbazar (Tk.55,000/ha) and the lowest was found at Kushtia (Tk.25,800/ha) for their selected rabi crops (combination) cultivation. Table shows that the S/M farmers of Kushtia did not apply any chemical fertilizers and insecticides/pesticides to their crop fields for lentil+mustard cultivation.

The highest total cost of potato+french bean+felon+radish cultivation was found at Cox'sbazar (Tk.1,46,789/ha) whereas it was the lowest at Kushtia (Tk.65,814/ha) for lentil+mustard cultivation (Table 7). Average total cash cost was amounted Tk.54,505/ha which is 48% of the total cost (Tk.1,13,362/ha) for multiple rabi crops cultivation at the study areas. The highest gross return was estimated Tk.2,34,183/ha from potato+french bean+felon+radish cultivation and found the lowest from lentil+mustard cultivation (Tk.1,26,082/ha). The average net profit obtained by the S/M farmers was Tk.81,859/ha on full cost basis and Tk.1,40,716/ha on cash cost basis (Table 7). It reveals from the table that the S/M farmers of Kushtia achieved higher return per taka investment both on full cost (1.92) and cash cost (6.91) basis compared to the farmers of Cox'sbazar and Bandarban. But average return per taka investment was observed 1.72 and 3.58 on full and cash cost basis respectively. From the above findings it can be deduced here that the S/M farmers of the study areas earned more profit with less cash and non-cash investment through multiple cropping systems in rabi season.

Comparative Economics between Multiple Rabi Crops and Tobacco Production

Per hectare comparative assessment between multiple rabi crops (combination) cultivation by the different group of farmers and tobacco production at farm level is presented in Table 8 and it shows the average results of the previous tables (from Table 1 to 7). It is obviously seen from the table that the highest per hectare human labour was used in tobacco production (372 man-days) whereas it ranged from 208 to 255 man-days in multiple rabi crops (combination) cultivation by the different groups of farmers. It might be due to the continuous labour needed to produce tobacco at farm level. As a result, higher wage rate (Tk.212/man-days) was found for tobacco production compared to multiple rabi crops cultivation. It reveals from the table that not a single dose of chemical fertilizer and insecticides/pesticides was used by the N/K farmers to produce multiple rabi crops (combination) at the study areas. The S/M farmers used less quantity of chemical fertilizers like Urea, TSP and MP to their crop fields compared to the N/I farmers. On the other hand, the tobacco farmers were used excessive and imbalance doses of chemical fertilizers (Urea: 823kg, TSP: 419kg, MP: 150kg, SoP: 172kg, DAP: 116kg and ZnSo₄ :18kg) per hectare for getting maximum yield (Table 8). Study showed that the tobacco farmers applied irrigation water more than four times to their crop fields whereas it was observed only two times for multiple rabi crops cultivation.

It is obviously seen from the table that the N/K farmers applied more manures (5774 kg/ha) to their crop fields instead of chemical fertilizers. It should be noted here that the N/K farmers used more manures from their owned sources (4211 kg/ha) which is about 73% of the total uses. On

the other hand, the N/I farmers used less quantity of manures (124 kg/ha) compared to the S/M farmers (1607 kg/ha) due to more application of chemical fertilizers to their crop fields. Average rental value of land for tobacco production was found the highest Tk.37,055/ha whereas it was ranged from Tk.25,557 to Tk.27,247/ha for multiple rabi crops (combination) cultivation at the study areas.

Under the multiple cropping system, the highest total cost was estimated Tk.1,33,241/ha from the N/K farmer's combination followed by the N/I farmer's combination (Tk.1,32,267/ha) and the S/M farmer's combination (Tk.1,13,362/ha) at the study areas. But in case of tobacco production, the total cost was calculated Tk.2,29,604/ha which is more than double compared to multiple rabi crops (combination) cultivation (Table 8). Average total cash cost was found the lowest (Tk.41,624/ha) from the N/K farmer's combination though total cost was observed the highest among different groups of farmer's combination. It indicates that the N/K farmers at the study areas used more home supplied inputs to produce multiple rabi crops (combination) compared to others. Among the different groups of farmers, the highest gross return obtained by the N/K farmers (Tk.2,59,854/ha) from multiple rabi crops cultivation followed by the N/I farmers (Tk.2,49,067/ha) and the S/M farmers (Tk.1,95,221/ha).

