# Alternative Agriculture In Bangladesh
# A Study Of UBINIG, CDA, and PROSHIKA Programmes

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## EXECUTIVE SUMMARY

*"Sustainability is not a choice for humanity, it is the only long-term option"*

*-The World Watch I*

Farmers and various organizations in different parts of the world are attaching increasing importance o alternative strategy for agriculture for production of healthy foods and the regeneration of soil quality w has been degraded severely due to the "green revolution" practices. Sustainability of agricultural has also a major concern in Bangladesh in recent time.

In Bangladesh, some organizations are propagating different types of alternative agriculture. Among t UBINIG has started a natural farming programme named "Nayakrishi Andolon (Ecological Agricultu CDA is calling it "Regenerative Agriculture" and PROSHIKA has named its programme as "Ecolo Agriculture or Alternative Agriculture". The Environment Group at BRAC undertook a quick study on or agriculture or ecological agriculture introduced by the three above organizations in Bangladesh.

**Objectives and Methods:**

The objectives of this study were to

a) generate information on alternative agriculture /ecological agriculture practices in Bangladesh
b) investigate the success and weaknesses of the alternative agriculture/ ecological agric programmes of selected organizations in Bangladesh.
c) explore the possibilities of BRAC introducing alternative agriculture/ ecological agricultur its Rural Development Programme as an environmental initiative.

This study was conducted in a short time, from mid- September to mid- October 1997. The principal investi tools were interviews and discussions with (i) Persons related to the programmes of the three organisation Farmers, and (iii) Villagers organised by Proshika, CDA, and UBINIG. Field observations of programme conducted to provide first hand information on the programme's environmental impacts and socio-ecc consequences. A literature review was also used to provide a basic knowledge of the ecological agric alternative agriculture and it's status elsewhere.

**Programmes of the three organizations:**

The study covered the alternative agriculture programmes of three nongovernmental organisati Bangaldesh: UBINIG, CDA and Proshika.

**UBINIG**, primarily a policy research organization, started its "Nayakrishi" programme in 1988. B 1997 it had implemented Nayakrishi projects in 24 districts. Out of these, activities in 130 villages un districts are being directly supervised and monitored by UBINIG. In the rest of the areas, farmers trai UBINIG are themselves carrying out the projects. Of the total 130 villages, all the farmers of 13 villa practicing ecological agriculture. UBINIG calls these "Nayakrishi village". Total area covered b projects is 2669.96 acres. According to UBINIG, Nayakrishi is an "Andolon" or movement of the farn Bangladesh to produce healthy food, healthy environment and happy life.

**CDA**, began a project in Dinajpur district called "Landless Farmers Development Programme" in 198 name of the programme has since been changed to "Regenerative Agriculture". Its main focus is on la integrated land use. Some 150 farmers of Dinajpur district are involved in this project. Most of the farn

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using 10 to 30 decimal of their land for vegetable or nursery project and 33 to 66 decimal of land for rice cultivation.

**PROSHIKA** started an organic vegetable cultivation programme in 1978 and organic rice cultivation in 1990. PROSHIKA's programme comprises three components: (a) agriculture, (b) homestead gardening, and (c) seed distribution. It supported 3,287 agriculture, 1000 homestead gardening, and 553 seed distribution projects during 1996 under its programme. Most of the farmers have 16 to 48 decimal of land under homestead gardening and 33 to 66 decimal under rice cultivation.

**Findings and Observations:**

In the visited areas (at Dinajpur, Manikganj and Tangail) farmers grow different kinds of seasonal vegetables, ginger, turmeric, fruits, flowers, rice, pulses, jute, sugarcane, wheat and nitrogen-fixing plants. All the three organizations propagate green manure. Hydrophytes (water lily, lotus, *Azolla, Lemna*, water hyacinth), *shon pat, meshta*, leguminous plant (pulses, *Cassia, dhaincha*, etc.) are used as green manure. For pest control, they use ash, *neem* powder, tobacco, jute seed, garlic, urine of cow. Marigold, lemon grass, mint, onion, are used as repellent to protect the crop from insect or disease. Cowdung, rice bran (*kura*), ash, oil cake, chicken and duck manure, leaf, green plant, weed, rice straw, household garbage are used to make different types of compost.

