

Comparative Economics of Producing Alternative Combinations
of Rabi Crops by Substituting Tobacco in Bangladesh

Reported
by

Md. Mosharraf Uddin Molla
Consultant (Phase-II)
Agricultural Economist

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Abstract

The study was undertaken to investigate the comparative economics of producing alternative combinations of rabi crops by substituting tobacco in Bangladesh. Three most concentrated tobacco growing areas of Bangladesh namely Kushtia, Cox'sbazar and Bandarban districts were selected for conducting the present study. The data were collected through a structured questionnaire from 36 Nayakrishi and 24 tobacco farmers during the present rabi season (2009-10), those were included as sample farmers for the previous study season (2006-07). The prominent rabi crops combinations practiced by the Nayakrishi farmers such as potato + maize + lentil + coriander at Kushtia, potato + french bean + felon at Cox'sbazar and Bandarban were investigated purposively. Data related to rabi crops (combination) cultivation as well as tobacco production were collected from the same crop fields of the respective farmers, those fields were used as sample plots for the previous season. The study unveiled that about 80% higher human labour required in tobacco production and the tobacco farmers paid more than 21% higher wages per man-days compared to rabi crops (combination) cultivation. The tobacco farmers used excessive and imbalance doses of chemical fertilizers and they performed on an average six times to apply insecticides/pesticides in their crop fields at the study areas. The study also revealed that per hectare yield of tobacco was lower during this season than the yield of tobacco in the previous season at each of the locations. On the other hand, the Nayakrishi farmers were utilized their farm and non-farm resources more efficiently during the present season and achieved higher yield per hectare of different rabi crops compared to previous season. The study showed that total cost (full cost) per hectare of tobacco production was more than 119% higher compared to rabi crops (combination) cultivation practiced by the Nayakrishi farmers. Moreover, the Nayakrishi farmers were achieved remarkable net profit from rabi crops (combination) cultivation than tobacco both on full and cash cost basis respectively. They obtained more return Taka 1.42 from per Taka investment by cultivating these rabi crops combinations during this season compared to tobacco production.

Introduction

The rate of growth in agriculture sector has an important bearing on overall growth of an economy. The agriculture sector, which accounts for 20% GDP, grew by 4.6% in FY 2009 up from 3.2% in FY 2008. The crops and horticulture sub-sector grew by 5.0% in FY 2009 compared with 2.7% in FY2008. Bangladesh is attaining reasonably good economic growth despite the unfolding global recession. GDP grew by 5.9 in FY 2009, slightly lower than 6.2% in FY 2008 because of the moderation in aggregate demand affected by a slowdown in exports and remittance inflows (ADB, 2009).

Bangladesh is a country where poverty rates are among the highest in the world. The HDI for Bangladesh is 0.524, which gives the country a rank of 147th out of 179 countries with data. A study performed by WFP in 2006 found that a relatively large group of extremely poor rural households does not participate in virtually any aspect of the movement toward development and are falling further behind other groups of households. The FAO/WFP crop and food supply assessment mission of Bangladesh (August 2008) estimates that the prevalence of under-nourishment in Bangladesh deteriorated in 2007-08 and is now affecting nearly 35 million people. This highly food insecure population, also referred to as the ultra-poor, has an average daily caloric intake of less than 1805 kcal and spends more than 80% of its disposable income on food.

With respect of food security, the WFP showed that more than half of the food insecure suffer from year-round food insecurity and another 20% had only during one to six month of the year access to adequate food. Most households only ate two meals per day and typically consumed poor quality diets (low in essential macro-and micro nutrients). The WFP report further mentions that 17% of the children throughout Bangladesh are severely stunted, the vast majority of them belonging to the ultra-poor households.

With almost half of the population living below poverty threshold, malnutrition is widespread in Bangladesh. More than one half of the adult women and 45% of the men do not have access to the minimum caloric requirements. Over 50% of infants, 70% of pre-school children, 50% of school-aged children, and 60% of pregnant and lactating women are vulnerable to food nutritional insecurity. Among these vulnerable groups, the rural landless and urban slum dwellers confront the greatest hardships. The consequences of malnutrition particularly micro-nutrient deficiency are severe—generation of children, unable to learn and grow, are nation's burden instead of its strength. It is therefore imperative that growth in income is essential for poverty reduction, better nutrition and improved livelihood.

Considering the importance in overall economic growth and poverty reduction, the government has recognized agriculture as a priority sector. 'Agriculture is where most poor work; the rural sector is where they live'. Agriculture and rural development can

thus effectively reduce poverty. For the purpose of ensuring food security for all, the government, alongside the efforts to increase food production, has been undertaken a programme to encourage crop diversification, help establish agro-based industries and eventually shift farming from subsistence to commercial level.

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.

Multiple cropping or crop intensification through legumes potentially generates more employment. Pulses, mostly lentil, mungbean and black gram, contribute greatly to household income and food security. As purchasing power of the rural poor is low, the consumption of pulses from domestic production provides opportunity to meet protein demand to a large extent. Lentil is an important pulse crop which provides an opportunity to contribute to food supplies through diversification of agricultural systems in many countries of the world. It is a major source of protein, minerals (K, P, Fe, Zn) and vitamins to the poorer section of the population and the straw is a valued animal feed. Various traditional food products from lentils are component of daily diet of the people of Asia (Sarker,et.al.2004). Lentil also contributes to sustainable cropping system by diversifying cereal dominating cropping systems through improvement of soil nitrogen and carbon status. Its ability to fix atmospheric nitrogen and sequester carbon results in improved soil nutrient status, which in turn contributes to sustainability of the production systems.

Significant number of infants (28.3%) and pre-school children (44%) of Asia are severely affected by malnutrition and under-nutrition. It is also estimated that more than 50% women in the region also suffer from under weight. Grain legumes are the major source of inexpensive protein for rural poor in South and South-east Asia and are important in balancing human and animal diets (Pande and Gowda, 2004). Although the potato can compete favorably with wheat, maize and rice in terms of total production, in protein content it does not do so well. Nevertheless, in terms of production value per hectare per day in developing countries, the potato does better than rice and wheat for edible energy and is only a little way behind wheat for edible protein (Hawkes, J. G. 1992).

