Study Number Eleven

Tanu Integrated Agriculture Farm: An Indication for Future Agriculture in Bangladesh

Introduction

World leaders largely are at a loss in meeting the challenges of food security and reducing climate change. Most affected are economically disadvantaged countries like Bangladesh, which is one of the four most climate vulnerable countries in the world. Today's technocrats are introducing hybrid and GM crops to combat food security and climate change. As a result large corporations often take over the control of agriculture from small, independent farmers. Although technological interventions are necessary to increase agricultural productivity, it has been shown that the green revolution technologies have not benefited the majority of poor farmers nor produced the safe and nutritious food necessary for food security. It has been proven in America and Europe that the farmers get only one-tenth of the profit from modern agriculture. Since the farmers are feeding the entire population, we must reform our existing agricultural production and marketing system.

For generations, our agricultural production system has been an integrated system, including fish, poultry, livestock, timber, medicinal plants, fruit, vegetables and other food crops as well as non-food cash-crops. Mainstream policy makers consider traditional farming as unproductive subsistence farming and envisage replacing it with monoculture-based agriculture without consideration for the ecosystem, environment, biodiversity or culture. They promote the introduction of foreign agro-technologies, which are thought to increase the food production in order to feed the nation. As a result, the gap between the rich and the poor increases. By blindly increasing purchasing power to ensure food security, the rich consume irrationally while the majority of people go hungry. As an alternative, the Tanu Integrated Agriculture (TIA) farm may be a model for the policy makers and farmers to determine the future of sensible and sustainable agriculture as a means to combat food security and climate change.

Study Area and Conditions

The farm selected for this study is located in the village of Arajipalashbari at the bank of the dying river Dharala which is 2.5 km from the centre of Kurigram town.

The area is well-known as a Monga (seasonal famine) affected area where the people do not have food and livelihood security. Very low productivity of the soil, flash flooding and drought are common in the area. A few decades ago the major crops of this area were cown (a type of grain), jute, mustard, lentil, and the local varieties of aus and aman rice. The farmers used to cultivate a mixture of aus and aman rice named Malshira and Ganjia which tolerates flood conditions. The crop yields were low. The farmers could make only a small profit from selling their major crop, jute, due to its low price on the world market. Without additional financial resources, the farmers could not adapt to the new high yielding technologies. As a consequence, many sold their land to the moneylenders of the township who, in turn, introduced monocultures of such crops as potatoes and maize to maximise their profits. Unable to keep pace with the changed situation, farmers left farming to become van drivers and rickshaw pullers or even agricultural laborers in their own fields. This change in agriculture practices increased the severity of Monga in the area. The government and various NGOs have initiated programs to combat Monga and have had some success in ensuring the availability of food and in increasing personal income. However, the sustainability of these programs is questionable. Today, a lack of education, poor health and unacceptable hygiene prevail. Other problems include high rates of population growth, early marriage, excessive dowry demands, and violence against women.

Objective

The main objective of the study is to verify the viability of the TIA farm as an alternative in combating climate change and food insecurity. A second objective is to evaluate the socio-economic and cultural impact of TIA-farming including the effect on soil, the environment, biodiversity and the ecosystem.

Description of the Activities of the Farm

Khandakar Musaddek Al-Mamun established his integrated farm, in defiance of the monoculture approach to farming, that has become

prevalent in the country due in large measure to government policies. As an agricultural graduate, he realized that integrated farming is necessary for the survival and sustainability of farmers. He observed that many farmers, especially the "modern" farmers were making huge profits from their monoculture farming of such crops as fruit, fish, poultry, livestock, maize, and potatoes. He determined that this trend realizes large profits for a few people in the short term but does not offer longterm sustainability. He further observed that the consumers prefer local fish, seasonal traditional fruit, and local poultry to the foreign species introduced by "modern" farming practices. He realized that local, traditional farming is more sustainable.

By trial and error, Mamun determined which crop varieties and technologies were best suited to the area. In 2005, he acquired ten acres of land and planted crops in two acres. Next he established ponds. When he completed his first pond in 2006, he started fish farming and fruit gardening on the land that was raised with the excavated earth of the pond. By 2009 the preliminary phase of his project was finalized. The land utilization for that area is presented in Table-1.