Though the tobacco farmers achieved the highest gross return (Tk.2,86,852/ha) compared to different groups of farmer's combination of multiple rabi crops but they earned less net profit both on full cost (Tk.57,248/ha) and cash cost (Tk.1,36,162/ha) basis. Study found that the tobacco farmers obtained less amount of net profit with more amount of cash and non-cash investment. On the other hand, the N/K farmers achieved higher net profit both on full cost (Tk.1,26,613/ha) and cash cost (Tk.2,18,230/ha) basis compared to others. In other words, the N/K farmers achieved higher profit from their selected multiple rabi crops (combination) cultivation with less cash investment. The highest return per taka investment was found from the N/K farmer's combination (1.95 on full and 6.24 on cash cost basis) followed by the N/I farmer's combination (1.72 and 3.58 respectively), the S/M farmer's combination (1.72 and 3.58 respectively) and tobacco production (1.25 and 1.90 respectively). From above findings it can be concluded here that the different groups of farmers earned more profit from multiple rabi crops cultivation compared to tobacco farmers.

Reasons behind Multiple Rabi Crops Cultivation and Tobacco Production

Table 9 shows the major reasons behind multiple rabi crops cultivation and tobacco production reported by the sampled respondents at the study areas. The N/K farmers stated that less labour as well as less cost was involved in multiple rabi crops cultivation and 97% of the farmers in the

study areas mentioned this reason. Ninety two percent of the N/K farmers reported that more than two rabi crops are grown at a time in a single plot. Moreover, multiple cropping helps to increase soil fertility and 83% of the respondents stated this reason. Sixty nine percent of the N/K farmers mentioned the high market price of rabi crops is one of the major reasons behind multiple rabi crops cultivation. Therefore, it gives more profit compared to tobacco and 56% of the total respondents stated this reason (Table 9).

It is seen from the table that 94% of the N/I farmers could not cultivate tobacco due to government restriction imposed on tobacco cultivation at “khas” land of the study areas. So, there was no other way to accept its substitute crops cultivation. Moreover, family members were not interested to produce tobacco due to its harmful affects on human health and 44% of the N/I farmers stated this reason behind multiple rabi crops cultivation. Twenty eight percent of the respondents reported that multiple cropping is as profitable as tobacco (Table 9).

Seventy eight percent of the S/M farmers at the study areas mentioned the reason that there is more cost involved in tobacco production compared to multiple rabi crops cultivation. Moreover, more human labour as well as continuous hard work is needed for tobacco production and 72% of the total respondents stated this reason. Lack of hired labour during tobacco processing period is one of the major problems reported by the 53% of the S/M farmers. Forty two percent of the S/M farmers mentioned that there is less cost and more profit involved in multiple cropping than tobacco. Yield of tobacco at the study areas is decreasing day by day and 31% of the respondent stated this reason behind the multiple rabi crops cultivation. Twenty two percent of the sampled S/M farmers mentioned that frequent health problems are directly related to tobacco production (Table 9).

On the other hand, 90% of the tobacco farmers reported that tobacco is an easy way to earn enough money at a time. In other words, it is an easy way to build a house by bricks and 82% of the respondent farmers stated this reason behind tobacco production. No tension for getting inputs (seeds, fertilizers and insecticides/pesticides) and for selling of tobacco is one of the major reason behind tobacco production stated by the 55% of the respondents at the study areas. Moreover, only 37% of the sampled tobacco farmers mentioned that tobacco is more profitable crop than other crops (Table 9).

Conclusions and Recommendations

The findings of the study revealed that the N/K farmers earned the highest net profit per hectare from potato+maize+garlic+coriander cultivation compared to the S/M farmers (lentil+mustard) at Kushtia. In case of Cox'sbazar, the N/K farmers obtained the highest net profit from potato+french bean+falon+radish cultivation followed by the N/I and the S/M farmers. The study also revealed that the N/K farmers at Bandarban obtained more return per taka investment from potato+french bean+coriander+sweet gourd cultivation compared to the N/I and the S/M farmers from potato+french bean+coriander cultivation. Under the multiple cropping systems, the yield of a particular single crop was not significant than the national average but all group of farmers at the study areas got more kinds of crop at a time from the same field.