It was found that UBINIG was trying to conserve or revive the natural ecosystem or resources through its "Nayakrishi". The organization is practicing ecological agriculture at its training center and also motivating the farmers to practice it. "Nayakrishi" programme includes herbal medicine practice, collecting native medicinal plants, and native crop variety, and protecting wild animal (*Nungor*, Monkey, *Shojaru*, Squirrel etc.).

CDA is doing farmer centered research with its 150 farmers and is mostly concerned with soil conservation. CDA has no activity to conserve or promote native species of plants or animals.

PROSHIKA is trying to restore the original ecosystem through its ecological agriculture programme. This organisation does not propagate composting, tillage operation (ploughing the land), use of pesticides, etc. The PROSHIKA programme aims to promote agriculture as a natural forest ecosystem where no extra care is needed for growing vegetation. However it was observed that the situation was completely different in the field. In the programme village that was visited (Ghatail thana) farmers are reportedly using compost, doing weeding and tillage operation.

**Success and weaknesses of ecological agriculture:**

The farmers interviewed for this study pointed out the success and weaknesses of ecological farming according to their own perception. These are stated below.

**Success:** Farmers mentioned that they do not have problems using this agricultural system, since this was a traditional practice in Bangladesh. They pointed out that the quality of crops was good, it is disease free and it can be kept fresh for a long time without treating with any chemicals. Taste of the product is also said to be good, so it has more demand. Available information (project records and case studies: secondary source) relating to these programmes suggest that ecological agriculture is comparatively more profitable than inorganic agriculture. Respondents mentioned that some other small and big farmers were also following them. They seem to be happy with organic/ecological agriculture since it has reduced their work load (as it requires less ploughing, weeding, and no use of pesticide). Income has increased compared to the cost of growing crops, quality of food is better, and soil is regaining its fertility. Farmers of UBINIG said that they are

reducing the use of compost or green manure every year gradually. Moreover, organic/ecological farming environment friendly.

**Weaknesses:** Organic vegetable cultivation is not new or difficult, since farmers have been practicing this household consumption long before this type of programme was introduced. But organic rice growing is m complicated. Small farmers can practice it on their land, but large farmers or those who are not motiva practice chemical farming in the adjacent lands which may affect the organic farms. Organic crops that stated to be disease free can also be infected by pests from other land. Moreover, it is difficult to get materi (e.g. cowdung, oil cake, plant residues) for composting. The poor farmers can not afford to buy these materi or they use these materials for other purposes (e.g. fuel, fodder). Yield of rice may be higher in inorga agriculture, but the total return is less as the input (fertilizer, pesticides, ploughing, weeding, irrigation) co for inorganic farming is higher.

**Conclusion:**

Alternative agriculture/ ecological agriculture introduced by UBINIG, CDA and PROSHIKA seems to b significant step towards bringing back the original biodiversity and ecosystem, conserve the native gene p and enrich the self-fertility of the soil. However, the practice of ecological agriculture is still in an experimer stage. There is lack of research on bio-fertilizer and bio-pesticides. Few native leguminous plants are be used as green manure, though there are a lot of leguminous species in Bangladesh. There is lack of initiat from intervening organizations or farmers on practicing native crop variety.

Since most of the farmers are economically marginal, they do not take the initiative to do the experime Another observation is that ecological farming is successful, but it is still being done in a small scale. La scale practice is still absent except UBINIG's Nayakrishi village which could be an example of large sc organic rice cultivation. It is difficult for NGOs to extend an ecological/organic agriculture system on a la scale as their members are either landless or marginal farmers who do not cover much of the land in a villa Ecological agriculture is quite a slow process in terms of soil regeneration. So it would be difficult to s with large scale organic rice farming, as it might affect the food security of the poor.

This was a quick study which was conducted in limited areas of Manikganj, Tangail, and Dinajpur. Theref it is not possible to give precise recommendations or draw a clear conclusion. It is necessary to have an depth and comprehensive study on ecological agriculture for specific conclusions on prospects and large-s adoption of ecological agriculture in Bangladesh.

**Some tentative recommendations:**

a) **Social mobilization:** Many of the farmers are still not aware of the long term benefits of ecolo agriculture. There is a need for social mobilization to make a programme of ecological agricul successful.
b) **Research:** An in-depth investigation is needed to have a clear view about various issues relate organic/ecological agriculture in Bangladesh.
c) **Institutional cooperation:** NGOs and GOs should work together in promoting/experimenting ecological agriculture.
d) **Pilot experimentation** of alternative agriculture (both rice and vegetable) in a larger area may gen sound idea about how farmers can adopt this system.