Tobacco is the second major cause of death in the world. It is currently responsible for death of one in ten adults worldwide (about 5 million death each year). If current smoking patterns continue, it will cause some 10 million deaths each year by 2020. Half

the people that smoke today that are about 650 million people will eventually be killed by tobacco. With current smoking patterns, 500 million people alive today will eventually be killed by tobacco use. More than half of these are now children and teenagers. By 2030 tobacco is expected to be the single biggest cause of death worldwide (World Bank, 1999). In the world as a whole, tobacco already kills 1 in 10 adults. By 2030 it is expected to kill 1 in 6 or more than 10 million deaths a year. At least 7 in 10 of these deaths will be in low income or middle income countries.

The WHO has estimated that worldwide smokeless tobacco (oral tobacco) is used by up to 400 million people, causing about 100,000 deaths a year in men and 50,000 in women. Smokeless tobacco contains more than 2000 chemicals, a number of which may be cancer causing. Just as much nicotine is observed as by smoking, though more slowly, so oral tobacco is equally addictive. The health effects are both local in the mouth and general in the body.

In Sweden a large study showed a 40% higher risk of cardiovascular mortality among smokeless tobacco users compared to non-users. The amount of nicotine observed from smokeless tobacco has been found to be 10 times more than that found in one cigarette. Smokeless tobacco is, therefore, exposed to higher dosages of nicotine and more heavily addictive. Even though statistical figures are not available in Bangladesh social customs and freedom of use and ignorance make smokeless tobacco popular among women so much so in some rural areas. More than 60% women use smokeless tobacco as a safe method of tobacco use. It is therefore evident that no form of tobacco and no method of use of tobacco are safe. Smokeless tobacco is more than or as harmful as smoking tobacco. The misconception and social freedom for smokeless tobacco is a great hindrance and people use it with the sense of safety. Saha (2004) found that, 39.4% of the workers of polluted industry had to consult doctor, 38.2% took sick leave, 20.0% fell seriously ill 13.2% were hospitalized, 100% with pre-service records of ill health, 66.5% will in-service record of ill health during the last one year.

Area and production of tobacco has been increased tremendously during the last three 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 current year (2009-10) which is about 68% higher than previous year. This alarming condition is very risky for the national food security programme.

Though the tobacco growers claimed that tobacco production generated steady cash income at a time. But the opportunity cost of tobacco production for any society is very high. Different profitable rabi crops such as potato, maize, wheat, pulses, oilseeds, beans, spices and vegetable etc. have to foregone on the land where tobacco is grown.

Moreover, tobacco consumption leads to various fatal diseases for which huge amount of money has to be incurred for treatment of the consumers.

In spite of many adverse effect of tobacco, the government of Bangladesh is silent due to the benefit of yearly export receipts from tobacco. According to the statistics of Bangladesh Bank (2010), export receipts from tobacco was Tk. 167.13 crores during 2008-09 whereas the figure was Tk. 14.69 crores and Tk. 70.00 crores during 2000-01 and 2004-05 respectively. The present study is a modest attempt to investigate the comparative profitability between rabi crops (combinations) and tobacco cultivation in different study seasons. Given this context the study has been conceived with the following objectives:

- i) To determine yield rate, cost of production and magnitude of profitability of selected crops in the study areas;
- ii) To find out the more profitable crop or crops combination for dissemination to the extend areas;
- iii) To estimate the level of input use and comparative assessment between rabi crops (combination) cultivation and tobacco production; and
- iv) To formulate the general recommendations arising from the findings.

Methodology

In the first phase of the project, a study on ‘Economic Assessment of Rabi Crops (combination) Cultivation as a Substitute of Tobacco Production’ was conducted in three major tobacco growing zones namely Kushtia, Cox’sbazar and Bandarban districts during April to June, 2007. The major objectives of the study were to determine the profitability of tobacco as well as rabi crops (combination) production followed by the Nayakrishi farmers and to identify the most suitable rabi crop or crops combination in the study areas. A total of eight rabi crops combinations were selected to find out the most profitable and suitable crops combination in the study areas. From the findings of the study, potato+ maize + lentil at Kushtia, potato + tomato + felon + coriander or potato + french bean + felon at Cox’sbazar and potato + french bean at Bandarban were identified the most suitable as well as profitable rabi crops combinations compared to tobacco.

In second phases, three most concentrated tobacco growing areas of Bangladesh namely Kushtia, Cox’sbazar and Bandarban districts were selected for conducting the present study. The villages surveyed are Chatiyani, Katuadah, Bheramara and Chuamallik para of Mirpur and Daulatpur upazila, Maij kakara and Monikpur of Chakaria upazila and Sabek Bilchhari and Dardari of Lama upazila under Kushtia, Cox’sbazar and Bandarban districts respectively. Data was collected from respondents by field visits using structured

questionnaire. A total of 36 Nayakrishi farmers (12 from each district) and 24 tobacco farmers (8 from each district) were selected purposively for carrying out the study. These selected farmers were also included as sample farmers for the previous study conducted in the first phase of the Project (2006-07). Data related to rabi crops (combination) as well as tobacco production were collected from the same plots/fields of the farmers due to fulfill the objectives of the study. The prominent rabi crops combinations practiced by the Nayakrishi farmers such as potato + maize + lentil + coriander at Kushtia, potato + french bean + felon at Cox'sbazar and Bandarban were investigated during the present rabi season (2009-10). The detailed field survey was conducted during the months of March to April, 2010. This study generated field data on the comparative yield rate and profitability of rabi crops combination as well as tobacco cultivation. Detailed cost of production was worked out for each crop separately. Secondary data was also used for comparative assessment between rabi crops combinations and tobacco in different seasons from the findings of the previous study (2006-07) conducted by UBINIG.

Farmers in the study areas used both purchased and home supplied inputs. Thus the total production cost of a particular crop consisted of cash and non-cash expenses. For purchased inputs such as hired labour, seeds/seedlings, fertilizers, pesticides/insecticides, irrigation water, fuel wood etc., they had to pay cash and it was easy to estimate the cost of these items. But no cash was actually paid for home supplied inputs such as family labour, home supplied seeds/seedlings, animal labour, manure, fuel wood, tools and equipment etc. was difficult for pricing. So, input items were valued at the prevailing market rates in the study areas during survey period, or at the farm gate price at which farmers bought. The amount of money needed to meet the expenses on hired or purchased input was treated as working capital. In the present study, interest on working capital was charged at the rate of 7% per annum and was estimated for the crop duration which the working capital was used. On the other hand, rental value of land was determined according to the opinions of the local respondents. Per hectare gross return was calculated by multiplying the total amount of product and by-product by their respective prevailing farm gate/market prices. Per hectare net profit was estimated by deducting the per hectare total cost (full cost) from the per hectare gross return.