Results showed that the N/K farmers applied more manures and seeds from their owned sources compared to the N/I and the S/M farmers. It was found that human labour was the largely used input (372 man-days/ha) in tobacco production. Besides, the tobacco farmers used huge quantity of chemical fertilizers, insecticides/pesticides and irrigation water for tobacco production. The highest per hectare total cost was estimated from the N/K farmer's combination followed by the N/I and the S/M farmer's combination at the study areas. But in case of tobacco production, it appeared to more than double in comparison with multiple rabi crops (combination) cultivation. The study indicated that the tobacco farmers obtained less amount of net profit with more amount of cash and non-cash investment at the study areas.

Both on full and cash cost basis, the highest return per taka investment was found from the N/K farmer's combination followed by the N/I farmer's combination, the S/M farmer's combination and tobacco production. Less labour and cost was the main reason behind the multiple rabi crops cultivation mentioned by 97% of the sampled N/K farmers at the study areas. The N/I farmers could not cultivate tobacco due to government restriction imposed on tobacco production at the study areas and 94% of the sampled farmers stated the reason. About 78% of the S/M farmers at the study areas mentioned that there is more cost involved in tobacco production compared to multiple rabi crops cultivation. On the other hand, 90% of the tobacco farmers reported the reason behind tobacco production that it is an easy way to earn enough money at a time. Though tobacco is found to be profitable from farmer's point of view but it has a high opportunity cost from social point of view. The entire return from tobacco can be deemed as a loss to the society because tobacco products are considered severely injurious to human health. Treatments cost of this amount appears to be even a huge loss to the society as a whole.

It can be concluded that multiple cropping is a unique technique for crop diversification, increase yield and additional cash generation. Farmers showed their keen interest to practice the multiple cropping technologies developed by UBINIG. It is noteworthy that more research efforts should be continued for effective dissemination of packages of technology (cropping patterns) to the farmers.

Though, tobacco is established by the BATB as a very profitable crop in the study areas. But its adverse effect on human health by now is known to the people at large including the companies who have been patronizing its production under contract farming system almost ignoring the government policy in this regard. Given the profitability situation it will be difficult in the short run to divert the farmers from tobacco production to other profitable substitute rabi crops. Therefore, in line with the government policy i.e. to gradually eliminate tobacco production, the following action programme may be taken:

- i) The government, the DAE, the crop research institutions, the NGO's as well as the tobacco companies involved, should have a concerted policy and action programme in the medium and long run to eliminate production of tobacco.
- ii) Like UBINIG, crop research institutions of Bangladesh should undertake research for developing competitive rabi crops/technologies for this areas. DAE and government should support the research institutions and NGO's in this particular endeavour.
- iii) Market price of high food value rabi crops such as pulses, beans, peas, oil seeds, spices and vegetables are very high. So, more crop combinations (multiple cropping) including those types of rabi crops should be trialed by the UBINIG research team at the intensive tobacco growing areas of Bangladesh.
- iv) Training programme should be organized by UBINIG authority for the tobacco farmers in collaboration with the DAE so that they (tobacco farmers) can easily realize the actual benefits/profits are achieved by the different group of farmers at tobacco growing areas of Bangladesh.
- v) Different awareness campaign tools like group approach, video clips, CD, crop modeling, poster, participatory whole family approach should be taken care off for greater adoption of multiple cropping technologies in different tobacco growing areas of Bangladesh.

Suggestions for Future Research: Not only multiple rabi crops combination but also round the year food crops based cropping pattern should be agro-economically evaluated against tobacco based cropping pattern at farm level.