## INTRODUCTION

### National and international perspective

Bangladesh, a predominantly agrarian economy, is characterized by small-scale, fragmented farming using non mechanized technology, and is one of the poorest and most populous nations in the world. Majority of the population lacks food security, as reflected in extreme poverty, widespread hunger and malnutrition. The land-man ratio is one of the lowest in the world. In a country like Bangladesh sustainable land use is of vital importance. Agriculture is the mainstay of majority of the population. It contributes to about half of the Gross Domestic Product (GDP) and employs two-thirds of the total labour force. However, high population growth offsets the increased agricultural production, thereby exacerbating the food deficit and poverty.

About 35 million acres of land are cultivated in Bangladesh of which 60% is in crop production (Huq & Rahman, 1994 in Env. And Dev. In Bangladesh). However, since the population is increasing, increases in food production must occur. Intensive and extensive cultivation increases cropage in the short term, but there is a cost to the natural environment and a decrease in yield in long term. Due to an ever-increasing gap between supply and demand of fuel wood, nearly 80% of agricultural waste and cowdung is being used for domestic purposes, which otherwise would have been recycled as organic manure. As a result, dependency on chemical fertilizers, pesticides, irrigation, and high yielding plants has been increasing, degrading the soil quality. A decline in land productivity has been caused by intensive cropping, indiscriminate use of fertilizers, continued use of irrigation and removal of bio-mass from agricultural fields. Fertilizers and pesticides are used inefficiently and indiscriminately with minimal or no controls. Pesticides and chemicals pollute waterways, air and soil, and poison the environment and reduce the genetic diversity of the plant population with the use of high yielding non-native plant species. Irrigation can also result in water logging of the soil and salinity.

Since the use of a number of persistent organo-chlorine pesticides appears to continue, the above effects can be expected to persist and even magnify in the long term. In the aquatic environment,

most of these pesticides will ultimately partition into sediments, leading to long tern contamination of benthic food webs. Furthermore, since some of these compounds are known t become bio-concentrated in food chains, effects on wildlife as well as humans, may also occu Many of the pesticides in use in Bangladesh are banned in the USA, Canada and EC membe states (William, 1996).

Although agriculture is, and probably to some extent must be artificial, it is still within the bound of nature and therefore under its limits. To reach sustainable food production for futur generations, agriculture has to follow the rules of nature. The current general recognition of th long term dangers of modern agriculture, and the realization of the problems in passing the limi of nature, has renewed interest in alternative methods of agriculture. All over the world, farmer organizations and movements, are trying to highlight an alternative strategy for agriculture base on sustainability and balanced ecosystem for the production of healthy foods and the regeneratic of soil quality which has been degraded severely by "green revolution" practices (Norgren, 1996

The 1996 annual report of World Watch Institute (Brown. *et al,* 1996) continues to descrit trends that will shape the future of the world. Thirty three key indicators during 1950-95 and a additional 12 new indicators provide a view of ecological, economic, and social forces affectir the world. The special new indicators include pesticide control, alternative agricultur environmental taxes, etc. along with other indicators.

Development Dialogue (Ayupon & Oliveros, 1992) reported that, due to government policy appropriating farm land for industrial development purposes, the Filipino peasant women faci economic displacement and degradation, are also witnessing the long-term effects of prolong exposure to the pesticides and chemical fertilizers that were forced upon them during the so-call Green Revolution. Increased rates of spontaneous abortions and stillbirths, as well as chro health problems, have been recorded. Biodiversity and soil fertility were threatened in the upla areas to which peasants were migrating. AMIHAN (the Peasant Women's Federation) is worki to end the use of chemical fertilizers and pesticides through integrated pest management and promoting alternative agriculture methods to restore soil fertility.

To address the issues of agro-ecosystem degradation and crop productivity concepts like 'organic', 'regenerative', 'biodynamic', 'ecological', 'alternative', 'natural', 'low-input', agriculture have been rightly or wrongly introducing contrasting 'high-input', 'maximum-production' and 'intensive agriculture'. However, all the terminologies do not cover the sustainability of agriculture in the strictest sense. 'Sustainable' agriculture involves the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of environment and conserving resources. The concepts as mentioned are now being the subject of discussion in almost all fora related to sustainability of agriculture and are being tried and promoted by some NGOs in Bangladesh like other countries.