Results and discussion

Economics of Rabi Crops Combinations at Different Locations

Table 1 shows that the cost and return per hectare of rabi crops combination practiced by the skilled Nayakrishi farmers at different study areas, The average human labour cost per hectare was observed the highest (Tk.30,831) at Kushtia in potato +maize+lentil+coriander crops combination compared to potato+french bean+felon at Cox'sbazar (Tk. 27,750) and Bandarban (Tk. 26,550).

It revealed from the table that except human labour and seed cost per hectare, all variable cost items like land preparation, manure and irrigation cost was found the highest in potato+ french bean + felon crops combination at Cox'sbazar and Bandarban than in potato + maize + lentil + coriander at Kushtia. The observed variation was mainly because of higher wages and prices of different inputs used by the Nayakrishi farmers at the study areas. The highest average total cost (Full cost) per hectare was amount to Tk. 1, 03, 688 in the combination of potato + maize + lentil + coriander at Kushtia followed by Tk. 1, 01, 142 and Tk. 99,073 in potato + french bean + felon combination at Cox'sbazar and Bandarban respectively.

Table shows that the highest per hectare average yield of potato (main crop) was 15728 kg compared to Cox'sbazar (13457 kg) and Bandarban (13560 kg) areas. The observed variation in yield among the locations might be due to the location effect and variation in rabi crops combination practiced by the Nayakrishi farmers. Average price of potato was reported as Tk. 14.50/kg and the Nayakrishi farmers at Cox'sbazar and Bandarban got the highest price of potato (Tk. 18.00/kg) than Kushtia.

In the study areas per hectare average gross return was observed Tk. 2, 50,457 and found the highest in potato + french bean + felon crops combination at Bandarban (Tk. 2,88,271/hectare) and the lowest in potato + maize + lentil + coriander at Kushtia (Tk. 2,16,927). Both on full and cash cost basis, per hectare net profit was higher at Bandarban (Tk. 1, 87, 129 and Tk. 2,48,245 respectively) compared to other two locations.

In other words, the Nayakrishi farmers at Cox'sbazar and Bandarban were achieved higher net profit per hectare from potato + french bean + felon crops combination than the farmers at Kushtia from potato + maize + lentil + coriander combination. Average return per taka investment was estimated as 2.47 on full cost basis and 5.40 on cash cost basis and indicated the cultivation of rabi crops as a profitable crops combination under the present farming systems practiced by the Nayakrishi farmers at the study areas.

Table 1. Cost and return per hectare of rabi crops combination at different locations

Items	Cost (Taka / hectare)			
	Kushtia	Cox'sbazar	Bandarban	Average
	Potato+maize+lentil+coriander	Potato+french bean+felon	Potato+french bean+felon	
Human labour:				
Family	15,222	15,750	17,850	
Hired	15,649	12,000	8,700	
Total :	30,831	27,750	26,550	28,377
Land preparation:				
Owned	-	2,733	4,281	
Purchased	3,255	3,549	1,997	
Total :	3,255	6,282	6,278	5,272
Seed:				
Owned	1,938	1,157	1,174	
Purchased	38,182	24,095	25,603	
Total :	40,120	25,252	26,770	30,714
Manure:				
Owned	4,283	4,672	6,168	
Purchased	-	1,546	189	
Total :	4,283	6,218	6,357	5,619
Irrigation:				
Owned	-	-	1,009	
Purchased	2,659	4,081	3,025	
Total :	2,659	4,081	4,034	3,591
Others (if any)	651	301	512	488
Interest on working capital (@ 7%)	1,057	798	701	852
Rental value of land: (for crop season only)	21,188	28,391	29,933	26,504
Total Cost (TC):	1,03,688	99,073	1,01,142	1,01,301
Total Cash Cost (TCC):	60,396	45,572	40,026	48,665
Yield of Crops (kg/ha):	15728+2845+116+81	13457+567+303	13560+616+328	-
Price of Crops (Tk/kg):	11.0+11.67+72.50+67.0	18.0+45.0+45.0	18.0+43.0+42.5	-
Gross Return (Tk/ha):				
Value of Crops	2,09,767	2,42,226	2,84,508	
Value of by-products	7,160	3,946	3,763	
Total :	2,16,927	2,46,172	2,88,271	2,50,457
Net Profit (Tk/ha):				
Full cost basis	1,13,239	1,47,099	1,87,129	1,49,156
Cash cost basis	1,56,531	2,00,600	2,48,245	2,01,792
Return per Taka Investment:				
Full cost basis	2.09	2.48	2.85	2.47
Cash cost basis	3.59	5.40	7.20	5.40

Economics of the Most Suitable Rabi Crops Combination at Kushtia

Comparative per hectare cost and return of the most suitable rabi crops combination in different seasons at Kushtia is presented in Table-2

Table 2. Comparative cost and return of the most suitable rabi crops combination at Kushtia