Table 1. Cost and return of multiple rabi crops cultivation at Kushtia

Items	Cost (Taka / hectare)		
	Nayakrishi farmer	Newly involved farmer	Self motivated farmer
	Potato+maize+ garlic+coriander	Not available	Lentil+mustard
Human labour:			
Family	17,250		16,050
Hired	25,950	-	9,750
Total :	43,200		25,800
Land preparation:			
Owned	237	-	-
Purchased	5,647		5,362
Total :	5884		5,362
Seed:			
Owned	32,041	-	731
Purchased	2,165		2,356
Total :	34,206		3,087
Manure:			
Owned	4,014	-	7,475
Purchased	119		-
Total :	4,133		7,475
Irrigation:			
Owned	-	-	-
Purchased	5,589		488
Total :	5,589		488
Others (if any)	525	-	281
Interest on working capital (@ 7%)	933	-	425
Rental value of land: (for crop season only)	22,019	-	22,896
Total Cost (TC):	1,16,489	-	65,814
Total Cash Cost (TCC):	39,995	-	18,237
Yield of Crops (kg/ha):	13918+4703+511 +80	-	1544+975
Price of Crops (Tk/kg):	6.5+13.5+81.7 +55.0	-	56.0+37.5
Gross Return (Tk/ha):			
Value of Crops	2,00,091	-	1,23,027
Value of by-products	5,807		3,055
Total :	2,05,898		1,26,082
Net Profit (Tk/ha):			
Full cost basis	89,409	-	60,268
Cash cost basis	1,65,903		1,07,845
Return per Taka Investment:			
Full cost basis	1.77	-	1.92
Cash cost basis	5.15		6.91

Table 2. Cost and return of multiple rabi crops cultivation at Cox'sbazar

Items	Cost (Taka / hectare)		
	Nayakrishi farmer	Newly involved farmer	Self motivated farmer
	Potato+french bean+felon+radish	Potato+french bean+felon	Potato+french bean+felon+radish
Human labour:			
Family	22,000	21,000	20,400
Hired	27,000	21,400	34,600
Total :	49,000	42,400	55,000
Land preparation:			
Owned	-	659	2,646
Purchased	6,848	4,034	3,381
Total :	6,848	4,693	6,027
Seed:			
Owned	32,111	9,189	11,979
Purchased	560	23,164	17,024
Total :	32,671	32,353	29,003
Manure:			
Owned	12,242	-	-
Purchased	3,566	988	4,495
Total :	15,808	988	4,495
Fertilizer:	-	12,009	13,030
Insecticides/Pesticides:	-	3,787	2,399
Irrigation:			
Owned	898	4,594	652
Purchased	2,785	511	4,570
Total :	3,683	5,105	5,222
Others (if any)	422	385	688
Interest on working capital (@ 7%)	961	1546	1,871
Rental value of land: (for crop season only)	28,068	28,585	29,054
Total Cost (TC):	1,37,461	1,31,851	1,46,789
Total Cash Cost (TCC):	41,181	66,278	80,187
Yield of Crops (kg/ha):	12228+555+887 +3231	13634+487+881	12138+720+589 +899
Price of Crops (Tk/kg):	15.3+37.0+39.0 +15.8	15.0+45.0+37.5	13.5+40.0+42.5+16.3
Gross Return (Tk/ha):			
Value of Crops	2,93,633	2,59,462	2,32,155
Value of by-products	2,290	2,252	2,028
Total :	2,95,923	2,61,714	2,34,183
Net Profit (Tk/ha):			
Full cost basis	1,58,462	2,29,863	87,394
Cash cost basis	2,54,742	1,95,436	1,53,996
Return per Taka Investment:			
Full cost basis	2.51	1.98	1.60
Cash cost basis	7.18	3.95	2.92