According to the natural environment in different locations of the world as well as the socio-cultural and economic conditions, alternative agriculture strategies develop differently. There are different organizations adopting different type of alternative agriculture in Bangladesh. For example, UBINIG is calling their natural farming "Nayakrishi Andolon (Ecological Agriculture)", CDA is calling it "Regenerative Agriculture" and PROSHIKA is calling it "Ecological Agriculture (or Alternative Agriculture)". It is also sometimes called "Organic Farming or Agriculture". All of these practices promote a natural system of farming which was previously practiced in Bangladesh before the "Green Revolution".

BRAC, through the implementation of its multifaceted development programmes, has learned some important lessons related to development and conservation of the environment. From that learning, BRAC has set up an Environment Group (EG) to address the emerging environmental issues. The EG is expected to strengthen, and where necessary, to incorporate environmental dimensions into BRAC programmes. This is likely to help achieve the goal of sustainable development in Bangladesh as BRAC activities are spread all over the country. As a part of its environmental activities, the EG has taken this initiative to study Alternative Agriculture or Ecological Agriculture practice in Bangladesh.

## Principles or characteristics of Organic farming /Ecological Agriculture:

1. It will not destroy the natural environment/ ecosystem,
2. This type of farming will increase the health of the natural environment. Specifically it will;
    - Increase the self fertility of soil (regenerative nature),
    - Increase soil micro fauna and flora i.e. biodiversity,
    - Result in better quality food,
    - Improve the health of consumers,
    - Restore the native variety of crops and reduce the use of external high yielding variety (HYV) plants,
    - Reduce pests and diseases of crops,
    - Restore the ecological balance of the nature.
3. It will be sustainable.
4. Production capacity will be equal or higher and production costs will be lower than chemical agriculture,
5. It will have less dependence on external input than chemical agriculture. Specifically, it requires:
    - No machines. i.e. no cultivation,
    - No weeding by tillage or herbicides. Weed should be controlled not eliminated.
    - No dependence on chemicals,
    - No need to hold water for rice fields throughout the growing season.
6. This method of farming requires less labour and does not require the use of fossil fuels.

(Ref. Norgren. 1996; PROSHIKA Activity report, 1995-96 )

According to Diek van Mansvelt (1992), the different types of organic agriculture do not follow rigid rules and are not defined solely by the non-use of nitrogenous fertilizers and pesticides. One of the main principles of organic agriculture is to respect local soil and climatic conditions. Self-sufficiency regarding external factors of production and an emphasis on recycling and optimal use of natural resources were concept ahead of their time when they initially were introduced in the 1920s. The specialization which restructured agriculture over the past century has seriously

damaged the system of mixed agriculture and the chain of food production. The solution will be to seek for each region an appropriate balance linking animals and agricultural production in an organic process.

## OBJECTIVES

The objectives of this study are:

1. To provide information on Organic Farming/ Ecological Agriculture practices in Bangladesh.
2. To investigate the success and weaknesses of the Organic Farming/ Ecological Agriculture programmes of selected organizations in Bangladesh.
3. To explore the possibilities of introducing Alternative Agriculture/ Ecological Agriculture at BRAC into its Rural Development Programme as an environmental initiative.

## METHODOLOGY

This study of Alternative Agriculture was conducted from mid- September to mid- October 1997, to investigate the alternative agriculture programmes of three NGOs of Bangladesh: (a) UBINIG (Policy Research for Development Alternative), (b) CDA (Community Development Association) and (c) PROSHIKA Manobik Unnayan Kendra.

These organisations have introduced their programmes in different parts of the country. Their programmes in three districts namely : Dinajpur, Manikganj, and Tangail, were visited by the researcher for field observation. The UBINIG programme at Bishnopur and Hinganagar village of Tangail was visited, where there was a Training Center and *Nayakrishi* village. CDA activities at several villages at Rani Shankoil (Bhognagar, Debipur, Rampur, Rahampur), Kaharul (Kaharul, Mukundapur), Birganj, and Birol (Birol, Lakhsmipur, Betura) thana of Dinajpur district were visited. Koitta Training Center of PROSHIKA at Manikganj was visited, where there was a

demonstration plot of organic vegetable and rice cultivation. Kusharia village of PROSHIKA Ghatail was visited during this investigation.