Items	Cost (Taka/ hectare)		Increase(+) / Decrease(-) in Percentage
	Season : 2006-07	Season : 1009-10	
	Potato+maize+ lentil	Potato+maize+ lentil+coriander	
Human labour:			
Family	5,835	15,222	
Hired	2,037	15,649	
Total :	7,872	30,831	(+)292
Land preparation:			
Owned	-	-	
Purchased	3,522	3,255	
Total :	3,522	3,255	(-) 8
Seed:			
Owned	-	1,938	
Purchased	11,705	38,182	
Total :	11,705	40,120	(+) 243
Manure:			
Owned	4,369	4,283	
Purchased	290	-	
Total :	4,659	4,283	(-) 8
Irrigation:			
Owned	-	-	
Purchased	2,206	2,659	
Total :	2,206	2,659	(+) 21
Others (if any)	537	651	(+) 21
Interest on working capital (@ 7%)	474	1,057	(+) 123
Rental value of land: (for crop season only)	19,011	21,188	(+)11
Total Cost (TC):	49,986	1,03,688	(+) 107
Total Cash Cost (TCC):	20,297	60,396	(+) 198
Yield of Crops (kg/ha):	3354 + 1988 + 651	15728+2845+116+81	(+)369/(+)43/(-)82
Price of Crops (Tk/kg):	12.00 + 10.09 + 38.24	11.0+11.67+72.50+67.0	(-)8 / (+)16 / (+) 90
Gross Return (Tk/ha):			
Value of Crops	85,195	2,09,767	
Value of by-products	3,615	7,160	
Total :	88,810	2,16,927	(+) 144
Net Profit (Tk/ha):			
Full cost basis	38,824	1,13,239	(+) 192
Cash cost basis	68,513	1,56,531	(+) 128
Return per Taka Investment:			
Full cost basis	1.78	2.09	(+) 17
Cash cost basis	4.38	3.59	(-) 18

. During 2006-07 rabi season, the most suitable rabi crops combination was found potato + maize + lentil among the three combinations. But during 2009-10 rabi season, the Nayakrishi farmers at the study area were selected coriander as an additional rabi crop

in their crops combination. They were cultivated the potato + maize + lentil + coriander crops combination at the same crop fields in this season (2009-10) those fields were used in the previous season (2006-07) for the cultivation of potato + maize + lentil crops combination.

Table shows that among the different cost items per hectare human labour and seed cost was increased at 292% and 243% respectively in this season compared to previous season (2006-07). The observed variation was found due to higher wage rate of labour and higher price of seed used by the Nayakrishi farmers at the study areas. It is revealed from the table that the Nayakrishi farmers were achieved about 369% higher yield per hectare from potato, 43% from maize and 82% from lentil during this season at the same crop fields. Results show that the Nayakrishi farmers at the study areas were utilized their limited resources efficiently to get optimum output from potato + maize + lentil + coriander crops combination in this season compared to previous season.

Though per hectare total cost was increased by 107% compared to previous season but the Nayakrishi farmers at Kushtia obtained more than 144% higher gross return per hectare from the same crop fields by cultivating the selected rabi crops combination. Average per hectare net profit was achieved as 192% and 128% higher than previous season both on full and cash cost basis respectively. Return per Taka investment on full cost basis was estimated as 2.09 during this season which is about 17% higher than previous season. Therefore, this rabi crops combination is still highly profitable compared to tobacco and it must be a matured technology of UBINIG for dissemination to the extend areas where tobacco grows intensively.

Economics of the Most Suitable Rabi Crops Combination at Cox'sbazar

Item wise break up of comparative cost and return per hectare of the most suitable rabi crops combination at Cox'sbazar is shown in Table 3. It revealed from the table that average per hectare cost of human labour, land preparation, seed and manure were increased at 13%, 31%, 21% and 24% respectively during this rabi season (2009-10) compared to previous season (2006-07) The Nayakrishi farmers at Cox'sbazar were achieved about 160% and 26% higher yield per hectare from the main crop potato and french bean respectively from the same crop fields than previous season.

The results indicate that the Nayakrishi farmers at Cox'sbazar were utilized their inputs properly and efficiently to get maximum output from the same fields during this season compared to previous season. Average gross return per hectare was increased at 79% than previous season whereas per hectare total cost was increased only at 37%. Both on full and cash cost basis, per hectare net profit was estimated as 124% and 56% higher from potato + french bean + felon combination practiced by the Nayakrishi farmers compared to previous season. From the above finding it can be deduced that potato + french bean + felon combination is still highly profitable compared to tobacco and it must

be a matured technology of UBINIG for dissemination to the extend tobacco growing areas of Cox'sbazar district.

Table 3. Comparative cost and return of the most suitable rabi crops combination at Cox'sbazar

Items	Cost (Taka/ hectare)		Increase(+) / Decrease(-) in Percentage
	Season :2006-07	Season : 1009-10	
	Potato+french bean+felson	Potato+french bean+felson	
Human labour:			
Family	22,432	15,750	
Hired	2,033	12,000	
Total :	24,465	27,750	(+) 13
Land preparation:			
Owned	1,960	2,733	
Purchased	2,823	3,549	
Total :	4,783	6,282	(+) 31
Seed:			
Owned	19,919	1,157	
Purchased	898	24,095	
Total :	20,817	25,252	(+) 21
Manure:			
Owned	5,018	4,672	
Purchased	-	1,546	
Total :	5,018	6,218	(+) 24
Irrigation:			
Owned	-	-	
Purchased	4,352	4,081	
Total :	4,352	4,081	(-) 6
Others (if any)	706	301	(-) 57
Interest on working capital (@ 7%)	210	798	(+) 280
Rental value of land: (for crop season only)	11,762	28,391	(+) 141
Total Cost (TC):	72,095	99,073	(+) 37
Total Cash Cost (TCC):	8,994	45,572	(+) 407
Yield of Crops (kg/ha):	5175 + 451 + 694	13457+567+303	(+)160/(+)26/(-)56
Price of Crops (Tk/kg):	17.12 + 36.31 + 38.98	18.0+45.0+45.0	(+)5 / (+)24 / (+)15
Gross Return (Tk/ha):			
Value of Crops	1,32,027	2,42,226	
Value of by-products	5,646	3,946	
Total :	1,37,673	2,46,172	(+) 79
Net Profit (Tk/ha):			
Full cost basis	65,578	1,47,099	(+) 124
Cash cost basis	1,28,680	2,00,600	(+) 56
Return per Taka Investment:			
Full cost basis	1.91	2.48	(+) 30
Cash cost basis	15.31	5.40	(-) 65

Economics of the Most Suitable Rabi Crops Combination at Bandarban

Comparative per hectare cost and return of the most suitable rabi crops combination at Bandarban is presented in Table 4.