Table 3. Cost and return of multiple rabi crops cultivation at Bandarban

Items	Cost (Taka / hectare)		
	Nayakrishi farmer	Newly involved farmer	Self motivated farmer
	Potato+french bean+coriander +sweet gourd	Potato+french bean+coriander	Potato+french bean+coriander
Human labour:			
Family	32,200	24,400	30,800
Hired	25,200	28,400	16,400
Total :	57,400	52,800	47,200
Land preparation:			
Owned	-	-	-
Purchased	6,866	7,101	6,130
Total :	6,866	7,101	6,130
Seed:			
Owned	32,021	4,693	-
Purchased	4,176	26,300	29,042
Total :	36,197	30,993	29,042
Manure:			
Owned	10,252	-	-
Purchased	1,887		
Total :	12,139		
Fertilizer:	-	8,226	8,131
Insecticides/Pesticides:	-	1,741	4,104
Irrigation:			
Owned	-	-	2,763
Purchased	5,063	3,544	790
Total :	5,063	3,544	3,553
Others (if any)	503	598	495
Interest on working capital (@ 7%)	1,020	1,771	1,519
Rental value of land: (for crop season only)	26,585	25,908	27,310
Total Cost (TC):	1,45,773	1,32,682	1,27,484
Total Cash Cost (TCC):	43,695	75,910	65,092
Yield of Crops (kg/ha):	11266+1519+230 +1125	11993+1037+80	13283+310+148
Price of Crops (Tk/kg):	16.0+40.0+80.0+15.2	16.0+40.0+25.0	15.5+45.0+30.0
Gross Return (Tk/ha):			
Value of Crops	2,76,516	2,35,368	2,24,277
Value of by-products	1,226	1,052	1,122
Total :	2,77,742	2,36,420	2,25,399
Net Profit (Tk/ha):			
Full cost basis	1,31,969	1,03,738	97,915
Cash cost basis	2,34,047	1,60,510	1,60,307
Return per Taka Investment:			
Full cost basis	1.91	1.78	1.77
Cash cost basis	6.36	3.11	3.46

Table 4. Cost and return per hectare of tobacco production at farm level

Items	Cost (Taka / hectare)			
	Kushtia	Cox'sbazar	Bandarban	Average
Human labour:				
Family	24,640	23,562	26,390	
Hired	45,760	60,588	56,078	
Total :	70,400	84,150	82,468	79,006
Land preparation:				
Owned	-	-	-	
Purchased	4,446	6,449	7,487	
Total :	4,446	6,449	7,487	6,127
Seed/seedlings:				
Owned	3,128	4,213	5,205	
Purchased	-	-	-	
Total	3,128	4,213	5,205	4,182
Fertilizers:	36,226	42,068	40,977	39,757
Insecticides / pesticides:	4,775	6,885	5,545	5,735
Irrigation:	6,984	8,982	8,298	8,088
Manure:				
Owned	-	-	-	
Purchased	-	5,077	4,600	
Total :	-	5,077	4,600	3,226
Drying/Curing				
Owned	4,400	7,194	5,750	
Purchased	26,249	26,787	26,205	
Total :	30,649	33,981	31,955	32,195
Others (transportation, stick, rope, medicine, etc.)	7,350	6,103	8,150	7,201
Interest on working capital (@ 7 %)	6,150	7,604	7,343	7,032
Rental value of land: (for crop season only)	35,520	37,050	38,594	37,055
Total Cost (TC):	2,05,628	2,42,562	2,40,622	2,29,604
Total Cash Cost (TCC):	1,31,790	1,62,939	1,57,340	1,50,690
Yield of Crops (kg/ha):	2994	3065	3133	3064
Price of Crops (Tk/kg):	90.86	95.00	95.00	93.62
Gross Return (Tk/ha.):				
Value of Crops	2,72,035	2,91,175	2,97,635	
Value of by-products	5,200	5,295	5,099	
Total :	2,77,235	2,96,470	3,02,734	2,86,852
Net Profit (Tk/ha):				
Full cost basis	71,607	53,908	62,112	57,248
Cash cost basis	1,45,445	1,33,531	1,45,394	1,36,162
Return per Taka Investment:				
Full cost basis	1.35	1.22	1.26	1.25
Cash cost basis	2.10	1.82	1.92	1.90

Table 5. Cost and return per hectare of multiple rabi crops cultivation by the Nayakrishi farmers