Table-1: The Land utilization of the Farm

Items	Land area	
	Decimal	Acre
Plantation	200	2.00
Bamboo	33	0.33
Pond	450	4.50
Fruit garden	400	4.00
House/shed/open space	60	0.60
Crop field	300	3.00
Total:	**1443**	**14.43**

Soil is the key element for sustainable farming. Due to the sandy nature of the soil and the frequent flooding, productivity was low. Mamun developed the land of his farm in a planned way. He elevated about five acres of land above flood level for fruit gardening and for building farmhouses, cowsheds, poultry and duck houses and other needed structures. He improved the soil texture by mixing the excavated sandy and clay soil while digging his ponds. He further improved the soil by regularly spreading cow dung and water hyacinth. Now, the soil is fertile for growing almost all crops.

Present Components of the Farm

1. Plantation

To ensure the sustainability and profitability of his farm, Mamun planted more than 4000 trees from about 40 different species of local timber, primarily, neem and bamboo. Neem and bamboo can be used in many different ways. Their multipurpose utilization makes them valuable. He planted the trees in a planned way by mixing species to realize the maximum utilization of his limited space.

2. Fruit Gardening

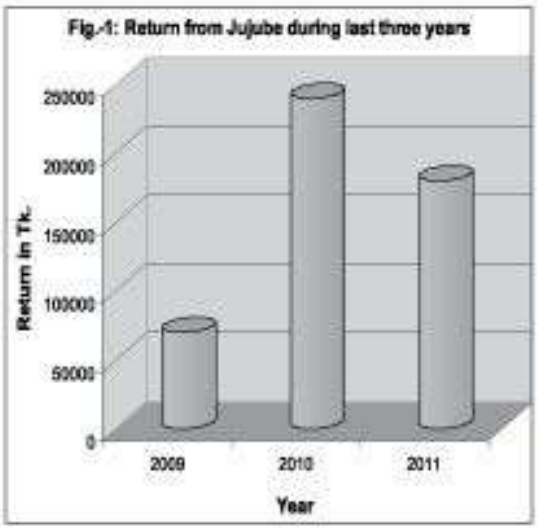
Fruit gardening is another major improvement on Mamun's farm. While many farmers in other parts of the country replace traditional fruit trees with fast growing and therefore more profitable timber, such as eucalyptus and acacia, and monocultural fruit trees, such as Baukul and Applekul, Mamun planted many different kinds of local fruits. These fruits were for both family consumption and commercial purposes. The list of the fruit trees on the farm is presented in Table-2.

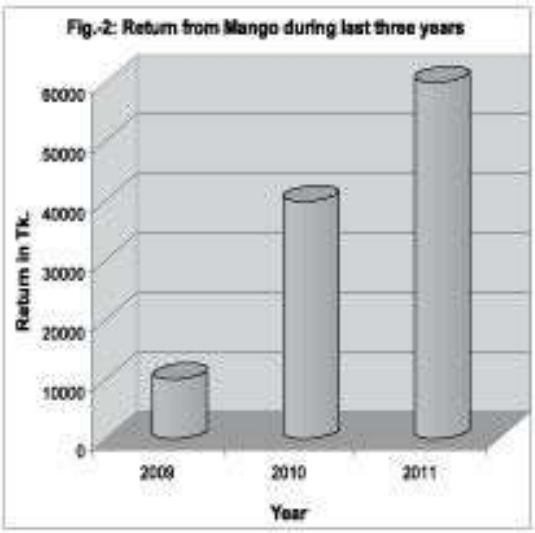
Table-2: List of fruit trees of the farm