Table 4. Comparative cost and return of the most suitable rabi crops combination at Bandarban

Items	Cost (Taka/ hectare)		Increase(+) / Decrease(-) in Percentage
	Season :2006-07	Season : 1009-10	
	Potato+french bean+felson	Potato+french bean+felson	
Human labour:			
Family	21,835	17,850	
Hired	2,569	8,700	
Total :	24,404	26,550	(+) 9
Land preparation:			
Owned	-	4,281	
Purchased	5,039	1,997	
Total :	5,039	6,278	(+) 25
Seed:			
Owned	9,781	1,174	
Purchased	11,584	25,603	
Total :	21,365	26,770	(+) 25
Manure:			
Owned	1,414	6,168	
Purchased	414	189	
Total :	1,828	6,357	(+) 248
Irrigation:			
Owned	-	1,009	
Purchased	3,088	3,025	
Total :	3,088	4,034	(+) 31
Others (if any)	-	512	-
Interest on working capital (@ 7%)	286	701	(+) 145
Rental value of land: (for crop season only)	15,808	29,933	(+) 89
Total Cost (TC):	71,817	1,01,142	(+) 41
Total Cash Cost (TCC):	12,267	40,026	(+) 226
Yield of Crops (kg/ha):	4297 + 267 + 138	13560+616+328	(+)216/(+)130/(+)138
Price of Crops (Tk/kg):	16.90 + 35.19 + 32.57	18.0+43.0+42.50	(+)7 / (+)35 /(+10
Gross Return (Tk/ha):			
Value of Crops	86,509	2,84,508	
Value of by-products	272	3,763	
Total :	86,781	2,88,271	(+)232
Net Profit (Tk/ha):			
Full cost basis	14,964	1,87,129	(+) 1151
Cash cost basis	74,514	2,48,245	(+) 233
Return per Taka Investment:			
Full cost basis	1.21	2.85	(+) 136
Cash cost basis	7.07	7.20	(+) 2

During 2009-10 rabi season, the Nayakrishi farmers at Bandarban were selected felon as an additional rabi crop in their crops combination. It shows from the table that all items of the cost per hectare of rabi crops (combination) cultivation were increased in the present season (2009-10) compared to previous season (2006-07). Average total cost per hectare was observed only 41% higher than previous season for cultivation of potato + french bean + felon combination. During the present season per hectare yield of potato, french bean and felon were estimated about 216%, 130% and 138% higher than previous season respectively. Results indicate that the Nayakrishi farmers at Bandarban were utilized their resources efficiently to get optimum output from the same crop fields compared to previous season.

Table shows that average gross return per hectare was observed as 232% higher than previous season. The higher gross return was mainly because of higher yield and higher price of crops obtained during the present season. The Nayakrishi farmers at Bandarban were achieved remarkable higher net profit per hectare both on full and cash cost basis respectively from the same crop fields compared to previous season (Table 4). The results indicate that potato + french bean + felon crops combination is still highly profitable than tobacco and as like as Cox'sbazar it must be a matured technology for dissemination to intensive tobacco growing areas of Bandarban district.

Economics of Tobacco Production at Different Locations

Cost and return per hectare of tobacco production at different intensive tobacco growing areas is presented in Table 5. Table revealed that the highest per hectare human labour cost was observed at Bandarban (Tk. 79,459) and the lowest at Kushtia (Tk. 42, 924) which is about 33% and 24% of the total cost of tobacco production respectively. The observed variation was mainly because of the variation in wage rate and labour use in the study areas. Among the three locations, average human labour cost was estimated to Tk. 65, 974/hectare which is about 30% of the total cost (Tk. 2, 21, 965/hectare). The second highest cost item was processing of tobacco leaves which was observed the highest at Cox'sbazar (Tk. 48, 066/hectare) and the lowest at Kushtia (Tk. 40, 172/hectare). Another remarkable cost item was chemical fertilizer application which is about 19% (Tk. 41, 166/hectare) of the total cost of tobacco production. Average per hectare rental value of land for tobacco cultivation was estimated the highest at Bandarban (Tk. 36, 021) and the lowest at Kushtia (Tk. 25, 319).

It reveals from the table that the total cost per hectare of tobacco was estimated to Tk. 2,21,965 and the highest at Cox'sbazar (Tk. 2,47,871) and the lowest at Kushtia (Tk.1,79,023). On an average, per hectare cash cost was observed the highest at Bandarban (Tk. 1,87,984) which is about 79% of the total cost of tobacco production. Though, the lowest total cash cost was observed Tk. 1,34,860 per hectare at Kushtia but it is estimated at 75% of the total cost of tobacco production.

Table 5. Cost and return per hectare of tobacco production at different locations

Items	Cost (Taka / hectare)			
	Kushtia	Cox'sbazar	Bandarban	Average
Human labour:				
Family	12,118	21,659	6,516	
Hired	30,806	53,879	72,943	
Total :	42,924	75,538	79,459	65,974
Land preparation:				
Owned	-	-	-	
Purchased	3,790	6,108	6,220	
Total :	3,790	6,108	6,220	5,373
Seed/seedlings:				
Owned	-	-	-	
Purchased	1,890	2,161	2,657	
Total	1,890	2,161	2,657	2,236
Fertilizers:	42,228	44,344	36,927	41,166
Insecticides / pesticides:	4,854	12,142	10,146	9,047
Irrigation:	4,564	9,645	9,417	7,875
Manure:				
Owned	117	415	803	
Purchased	1,297	712	-	
Total :	1,414	1,127	803	1,115
Drying/Curing				
Owned	1,102	2,121	-	
Purchased	39,070	45,945	42,596	
Total :	40,172	48,066	42,596	43,611
Others (transportation, stick, rope, medicine, etc.)	6,361	8,818	7,078	7,419
Interest on working capital (@ 7 %)	5,507	7,503	7,676	6,895
Rental value of land: (for crop season only)	25,319	32,419	36,021	31,253
Total Cost (TC):	1,79,023	2,47,871	2,39,000	2,21,965
Total Cash Cost (TCC):	1,34,860	1,83,754	1,87,984	1,68,866
Yield of Crops (kg/ha):	1775	2220	1898	1964
Price of Crops (Tk/kg):	102.00	120.00	125.00	116.00
Gross Return (Tk/ha.):				
Value of Crops	1,81,050	2,66,400	2,37,250	
Value of by-products	3,445	6,989	7,927	
Total :	1,84,495	2,73,389	2,45,177	2,34,354
Net Profit (Tk/ha):				
Full cost basis	5,472	25,518	6,177	12,389
Cash cost basis	49,635	89,635	57,193	65,488
Return per Taka Investment:				
Full cost basis	1.03	1.10	1.03	1.05
Cash cost basis	1.37	1.49	1.30	1.39

Table also shows that average per hectare yield of tobacco leaves was observed the highest 2220 kg at Cox'sbazar whereas the price of tobacco leaves was found the highest Tk. 125/kg at Bandarban. Average per hectare net profit and return per Taka investment on full cost basis was estimated as Tk. 12, 389 and 1.05 respectively. From the above findings it can be concluded that the tobacco farmers of the study areas obtained less profit from more cash investment.