Items	Cost (Taka / hectare)			
	Kushtia	Cox'sbazar	Bandarban	Average
	Potato+maize+garlic+coriander	Potato+french bean+felonl +radish	Potato+french bean+coriander +sweet gourd	
Human labour:				
Family	17,250	22,000	32,200	
Hired	25,950	27,000	25,200	
Total :	43,200	49,000	57,400	49,867
Land preparation:				
Owned	237	-	-	
Purchased	5,647	6,848	6,866	
Total :	5884	6,848	6,866	6,533
Seed:				
Owned	32,041	32,111	32,021	
Purchased	2,165	560	4,176	
Total :	34,206	32,671	36,197	34,358
Manure:				
Owned	4,014	12,242	10,252	
Purchased	119	3,566	1,887	
Total :	4,133	15,808	12,139	10,693
Irrigation:				
Owned	-	898	-	
Purchased	5,589	2,785	5,063	
Total :	5,589	3,683	5,063	4,778
Others (if any)	525	422	503	483
Interest on working capital (@ 7%)	933	961	1,020	971
Rental value of land: (for crop season only)	22,019	28,068	26,585	25,557
Total Cost (TC):	1,16,489	1,37,461	1,45,773	1,33,241
Total Cash Cost (TCC):	39,995	41,181	43,695	41,624
Yield of Crops (kg/ha):	13918+4703+511 +80	12228+555 +887 +3231	11266+1519 +230 +1125	-
Price of Crops (Tk/kg):	6.5+13.5+81.7 +55.0	15.3+37.0+39.0 +15.8	16.0+40.0+80.0 +15.2	-
Gross Return (Tk/ha):				
Value of Crops	2,00,091	2,93,633	2,76,516	
Value of by-products	5,807	2,290	1,226	
Total :	2,05,898	2,95,923	2,77,742	2,59,854
Net Profit (Tk/ha):				
Full cost basis	89,409	1,58,462	1,31,969	1,26,613
Cash cost basis	1,65,903	2,54,742	2,34,047	2,18,230
Return per Taka Investment:				
Full cost basis	1.77	2.51	1.91	1.95
Cash cost basis	5.15	7.18	6.36	6.24

Table 6. Cost and return per hectare of multiple rabi crops cultivation by the Newly involved farmers

Items	Cost (Taka / hectare)			Average
	Kushtia	Cox'sbazar	Bandarban	
	Not available	Potato+french bean+felon	Potato+french bean+coriander	
Human labour:				
Family	-	21,000	24,400	
Hired		21,400	28,400	
Total :		42,400	52,800	47,600
Land preparation:				
Owned	-	659	-	
Purchased		4,034	7,101	
Total :		4,693	7,101	5,897
Seed:				
Owned	-	9,189	4,693	
Purchased		23,164	26,300	
Total :		32,353	30,993	31,673
Manure:				
Owned	-	-	-	
Purchased		988		
Total :		988		494
Fertilizer:	-	12,009	8,226	10,118
Insecticides/Pesticides:	-	3,787	1,741	2,764
Irrigation:				
Owned	-	4,594	-	
Purchased		511	3,544	
Total :		5,105	3,544	4,325
Others (if any)	-	385	598	492
Interest on working capital (@ 7%)	-	1546	1,771	1,659
Rental value of land: (for crop season only)	-	28,585	25,908	27,247
Total Cost (TC):	-	1,31,851	1,32,682	1,32,267
Total Cash Cost (TCC):	-	66,278	75,910	71,094
Yield of Crops (kg/ha):	-	13634+487+881	11993+1037+80	-
Price of Crops (Tk/kg):	-	15.0+45.0+37.5	16.0+40.0+25.0	-
Gross Return (Tk/ha):				
Value of Crops	-	2,59,462	2,35,368	
Value of by-products		2,252	1,052	
Total :		2,61,714	2,36,420	2,49,067
Net Profit (Tk/ha):				
Full cost basis	-	2,29,863	1,03,738	1,16,800
Cash cost basis		1,95,436	1,60,510	1,77,973
Return per Taka Investment:	-			
Full cost basis		1.98	1.78	1.88
Cash cost basis		3.95	3.11	3.50

Table 7. Cost and return per hectare of multiple rabi crops cultivation by the Self motivated farmers