## Data collection

Information was collected using a three pronged approach: (i) literature review, (ii) field observations, and (iii) interviews. The principal investigation tools were interviews and discussions with (i) persons related to the programme (ii) farmers, and (iii) village organization's group. Field observation of programmes provided first hand information on the programme's environmental impacts and socio-economic consequences. A literature review was also used to provide a basic knowledge on Alternative Agriculture topic and its status elsewhere.

Group interviews were held with semi-structured and most questions were open-ended. Interview questions were based on a checklist (appendix 1) designed to collect information and evaluate the successes and weaknesses of the programme. More precisely, the checklist focused on (i) objectives, (ii) description of activities, (iii) advantages and disadsvantages, (iv) environmental impacts, and (v) socio-economic impacts. In many instances, however, questions were omitted or added to the original checklist according to the experience of the interviewee(s). The information collected and analysed is qualitative.

## Limitations

Any study involving interviews and visual observations will be prone to biases, which may or may not affect the findings. Attempts were made to maintain a unbiased outlook when collecting information and conducting interviews. The methodology used presents the following limitations which have probably biased the findings of this study (i) Successful bias: it is likely that the farmer and village selected during investigation were among the best ones, (ii) Geographical bias: it is likely that geographical issues were omitted/neglected, since only selected areas were visited, (iii) Knowledge bias: time limitations affected the availability and reliability of data, as the researcher it was not possible to collect primary data and existing data did not cover all the required information, (iv) Organisatonal difficulties: some unavoidable circumstances did not allow field visits to other locations which would

have provided a whole view of Alternative Agriculture/ Ecological Agriculture in Bangladesh. However, it is difficult to calculate the extent to which the results of the study may have been affected. In spite of these restrictions, the information presented in this report is believed to maintain a creditable degree of precision in detailing the conditions and circumstances of the programmes.

## RESULTS

### ECOLOGICAL AGRICULTURE PROGRAMME OF UBINIG (NAYAKRISHI ANDOLON)

"Nayakrishi Andolon" in essence is a new way to relate with Nature, both metabolically and culturally. According to UBINIG, it is metabolic because our life activities in the external world are as biological as the internal processes of the body. In the same spirit it is cultural.

> Nayakrishi is an "Andolon" or movement of the farmers of Bangladesh to produce healthy food, healthy environment and happy life. In its simplest expression it is an act of "ananda", a happy way to enjoy life as an activity as well as an object of happiness among and within the members of the world of human and non-human beings, both organic and inorganic. The "ananda" or happiness is both material and cultural and must be grasped as a living experience of a social being within a community (Nayakrishi Andolon, 1996).

UBINIG is primarily an information source for the farmers, an interpreter in popular language of the available knowledge from science or other discourses.

In 1990 UBINIG conducted a major study with the farmers to understand farmers' perception of chemical agriculture. The result of the study provided an initial basis from which the Nayakrishi practice evolved. It was found that:

1. The fertility of the soil had declined alarmingly, decreasing yield from the land under "modern" methods of agriculture.
2. The health situation of women and children was terrible because of the use of pesticides and chemicals.

3. The fish population was declining in the water bodies and ponds both in quantity as well as in diversity. Most of the familiar local varieties of fish have disappeared. The frog population has also declined alarmingly. Farmers had even noticed that there were no leeches in the water any more.
4. Pest attacks to crops had increased.

**Principles of Nayakrishi adopted by UBINIG are as follows** (Noyakrishi Andolon. 1996):

1. Absolutely no use of pesticides.

   If necessary farmers use *neem* powder, old jute seed, datura leaf, *arjun* bark, light trapping.

2. No use or gradual decrease in the application of chemical fertilizers.

   Farmers use compost or green manure.

3. Multi-cropping, inter-cropping, mixed cropping, agroforestry and other familiar methods are used to retain and enhance soil fertility.

   The best method for pest management is conservation and constant regeneration of biodiversity. The practice of multiple cropping has become popular mainly for pest management and to maintain the health of the soil. Nitrogen fixing species of plants and trees are becoming familiar and farmers are eager to experiment with new species. They are constantly innovating new ways to increase the fertility of the soil, without "external" inputs. The ingenuity lies in recognizing the fact that soil will become "alive" if proper care is taken.

4. The practice of agroforestry and integration of fuel wood, fruit and various multipurpose trees along with rice and vegetable fields.