Comparative Economics of Tobacco Production at Kushtia

Comparative cost and return per hectare of tobacco production in different seasons at Kushtia is presented in Table 6. It is obviously seen in the table that all items of cost per hectare of tobacco production were increased tremendously in the present season (2009-10) compared to previous season (2006-07). The tobacco farmers were used more chemical fertilizers, manures, insecticides/pesticides and irrigation water in the same crop fields during this season compared to previous season. As a result, per hectare average cost of chemical fertilizers, manures, and insecticides/pesticides were increased about 304%, 910% and 225% for producing tobacco in this season than previous season. On an average, total cost per hectare of tobacco production was increased more about 57 % at Kushtia in the present crop season at the study area.

Table shows that average yield per hectare of tobacco leaves was 1775 kg which is about 9 % lower than the yield of previous crop season. The results indicate that the tobacco farmers were got less yield per hectare from the same crop field in spite of used more chemical fertilizers, manures, insecticides/pesticides and irrigation water compared to previous season. The observed variation in yield at the same fields might be due to the adverse effect of the more chemical fertilizers, insecticides/pesticides applications as well as continuous cultivation of tobacco year after year at the study areas.

Although the yield of tobacco leaves were decreased but gross return per hectare was estimated to Tk. 1, 84, 495 which is about 45% higher than previous crop season. The higher gross return was mainly because of the higher price of tobacco leaves obtained in the study area and it was about 58 % higher during this season than previous crop season (Table.6).

But compared to previous crop season, average net profit per hectare was estimated as 60% and 12% lower both on full and cash cost basis respectively. From the above findings, it can be deduced that the productivity and profitability of tobacco at the same crop fields have been decreasing remarkably in present farming systems.

Table 6. Comparative cost and return per hectare of tobacco production in different seasons at Kushtia

Items	Cost (Taka/ hectare)		Increase(+)/ Decrease(-) in Percentage
	Season :2006-07	Season : 1009-10	
Human labour:			
Family	13,776	12,118	
Hired	14,862	30,806	
Total :	28,638	42,924	(+) 50
Land preparation:			
Owned	-	-	
Purchased	1,734	3,790	
Total :	1,734	3,790	(+) 119
Seed / Seedlings:			
Owned	-	-	
Purchased	1,871	1,890	
Total :	1,871	1,890	(+) 1
Fertilizers:	10,454	42,228	(+) 304
Insecticides / Pesticides:	1,494	4,854	(+) 225
Irrigation:	4,258	4,564	(+) 7
Manure:			
Owned	140	117	
Purchased	-	1,297	
Total :	140	1,414	(+) 910
Drying/Curing			
Owned	3,055	1,102	
Purchased	31,866	39,070	
Total :	34,921	40,172	(+) 15
Others (transportation, stick, rope, medicine, etc.)	4,396	6,361	(+) 45
Interest on working capital (@ 7%)	2,483	5,507	(+) 222
Rental value of land: (for crop season only)	23,479	25,319	(+) 8
Total Cost (TC):	1,13,868	1,79,023	(+) 57
Total Cash Cost (TCC):	70,935	1,34,860	(+) 90
Yield of Crops (kg/ha):	1952	1775	(-) 9
Price of Crops (Tk/kg):	64.50	102.00	(+) 58
Gross Return (Tk/ha):			
Value of Crops	1,25,878	1,81,050	
Value of by-products	1,768	3,445	
Total :	1,27,646	1,84,495	(+) 45
Net Profit (Tk/ha):			
Full cost basis	13,779	5,472	(-) 60
Cash cost basis	56,711	49,635	(-) 12
Return per Taka Investment:			
Full cost basis	1.12	1.03	(-) 8
Cash cost basis	1.80	1.37	(-) 24

Comparative Economics of Tobacco Production at Cox'sbazar

Comparative cost and return per hectare of tobacco production in different season at Cox'sbazar is presented in Table 7.

Table 7. Comparative cost and return per hectare of tobacco production in different seasons at Cox'sbazar

Items	Cost (Taka/ hectare)		Increase(+) / Decrease(-) in Percentage
	Season :2006-07	Season : 1009-10	
Human labour:			
Family	16,565	21,659	
Hired	31,013	53,879	
Total :	47,578	75,538	(+) 59
Land preparation:			
Owned	-	-	
Purchased	4,154	6,108	
Total :	4,154	6,108	(+) 47
Seed / Seedlings:			
Owned	-	-	
Purchased	3,234	2,161	
Total :	3,234	2,161	(-) 33
Fertilizers:	17,078	44,344	(+) 160
Insecticides / Pesticides:	4,520	12,142	(+) 167
Irrigation:	5,030	9,645	(+) 92
Manure:			
Owned	283	415	
Purchased	391	712	
Total :	674	1,127	(+) 67
Drying/Curing			
Owned	3,739	2,121	
Purchased	40,797	45,945	
Total :	44,536	48,066	(+) 8
Others (transportation, stick, rope, medicine, etc.)	5,841	8,818	(+) 51
Interest on working capital (@ 7%)	3,922	7,503	(+) 91
Rental value of land: (for crop season only)	19,998	32,419	(+) 62
Total Cost (TC):	1,56,563	2,47,871	(+) 58
Total Cash Cost (TCC):	1,12,054	1,83,754	(+) 64
Yield of Crops (kg/ha):	2886	2220	(-) 23
Price of Crops (Tk/kg):	68.36	120.00	(+) 76
Gross Return (Tk/ha):			
Value of Crops	1,97,314	2,66,400	
Value of by-products	2,580	6,989	
Total :	1,99,894	2,73,389	(+) 37
Net Profit (Tk/ha):			
Full cost basis	43,331	25,518	(-) 41
Cash cost basis	87,837	89,635	(+) 2
Return per Taka Investment:			
Full cost basis	1.28	1.10	(-) 14
Cash cost basis	1.78	1.49	(-) 16

Comparative Economics of Tobacco Production at Bandarban

Comparative cost and return per hectare of tobacco production in different seasons at Bandarban is presented in Table 8.