Name of fruit	No. of plants	No. of varieties		Name of fruit	No. of plants	No. of varieties	
		Traditional	Modern			Traditional	Modern
Banana	700	3	0	Olive	5	1	0
Mango	350	18	5	Aonla	2	1	0
Jujube	500	2	4	Hogplum	2	1	0
Papaya	370	3	0	Palm	5	1	0
Guava	30	5	0	Date palm	50	1	0
Litchi	120	2	2	Velvety apple	2	1	0
Jackfruit	80	4	0	Carambola	2	1	0
Sapota	1	1	0	Lemon	20	5	0
Black berry	10	1	0	Pomegranate	10	1	0
Wax apple	10	1	1	Indian elellenia	3	1	0
Elephant's foot apple	5	1	0	Rose apple	1	1	0
Wood apple	10	3	0	Wood litchi	2	1	0
Bullock's heart	5	1	0	Orange	1	0	1
Coconut	30	3	0	Sweet orange	2	0	1
Betel nut	100	1	0	Oil palm	50	0	1
Total	**2321**	**49**	**12**	**Total**	**157**	**16**	**3**

Out of the 350 mango plants more than 200 plants are of a popular but endangered local variety named Harivanga. The 120 litchi plants are of the three varieties China-3, Bombay and Muzaffari, and the 500 jujube plants are of the varieties BAUKUL, Applekul, Taiwanikul,

Naricalikul (a local endangered variety). He plans to produce and market commercially all the fruits. Mamun's orchard is the first and only commercial fruit garden in this area. Mamun is the first and so far only supplier of endangered, local mango varieties named Harivanga, Kupahari and Kapilbangri. Mamun plans to save further indigenous varieties of fruit that are under threat of extinction due to the aggressive, commercial production of timber trees and the importing of exotic fruits such as oranges, grapes, and apples.





Mamun utilizes the grafting method in his orchards. He practices cleft grafting: a scion (a tender branch of plant of desired variety) is grafted with a stock seedling or stock plant. The grafted trees usually ensure a better fruit quality and usually take only three years to give yield while fruit trees grown from seedlings take more time before harvesting. In Mamun's orchard harvesting of mango, litchi, jujube, guava, and jamrul (wax apple) started three years ago. The returns from jujube and mango are presented in Fig.1 and Fig. 2 respectively. These returns from jujube and mango are increasing very rapidly, though in 2011 the jujube harvest was reduced due to unfavourable weather. In 2011 Mamun ran the farm profitably because of the diversity of his crops; he made a good profit from mango and papaya that year. Had he had a monoculture of

jujube, it would have been very difficult for him to survive. Other commercial fruit gardeners suffered huge losses from cultivating only jujube that year. Mamun's farm is a profitable enterprise but since it has great plant diversity it can also be considered a rich centre for germplasm. He maintains this diversity to combat the threats of climate change and to fulfill the consumers' food demands throughout the year. With his success he created employment for permanent labors throughout the year.

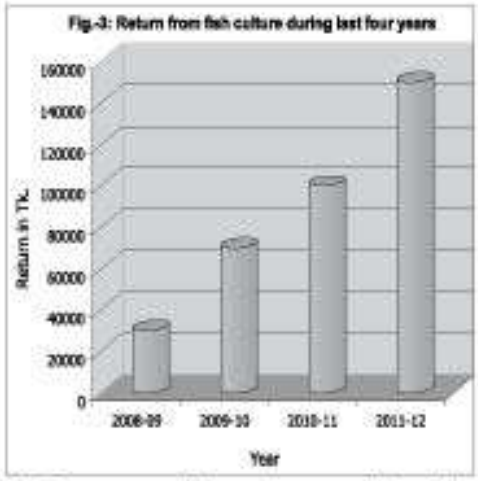
3. Nursery

Mamun has established a small-scale nursery to meet his own demand for saplings. Concurrently, he can supply saplings to others. Learning about Mamun's success from a television report, a farmer from Dinajpur District ordered 2000 mango saplings. The quality of Mamun's saplings and his generous advice attract many new customers.

4. Medicinal Plants

Mamun also cultivates medicinal plants. He started with mother plants and is gradually extending the commercial production. At present, there are 29 kinds of medicinal plants on the farm including Neem, Amlaki, Hartaki, Bohera, Arjun, and Tulsi. Mamun plans to supplement his produce with additional medicinal plants.

5. Fish Farming



Fish farming can be an important component of integrated farming. The Bangladesh fish sector has been separated from the agriculture sector by the policymakers, as a result of the government's policy, which favors monoculture. Fishing is a vital protein source in Bangladesh. There has been a significant growth of the fish sector during the last decades, which has contributed considerably to the GDP of Bangladesh.