Items	Cost (Taka / hectare)			Average
	Kushtia	Cox'sbazar	Bandarban	
	Lentil+mustard	Potato+french bean+felon +radish	Potato+french bean+coriander	
Human labour:				
Family	16,050	20,400	30,800	
Hired	9,750	34,600	16,400	
Total :	25,800	55,000	47,200	42,667
Land preparation:				
Owned	-	2,646	-	
Purchased	5,362	3,381	6,130	
Total :	5,362	6,027	6,130	5,840
Seed:				
Owned	731	11,979	-	
Purchased	2,356	17,024	29,042	
Total :	3,087	29,003	29,042	20,377
Manure:				
Owned	7,475	-	-	
Purchased	-	4,495	-	
Total :	7,475	4,495	-	3,990
Fertilizer:	-	13,030	8,131	7,054
Insecticides/Pesticides:	-	2,399	4,104	2,168
Irrigation:				
Owned	-	652	2,763	
Purchased	488	4,570	790	
Total :	488	5,222	3,553	3,088
Others (if any)	281	688	495	488
Interest on working capital (@ 7%)	425	1,871	1,519	1,272
Rental value of land: (for crop season only)	22,896	29,054	27,310	26,420
Total Cost (TC):	65,814	1,46,789	1,27,484	1,13,362
Total Cash Cost (TCC):	18,237	80,187	65,092	54,505
Yield of Crops (kg/ha):	1544+975	12138+720+589 +899	13283+310 +148	-
Price of Crops (Tk/kg):	56.0+37.5	13.5+40.0+42.5 +16.3	15.5+45.0 +30.0	-
Gross Return (Tk/ha):				
Value of Crops	1,23,027	2,32,155	2,24,277	
Value of by-products	3,055	2,028	1,122	
Total :	1,26,082	2,34,183	2,25,399	1,95,221
Net Profit (Tk/ha):				
Full cost basis	60,268	87,394	97,915	81,859
Cash cost basis	1,07,845	1,53,996	1,60,307	1,40,716
Return per Taka Investment:				
Full cost basis	1.92	1.60	1.77	1.72
Cash cost basis	6.91	2.92	3.46	3.58

Table 8. Comparative economics between multiple rabi crops (combination) cultivation and tobacco production

Items	N/K farmer's combination	N/I farmer's combination	S/M farmers combination	Tobacco production
Human labour (No.):				
Family	122	113	109	117
Hired	133	125	99	255
Total :	255	238	208	372
Wage rate (Tk./man-days)	195	200	205	212
Fertilizers (kg/ ha):				
Urea-	Nil	74	48	823
TSP-		106	57	419
MoP-		36	15	150
SoP-		-	-	172
DAP-		-	-	116
ZnSo ₄ -		-	-	18
Insecticides/Pesticides(No):	Nil	2	2	6
Irrigation (No.):	2.5	2	2	4.5
Manures (kg/ha):				
Owned	4211	-	1246	-
Purchased	1563	124	361	2011
Total :	5774	124	1607	2011
Rental value of land: (for crop season only)	25,557	27,247	26,420	37,055
Total Cost (Tk./ha):	1,33,241	1,32,267	1,13,362	2,29,604
Total Cash Cost (Tk./ha):	41,624	71,094	54,505	1,50,690
Gross Return (Tk/ha):	2,59,854	2,49,067	1,95,221	2,86,852
Net Profit (Tk/ha):				
Full cost basis	1,26,613	1,16,800	81,859	57,248
Cash cost basis	2,18,230	1,77,973	1,40,716	1,36,162
Return per Taka Investment:				
Full cost basis	1.95	1.88	1.72	1.25
Cash cost basis	6.24	3.50	3.58	1.90

Table 9. Reasons behind multiple rabi crops (combination) cultivation and tobacco production

Nayakrishi farmers (n = 36)	%	Newly involved farmer (n = 18)	%
Less cost and less labour required	97	No other way due to government restriction on tobacco production	94
More crops are grown at a time	92	Family members are not interested to produce tobacco	44
It helps to increase soil fertility	83	Multiple cropping is as profitable as tobacco	28
Market price of rabi crops are high	69		
More profit compared to tobacco	56		
No harmful affect like tobacco	33		

Table 9. contd.....

Self motivated farmers (n = 36)	%	Tobacco farmers (n = 60)	%
More cost involved in tobacco production than multiple cropping	78	Easy way to earn enough money	90
More labour and continuous hard work is required for tobacco production	72	Easy way to build a house by bricks	82
Lack of hired labour for tobacco processing	53	No tension for getting inputs and also for selling tobacco	55
Less cost and more profit involved in multiple cropping	42	More profit than other crops	37
Yield of tobacco is decreasing day by day	31		
Frequent health problems related to tobacco production	22		

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