Table 8. Comparative cost and return per hectare of tobacco production in different seasons at Bandarban

Items	Cost (Taka/ hectare)		Increase(+) / Decrease(-) in Percentage
	Season :2006-07	Season : 1009-10	
Human labour:			
Family	42,468	6,516	
Hired	5,105	72,943	
Total :	47,573	79,459	(+) 67
Land preparation:			
Owned	3,345	-	
Purchased	1,706	6,220	
Total :	5,051	6,220	(+) 23
Seed / Seedlings:			
Owned	-	-	
Purchased	3,643	2,657	
Total :	3,643	2,657	(-) 27
Fertilizers:	9,190	36,927	(+) 302
Insecticides / Pesticides:	985	10,146	(+) 930
Irrigation:	6,680	9,417	(+) 41
Manure:			
Owned	1,656	803	
Purchased	-	-	
Total :	1,656	803	(-) 52
Drying/Curing			
Owned	-	-	
Purchased	21,751	42,596	
Total :	21,751	42,596	(+) 96
Others (transportation, stick, rope, medicine, etc.)	6,500	7,078	(+) 9
Interest on working capital (@ 7%)	1,945	7,676	(+) 295
Rental value of land: (for crop season only)	23,996	36,021	(+) 50
Total Cost (TC):	1,28,970	2,39,000	(+) 58
Total Cash Cost (TCC):	55,559	1,87,984	(+) 238
Yield of Crops (kg/ha):	1994	1898	(-) 5
Price of Crops (Tk/kg):	68.75	125.00	(+) 82
Gross Return (Tk/ha):			
Value of Crops	1,37,075	2,37,250	
Value of by-products	1,811	7,927	
Total :	1,38,886	2,45,177	(+) 77
Net Profit (Tk/ha):			
Full cost basis	9,916	6,177	(-) 38
Cash cost basis	83,327	57,193	(-) 31
Return per Taka Investment:			
Full cost basis	1.08	1.03	(-) 5
Cash cost basis	2.50	1.30	(-) 48

During 2009-10 crop season, per hectare human labour cost of tobacco production was observed as Tk. 79, 459 which is 67% higher than previous season. Like other study areas, the tobacco farmers used more chemical fertilizers, insecticides/pesticides and irrigation water at the same crop fields in this season compared to previous season. Table shows that per hectare processing cost of tobacco was estimated to Tk. 42, 596 during this season which is about 96% higher than previous season. That's why, per hectare total cost of tobacco production was observed as 85% higher than previous season at the study areas.

Though yield of tobacco leaves per hectare was found as 5% lower than previous season but gross return per hectare was estimated as 77% higher due to 82% higher price of tobacco leaves obtained by the tobacco farmers at Bandarban during this season. Table also shows that net profit per hectare of tobacco production both on full and cash cost basis was 38% and 31% lower than previous season respectively.

Comparative Input Use between Rabi Crops Combination and Tobacco Cultivation

Level of input use and comparison between rabi crops combination and tobacco cultivation at farm level is presented in Table 9. This table represents the average findings of the previous tables of different rabi crops combinations and tobacco cultivation during the present crop season at different locations.

It reveals from the table that average human labour per hectare for rabi crops (combination) cultivation was estimated as 231 man-days. On the other hand, for tobacco production it was observed as 415 man-day per hectare which is 88% higher compared to rabi crop (combination) cultivation. So, it can be concluded that tobacco is more labour intensive production system than rabi crops (combination) cultivation. Average human labour wage rate was estimated to Tk. 140 per man-day for rabi crops (combination) cultivation whereas it was about 21% higher (Tk. 169 man-day) in case of tobacco production. The observed variation in wage rate was mainly due to the continuous hard work was done by the tobacco farmers at the study areas. It is found from the study that the Nayakrishi farmers did not use any chemical fertilizer and insecticides/pesticides for cultivation of different rabi crops combinations. They used more manures (8641 kg/hectare) in their crop fields than tobacco farmers (2427 kg/hectare). It is seen from the table that the Nayakrishi farmers used about 89% own sourced manure of the total to increase the fertility of the crop fields. On the other hand, the tobacco farmers performed an average six times to apply insecticides/pesticides in their crop fields. Besides, the tobacco fields need more irrigation water compared to rabi crops (combination) fields at the study areas. But in case of rabi crops (combination) cultivation, incidence of pest and diseases were reportedly absent in the study areas and the Nayakrishi farmers were not found to apply insecticides and pesticides.

Table 9. Level of input use and comparison between rabi crops (combination) and tobacco cultivation during the present season

Items	Rabi Crops	Tobacco	Remarks
Human labour (No.): Family Hired Total :	114 117 231	110 305 415	About 88% higher human labour required in tobacco production compared to rabi crops (combination) cultivation.
Wage rate (Tk./man-days)	140	169	Tobacco farmers paid more than 21% higher wages per man-days for tobacco production than rabi crops (combination) cultivation.
Fertilizers (kg/ ha): Urea- TSP- MoP- SoP- DAP- ZnSO ₄ -	Nil	575 366 35 235 44 57	Tobacco farmers used excessive and imbalance doses of chemical fertilizers in their crop fields. But the Nayakrishi farmers did not use any chemical fertilizers in their rabi crops fields.
Insecticides/Pesticides(No):	Nil	6	Tobacco farmers performed an average six times to apply insecticides/pesticides in their crop fields. But the Nayakrishi farmers did not apply any insecticides/pesticides in their rabi crops fields.
Irrigation (No.):	3	5	More irrigation water (on an average five times) required in case if tobacco production than rabi crops(combination) cultivation.
Manures (kg/ha): Owned Purchased Total :	7594 1047 8641	970 1457 2427	The Nayakrishi farmers used more manures than tobacco production and they used about 89% manures from their owned sources.
Rental value of land: (for crop season only)	26,504	31,253	Rental value of land for tobacco production was found more than 18% higher compared to rabi crops (combination) cultivation.
Total Cost (Tk./ha):	1,01,301	2,21,965	Tobacco incurred more than 119% higher cost per hectare than rabi crops (combination) cultivation.
Total Cash Cost (Tk./ha):	48,665	1,68,866	Rabi crops (combination) cultivation required 71% less cash expenses than tobacco. So it is proved that tobacco is highly cash cost intensive crop.
Gross Return (Tk/ha):	2,50,457	2,34,354	More than 7% higher return achieved from rabi crops (combination) cultivation.
Net Profit (Tk/ha): Full cost basis Cash cost basis	1,49,156 2,01,792	12,389 65,488	The Nayakrishi farmers at the study areas obtained remarkable net profit from different types of rabi crops (combination) cultivation compared to tobacco production both on full and cash cost basis.
Return per Taka Investment: Full cost basis Cash cost basis	2.47 5.40	1.05 1.39	The Nayakrishi farmers got more return Taka 1.42 from per Taka investment by cultivating these rabi crops combinations compared to tobacco production.