Over the years, the species of natural fish have diminished, due to water being contaminated with agro-chemicals, water diversion of irrigation schemes and water scarcity caused by climate change. The present trend in fish farming is toward the monoculture of a few exotic fish varieties like Talapia and Pangus. These are diminishing the traditional crop land which is being replaced with ponds. The huge amount of external fish food which is often supplemented with antibiotics, makes this effort more tenuous for the farmers, whilst fish feed companies are making large profits. Mamun has resisted this course because he thinks that, although it might be profitable on a short term basis, it is not sustainable in the long run. Intensive fish farming with purchased fish feed requires huge investments with uncertain returns. Actually, the consumers do not like to eat the exotic fish. Mamun's farm integrated fish production is an excellent example that shows that, with a certain pond management, traditional fish farming can be made profitable. His profit from fish farming is shown in Fig. 3 in previous page. The graph indicates that the return increases consistently when the fish are fed with farm byproducts such as cow dung and mustard oil cake. At present, he produces a mixture of new varieties and traditional fish such as Rui, Katla, Mrigel, Silver carp, Carfu, Sarputi, Taki, Puti, Chela, Shoal, Shing, and Magur.

6. Livestock

Livestock is another important part of an integrated farm, not only for the profitability but also as a source of cow dung for plant fertilization and fish feeding. At present, there are eight cows and eight calves on Mamun's farm. The cows are primarily local species, which are best adapted to the local climate and environment, and a few crossbreeds. In 2005 he started with a male and a female calf costing him BDT 12,000. After one year, he sold the male for BDT 13,000 and from the remaining cow he has received four calves so far. Subsequently he purchased two more cows. His total investment in cattle was BDT 100,000, which resulted in livestock worth more than BDT 300,000. This amount does not include the income from milk and cow dung. He is also raising five goats, valued at BDT15000. He needs to purchase

very little additional feed for the cows and goats since they mostly eat the byproducts of the farm. Importantly, the animal husbandry also creates work for his permanent laborers throughout the year. He also plans to raise local poultry, duck and pigeons in the near future.

7. Vegetables and other field crops

Mamun is producing vegetables on a small scale on his limited land. This year, he has cultivated carrots on only 35 decimals of land. From these he has grossed BDT 45,000 from an investment of BDT 12,000, plus the labor cost. Area farmers cultivate selected vegetables based on market demand with the goal of maximum profits. Mamun selects vegetables considering not only the market but also environmental aspects like soil and climate as well as the fodder needed for his livestock. This year farmer Mamun cultivates lentils, rice, and mustard mainly for family consumption and to obtain byproducts for his farm. From mustard he mainly produces oil for his family and the mustard oil cake is used to feed his fish and cows.

Likewise, he cultivates lentils and rice for his family, his livestock and fish. He also grows onion, garlic, and turmeric, carefully planning and using appropriate technologies and timing. Further he cultivates jute. This year, he got a very good price for his jute because of his timely sowing and harvesting which resulted in a high quality crop yield. For his field crops, he selects high yielding modern varieties developed by the research organizations of the country, uses quality seeds and applies improved organic management techniques that give him the best yields at the lowest production cost. He follows the best-fitted cropping patterns, always considering the soil and climatic condition of this area.

Marketing system

The existing marketing system is one of the biggest challenges for the farmers, because they often do not get a profitable price for their products. Middlemen are taking a disproportionate part of the profit generated from agriculture. The present market system has little affect

on Mamun. Because of proper planning and his negotiation strength, he has more control over the middlemen. This year the price for onion and garlic is very low, and some farmers can sell them only with a loss. Mamun will store his onion and garlic harvest until the price has increased again after the harvesting season. His good market assessment and storage capacity is an important base for his economic success. As much as possible he uses his direct linkage to the consumers, who prefer his products of better quality. This linkage between Mamun and the consumers results in benefit and satisfaction for both. Consumers get better products at lower prices than in the market. His wife is playing an increasingly important role in community marketing. She knows the women of surrounding families and has their confidence. She plans to get involved in food processing and wants to establish a shop in the town. Some of Manun's fruits are going abroad with the help of trusted middlemen, who get a reasonable share of the profit. He avoids serving the co-called syndicate market with its exploitive mechanism.