   Exotic or imported agroforestry species are generally rejected. The local species are used. Farmers are involved in various research to identify appropriate local species

5. Calculate total yield of a farming household and the material grains of the community as a whole through maintenance and enhancement of biodiversity.

   Total yield is not the quantitative productivity of a single crop, but includes crop production, input, loss of biodiversity and natural resources etc.

6. Livestock, poultry, semi-domesticated birds are part of the farming household.

   The combination of rice-duck, fish-duck or triple combination of rice-fish and duck are seen as potential ideas to study the inter linkage of Nature.

7. Priority is given to local varieties (breeds) of livestock, poultry and fish is given. Local varieties (breeds) are almost always economically advantageous and ecologically suitable.

8. Seeds and genetic resources must be conserved at the household and community level. Seeds and genetic resources should never get out of the hands of the farmers, particularly women. Resist privatization of seed, genetic resources and patenting of life forms.

**FIELD OBSERVATIONS - UBINIG**

UBINIG started this programme in 1988. By June 1997 UBINIG had implemented Nayakrishi projects in 14 districts in: Panchagar, Thakurgaon, Dinajpur, Meherpur, Rangpur, Chittagong, Kurigram, Habiganj, Shatkhira, Pirojpur, Rangamati, Jessore, Sunamganj and Gajipur. There are 13 Nayakrishi villages under this project, where all farmers practice Ecological/Organic agriculture. Two demonstration areas and one Nayakrishi village named Hinganagar were visited at UBINIG Tangail Project for this study. Activities involved in Nayakrishi projects are:

- Village nursery
- Community extension farmer's nursery
- Marketing (sale centers Shasshya Sundar)
- Compost preparation
- Fish cultivation
- Identification of natural resources of a village
- Training
- Cultural activities
- Nayakrishi campaign
- Research, documentation and information
- Community seed wealth centre (Beez Sundar)

*Gram karmi* (village worker) of UBINIG keep in touch with the farmers and extension farmers. Extension farmers work for Nayakrishi campaign, mobilization, motivation, seed collection, organize farmers at new areas, visit their fields, monitoring etc. They have a role in the policy making of Nayakrishi. No service charge is taken from the farmer by UBINIG or by extension farmers. They have a farmer exchange programme with other areas or countries to disseminate their experience, ideas and gather more knowledge from others.

Since the crops are adopted in their natural environment, there is less chance for pest attack and they can be preserved for a long time without any treatment or chemical use. Farmers and consumers mentioned that the taste of the food is better than chemical products. The demand for organic food in the market is greater than for chemical food. Production costs of crops are less, so the price of products are not higher than chemical products, except for brown rice, sugar and mustard oil which is more costly because of higher production costs (brown rice is husked by hand or *Dheki*; brown sugar preparation is complicated; and mustard is ground by manual grinders which produces lesser amounts of oil then electrical grinder).

In first year of practicing ecological agriculture, crop yield decreases, but it does not affect profit since the input is less than chemical farming. For example no irrigation, fertilizer, pesticides etc are needed, therefore there is no need to borrow money from the money lender at high interests This also helps the fish production and animal rearing since the water and fodder are free from pollution.

Farmers preserve seeds from their own crops. They preserve the seeds using indigenou knowledge (sealed/air-tight containers, sun-dry during rainy season, use *neem* powder etc.) Preservation is needed for seed viability and vigour and farmers prefer to preserve seeds for on year to get the best performance. Sometimes farmers collect good quality seeds from neighbor and there are seed committees to collect and exchange seeds. UBINIG farmers have collecte more than 80 native rice varieties.

Most of the land in the programme area is low land. The type of soil is clay, sandy loam and loamy. Crop are selected based on soil condition e.g. carrot, radish, beet in sandy loam soils and eggplant, tomato, chili in clay-type soil. Sometimes, nitrogen-fixing plants, fruits, flowers and vegetables are planted together.