The study also found that the tobacco farmers irrespective of locations did not follow the recommended does of chemical fertilizers. They used excessive and imbalance doses of Urea (575 kg/ha), TSP (366 kg/ha), MoP (35 kg/ha), SoP (235 kg/ha) DAP (44 kg/ha)

and Znso₄ (57 kg/ha) to their crop fields. These excessive does of chemical fertilizers might be a cause of decreasing yield rate of tobacco leaves at the study areas during this crop season. On an average total cost per hectare of rabi crops (combination) cultivation was amounted to Tk. 1, 01, 301 and tobacco incurred about 119% higher cost (Tk. 2, 21, 965/hectare) compared to rabi crops (combination) cultivation. Besides, the study also found that for cultivation of rabi crops (combination) required about 71% less cash expenses than tobacco production (Table-9).

Table also shows that more than 7% higher gross return per hectare was achieved from rabi crops (combination) cultivation than tobacco production. Average net profit per hectare of rabi crops (combination) cultivation both on full and cash cost basis was estimated higher compared to tobacco production. The result shows that the Nayakrishi farmers obtained higher return Tk. 1.42 from per Taka investment by cultivating rabi crops combinations than tobacco production. On the basis of the above findings it can be concluded here that the rabi crops (combination) cultivation at the study areas was more profitable compared to tobacco production.

Conclusion

The study was conducted in three major intensive tobacco growing areas of Bangladesh. The overall objective of the study was to assess the comparative economics of producing alternative combinations of different rabi crops by substituting tobacco in Bangladesh. The study revealed that an average human labour per hectare was required 231 man-days for rabi crops (combination) cultivation whereas it was 415 man-days for tobacco production. Besides, average labour wage rate was observed as 21% higher in tobacco production compared to rabi crops (combination) cultivation practiced by the Nayakrishi farmers at the study areas.

The study also found that the tobacco farmers used more chemical fertilizers, insecticides/pesticides and irrigation water in their crop fields during this season (2009-10) compared to previous season (2006-07). They did not follow the recommended doses of chemical fertilizers and used excessive doses of Urea, TSP, MoP, SoP, DAP and ZnSo₄ to get higher yield. But the observed yield per hectare of tobacco was lower than the yield of previous season at each of the locations. On the other hand, the Nayakrishi farmers used more than 89% own sourced manures of the total and achieved higher yield of rabi crops during this season than previous season. So, it can be concluded that the Nayakrishi farmers were utilized their inputs of production (land, labour, manure, irrigation etc.) more efficiently during this season compared to previous season. The study revealed that tobacco incurred more cash expenses in the whole production system. On the other hand, for cultivation of per hectare rabi crops (combination) required 71% less cash expenses than tobacco. Average total cost per hectare of tobacco was estimated about 119% higher during this season compared to rabi crops (combination) cultivation.

Due to higher yield and prices of rabi crops, the Nayakrishi farmers obtained higher gross return per hectare during this crop season than previous season. Both on full and cash cost basis, the Nayakrishi farmers achieved remarkable net profit per hectare from rabi crops (combination) cultivation compared to tobacco production. They also obtained higher return Tk.1.42 from per Taka investment of rabi crops (combination) cultivation than tobacco at the study areas.

From the findings of the study it can be concluded here that profitability of producing alternative combinations of rabi crops practiced by the skilled Nayakrishi farmers are still attractive and any other farmers of the study areas can easily earn more profit with less cash investment from these types of rabi crops (combinations) by substituting tobacco in Bangladesh.

Recommendations

- More concentration should be given for strengthening of the linkage between the researchers of UBINIG and DAE extension personnel due to accelerate the dissemination of new evolved technologies of UBINIG (different rabi crops combinations practiced by the Nayakrishi farmers) to the intensive tobacco growing areas of Bangladesh.
- Now-a-days, the market price of all types of pulses, beans, peas and spices are very high. So, more crop combinations including those types of rabi crops should be developed and trialed by the UBINIG research personnel at the intensive tobacco growing areas of Bangladesh.
- Training programme on comparative economic profitability between different rabi crops (combinations) cultivation and tobacco production should be organized by UBINIG authority for the tobacco farmers so that they can easily realize the actual benefits/profits are achieved by the Nayakrishi farmers at the study areas.
- Continuous mono-cropping of cereal crops is causing deterioration of soil fertility and quality. There are greater opportunities to break the cereal mono-cropping and to increase income per unit of land by cultivating those rabi crops (combinations) practiced by the Nayakrishi farmers under the crop diversification programme. Because, crop diversification provides continuous income and variety of food items for family consumption.
- Tobacco cultivation area is increasing tremendously from the past few years. Therefore, cultivation area of tobacco should be fixed by the government such as no three or two cropped area of the country will be used further for tobacco cultivation.
- Most of the rabi crops are perishable by nature. So, effective and efficient marketing system of rabi crops should be developed by the government immediately. In other words, institutional arrangements should be made to establish sufficient linkage between production, processing and marketing in rural areas.
- Not only paddy, rice and wheat, most of the rabi crops of the country should be included in government 'price support programme'. Besides, storage facilities for all types of rabi crops should be increased rapidly both in public and private sector.

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