Income-expenditure analysis

It was very difficult to calculate the economy of an integrated farm, mainly due to the complexity of the many components and the difficulty in maintaining proper records. Table 3 gives an estimated calculation of income and expenditure for 2011. The figures presented in the table indicate that the total return of the farm during the year 2011 was BDT 817,000 against an investment of BDT 680,900 giving a net profit BDT 136,100. These results do not include the food produced for the own consumption.

The initial cash investment is presented in Table 4 and a projection of future values, based on the major fixed assets of the farm, are given in Table 5. The tables indicate that the farm is going to be very profitable in the long run thus ensuring its sustainability. The land was purchased for BDT 560,000 between 2000 and 2010. Within a very short time the value of the land will increase to at least BDT 12,000,000 mainly due to the increasing productivity of the land. After five years the value of the

Table-3: Income-expenditure and profitability of the farm during 2011.

Items	Quantity	Expenditure (BDT)	Income (BDT)
Fish farming	3 ponds	50000	150000
Mango	350 plants	20000	56000
Jujube	500 plants	30000	180000
Papaya	70 plants	5000	62000
Banana	500 plants	20000	50000
Guava	30 plants	1200	40000
Litchi	120 plants	6000	3000
Jackfruit	80 plants	3200	0
Rice	33 decimal	2000	10000
Jute	33 decimal	5000	16000
Lentil	60 decimal	5000	10000
Carrot	35 decimal	12000	45000
Sweet gourd	pond side	1500	5000
Bamboo	30 decimal	1000	20000
Nursery	10 decimal	30000	50000
Livestock rearing	16 animals	75000	0
Livestock (sale)	3 bullocks	0	90000
Milk	3 cows	0	20000
Goat sale	2 goats	0	10000
Total		**325900**	**817,000**
Permanent labour	7 labours	325000	
Temporary labour	200 man-days	30000	
	Total cost:	**680,900**	
Net profit during 2011: BDT 136100.			

land is expected to be BDT 15,000,000 and after ten years it should be BDT 18,000,000.

Table-4: Initial Cash Investment

Items	Amount (BDT)
Land purchase	560000
Pond digging	800000
Saplings purchase	200000
Irrigation facilities	50000
Shed building	95000
Cow purchased	100000
Goat purchase	3000
Total:	**1,808,000**

Considering the other fixed assets, including timber trees, cows and goats, the table shows the present value of the farm as BDT 8,306,000, which will increase to at least BDT 12,580,000 and BDT 16,825,000 after five and ten years respectively. These figures do not include the family's own consumption and the consumption of the farm's permanent laborers, who get a considerable amount of food from the farm in addition to their payment.

Table-5: Projection of profitability of the farm after 5 and 10 years considering a few items. Figures are in BDT.

Items	Quantity	Rate	Total	Rate after 5 yrs.	Total after 5 yrs.	Rate after 10 yrs.	Total after 10 yrs.
Land with pond	15 acres	800000	12000000	1000000	15000000	1200000	18000000
Timber Plant	4000	2000	8000000	3000	12000000	4000	16000000
Cow	8	25000	200000	40000	320000	50000	400000
Calf	8	12000	96000	30000	240000	50000	400000
Goat	5	2000	10000	4000	20000	5000	25000
Total excluding land value:			8306000		12580000		16825000
Total including land value:			**20306000**		**27580000**		**34825000**

Impacts

The overall in impacts of the farm are described below:

i. Employment Generation and Food Security

At present seven laborers (four males and three females) have permanent employment on this farm throughout the year while other temporary workers have at least 200 person-days of employment during the harvesting seasons. This fact has contributed substantially in mitigating Monga in the area. Integrated farming ensures employment throughout the year, which is vital for Monga affected people. The work and the farm products that laborers and their families obtain free of cost from the farm improve the food security in the region.

ii. Environmental and Ecological Impact and Climate Change Mitigation and Adaptation