**INTERVIEW AND GROUP DISCUSSIONS**

One Nayakrishi village was visited during this study, where all farmers in the village are practicing organic farming. Mrs. Naher, the wife of Mr. Mazibur Rahman Sikdar of Hinganagar Boro bari Village, has 200 decimals of land in crop field. She has been practicing Nayakrishi activities for five years. She believes that if chemical fertilizer is used for three years the soil will die *i.e.* soil will lose its self fertility and soil organisms will die. She did not have expected production before practicing Nayakrishi, even she increased the use of fertilizer from 1/4 *seer* to one *seer* per decimal land gradually. Production was decreasing every year even though the fertilizer and pesticide use was increasing. She has learnt how to prepare compost using banana plant, water hyacinth, rice straw, papaya plant, cowdung etc. The production of rice was less during the first year of practice but increased in the next year. In the low land (*beel*) area there are two crops (rice only) cultivated e.g. IR8, Boro, Aus/Aman. There is no need to use chemical fertilizer. There are a lot of hydrophytes (water lily, lotus, Azolla, Lemna etc.) in the field during flood/rainy season. Sometimes oil cake, compost are used in the field during the dry season. All of these hydrophytes and organic fertilizers make the soil fertile. Land of medium elevation can be used to cultivate 3-4 crops, e.g. rice, pulses, rice/jute, sugarcane, vegetable, wheat during the rainy and dry season. High land is used only to cultivate vegetable and fruits. Sometimes high land is used to grow green manuring crops (Dhaincha, shonpat, meshta, leguminous plant) and for the preparation of seed bed. They have not used irrigation water since practicing this Nayakrishi. As they mentioned, the plant has regained its natural resistant capacity, therefore pest can not attack them. There is no record of epidemic disease of crops.

Fish resources are increased in their wetlands since they do not use pesticides in the field. Fish diversity also increased (different kinds of local small and big fishes are available). They have no problem of fuel wood (since they have homestead garden, roadside plantation, green manuring

crops etc.), and can even sell to others. There is no need to buy pesticides, weedicides, or fertilizer. They have more free time and less work load (since they do not use pesticides or fertilizer they can save time). They are also practicing herbal medicine to cure disease.

The quality of crops are good, disease free, fresh, can keep for a long time without any treatmen (adding chemicals), compact, more weight. The test is good so it has more demand even the pric is higher than chemical crops.

According to them, the weakest part of Nayakrishi is the first year yield which is comparativel less than chemical practices, so it is difficult to motivate the farmer. In the Nayakrishi village the have started Nayakrishi with a small amount of land and kept practicing chemical farming on th other land at the same time. The following year they extended Nayakrishi practice to more lanc and gradually covered all their land in the village with Nayakrishi practice.

## REGENERATIVE AGRICULTURE PROGRAMME OF CDA

The vision of Community Development Association (CDA) is to establish a society which i ecologically balanced, socially just and democratic where the poor, being economicall productive, enjoy an equitable environment.

The "Regenerative Agriculture" practice is under CDA's Environment and Sustainable Land U programme. This programme has been developed for environmentally sound land use and far management by the marginal and landless farmers and to help the farmers uplift their econom status. This programme put greater emphasis on production, diversity and integrated farmir practices (CDA, An Overview).

Under "Regenerative Agriculture" practices, CDA is doing:

- Central Nursery
- *Gram* Nursery

- Homestead Gardening
- Rice cultivation
- Agro-forestry

**FIELD OBSERVATIONS - CDA**

In 1988 there was a scarcity of water at Ranishankoil thana of Dinajpur district. One area was suffering from soil drying (sandy soil). CDA began a project with the farmers of this area called "Landless Farmers Development Programme". After two years of this project, CDA started another project named Farmer Economic and Environmental Development (FEED) in 1991. The main objective of this programme was sustainable land use which is related to farming. The name of this programme has since changed to "Regenerative Agriculture". CDA's main focus is on land and integrated land use which is quite different from others, e.g. PROSHIKA's programme focuses on crops (quality, quantity etc.) while CDA puts importance on soil/land.

There are 150 farmers working under this project. Most of the land is high land and sometimes needs irrigation during the dry season. Different types of timber, fruits, fuel wood, vegetable etc. are cultivated in Central and *Gram* nursery, and homestead gardening. The central nursery is maintained and run by CDA, and all other activities are maintained and run by group members (farmers).

There are different kinds of organic fertilizer used by CDA farmers, such as liquid fertilizer (alternative to urea), and compost (Pit compost, heap compost, vermae Compost).

They use ash, *neem* powder, tobacco, jute seed, garlic etc. for pest control, and they sometimes use Bordeaux mixture. They use marigold, lemon grass, mint, onion etc. as repellents for pests. Some fast growing plants like *Kalo keshori, Boka medula, Dhol kolmi* etc., are used as live fences.