Mamun's farm is in a disaster prone area and climate change has intensified the vulnerability of the people of the area. Farmer Mamun has experienced climate-induced disasters for almost a decade. He has used these experiences to include proper adaptation strategies in managing his farm. The wide diversity of his farm is the key strategy in ensuring ecosystem-based adaptation. As a result, climate change induced disasters have had a reduced effect on the farm. Mamun has learned that if the climatic conditions become unfavorable for one

product, they often become favorable for another. For example, if excessive rainfall damages a fruit garden it can enhance fish farming and vice versa. The wide diversity of the farm is the key strategy for adapting to climate change as well as building food security. Climate change induced disasters like floods, droughts, disease infestation and insects do not affect the farm significantly because of its planned structure. Parts of the land have been elevated above flood level with the excavated material of the fish ponds which reduces the flooding of the farm. Other adaptation strategies include integration of the farm components, adoption of appropriate technologies, and proper risk management. The number of birds, wild animals and insects has significantly increased on the farm, indicating a revival of the previously destroyed ecosystem and the biodiversity of the area. Soil conditions have also improved. The planting of fruit trees has also had a positive impact on the environment and contributes to climate change mitigation.

iii. Socio-cultural impacts

Mamun's success has built trust, respect and support for him from the neighboring farmers. He is a source of experience and advice. The good relationship with his neighbors has been strengthened with his emphasis on community marketing. This strengthening has a ripple effect, bringing the wider community closer together with a sense of sharing and solidarity. Mamun readily admits that the learning process has been mutual, that the experience of his colleagues also has expanded his knowledge and skills.

iv. Gender Development

At present ten family members, six men including Mamun and four women, work on the family farm. Questionable is that Mamun pays women less than men on his farm, as is common throughout Bangladesh. However, with permanent employment throughout the year women benefit from Mamun's integrated farming. Women are more respected in their families with the experience that they gain on Mamun's farm, which increases their opportunity for decision-making.

Recognition so far

The success of Mamun's farm has motivated the people in the surrounding communities. Researchers and the media are interested in his successful experiences. Local and national print and electronic media have covered stories. One media outlet labeled the farm the, "Green Revolution in the Char". Recently, Dr. M. A. Rahim, professor of Bangladesh Agricultural University, visited the farm with some colleagues and recognized its success as extraordinary. Mamun has been awarded the designation 'Local Food Hero' by the Campaign for Sustainable Rural Livelihood (CSRL) for his contribution to food security and climate change adaptation.

Limitations

However, Mamun's farm faces some difficulties and challenges, which are as follows:

- During monsoon, the farm on the char is disconnected from the mainland and has no road access. However, Mamun is planning to construct a narrow dam with an earth road to assure an all-season road access.
- There is no electricity on the farm. An environmentally friendly electricity system is needed to improve the working conditions on the farm.
- The immense work on the farm limits proper records keeping. Also the financial management is weak. There are no skilled administrative staff available nor any administrative support from the government.

Future Plan

Mamun has further plans to expand his enterprise such as the keeping of indigenous poultry, fish-duck mix farming (duck farming in fish-ponds and adjoining water bodies), processing and marketing of medicinal plants, honey production, improving and expanding the food processing and marketing systems with new outlets, establishing a biogas plant, and adapting modern organic farming technologies.

Conclusion

This farm was developed by a farmer of Bangladesh who has experienced the country's problems in agriculture The farm's diversity of fruit, fish, vegetables, and other crops is unique and remarkable. The major motivation for Mamun was security for his family and interest in successful marketing his products. He became a farmer when other farmers were struggling to survive in this agro-based country, which faces the difficulties of Monga, flooding, climate change, and a highly volatile market. Although the small holders supply most of the nation's food, they have the least food security. Originally, Mamun was not a farmer, but he acquired skills and know-how to develop a model for the many farmers who are victims of corporate agriculture. Mamun's farm is a model for the policymakers in promoting food security by learning from Bangladesh's tradition of environmentally and ecologically sound integrated farming. It is a viable alternative to the monoculture-based, "modern" agriculture. Mamun's farming practices contribute to sustainable food security and reduce the threats of seasonal hunger (Monga) and climate change.