Crop selections are as follows: surface rooting crops (e.g. eggplant, ladies finger, red spinach) i one season, deep rooted crop (e.g. cabbage, radish) in the next to keep a balance of nutrien uptake from the soil. All are selected from seasonal crops.

**INTERVIEW AND GROUP DISCUSSIONS**

Mr. Benjamin of Bhog nagor village cultivates rice and wheat in his 2 acres of crop land. N fertilizer or pesticide is used except ash and compost. Mechanical techniques are used to remov pests from the rice field, such as light trapping, stick in the field as perches for insect eating birds netting. Normally there are no pests in their field. Crops are smaller in size, but the quality better than chemical crops. He gets 12-16 maunds of rice per 50 decimal of land. His wif collects fuel from Singra forest.

Mrs. Rubina from Debipur village has 5 *bighas* of rice field. She grows two crops per year, ric and wheat, and then keeps it fallow, even though she could grow pulses or other leguminou plant. Three years ago the yield was 5 maunds of rice per 25 decimal using chemical fertilizer ar pesticides. Now the yield is 8 maunds per 25 decimal without applying fertilizer. The use c chemical fertilizers used to cost 80 - 100 Tk. One hundred *bhar* of cow dung is used per 3 decimal, available by home collection or at a cost of 1-1.5 Tk. per *bhar*. The weeds from th vegetable gardens are used as compost. She grows seasonal vegetables (bean, chili, bitter gour yam, pumpkin) and seedlings of fruit and timber trees (Papaya, berry, jackfruit, black berry, *neer* mahogany, *shal* etc.) in the rice field because this is more profitable than rice cultivation as si mentioned.

Mrs. Asia from Rampur village has 10 *katha* (25 decimal) of land for a nursery. There w nothing in the land except jute, which is used as vegetable. The soil is sandy, she could not gro other vegetable this year because heavy rain washed all the soil away.

Mrs. Fatema Begum of Rahampur has 20 decimal of land for vegetable cultivation. She had dug small ditch to cultivate fish, but because of the sandy soil the ditch could not hold water. So it now used for composting. She has leased another 15 decimal of land for vegetable cultivati after practicing this programme for three years.

Eucalyptus is an exotic tree species, which is considered harmful for other plants and micro organisms of the area. However, according to CDA, after using it for 11 years, the use of Eucalyptus in rice fields is not harmful. It is a deep rooted plant, although if root and branch pruning is done regularly it will not affect the yield. Because wood from this plant can be harvested after 8 years, farmers are interested in growing this plant. There are also fast-growing trees. In 1 acre of rice field, 54 plants can be planted in 25 feet intervals, including Eucalyptus, raintree, and shishu or other trees.

Mr. Nazrul from Laksmipur village uses fallow land for vegetable gardening. The production from the garden is encouraging him to work more. He grows seasonal vegetable in the garden and timber and fruit trees around the garden as live fences. He is also studying in higher secondary school and, as he mentioned, this gardening does not hamper his study, rather it provides money for his schooling.

**A case study on Regenerative Agriculture of CDA**

Mr. Alesh Chandra Roy, a marginal farmer from Betura village of Birol Thana, formed a youth group namely "Betura Jubo Bhumihin Samity" in 1993 with the assistance of CDA. The group members have received training from CDA. Mr. Ales, the cashier of the group, attended a training course on "Regenerative Agriculture" at the Ranishankail training centre of CDA in April 1994. In this training course, he learned about the negative consequences of chemical-based agriculture, as well as the alternatives to chemical agriculture. After returning to his village, he promised never to use chemicals on his land. He started with vegetable cultivation in his small homestead garden and got good results from the land. However, he had not had any experience growing HYV rice organically. Using his knowledge from the vegetable growing, he decided to cultivate the HYV rice in all of his 33 decimal of land. He has had ongoing contact with CDA staff and attended several refresher courses/discussions. He is now cultivating the HYV rice in an organic way. He uses mainly compost, cowdung, green manure etc. as manure, and piercing, hand picking, and other mechanical methods as insect control. Ash, Bordeaux mixture and other natural pesticides are used to control the diseases. The following figures (Figure 1 & 2) shows his success in this

respect (source: Mr. Sadequl Islam, CDA). Some data on his expenditure and income are given in appendix. 2, and is summarized below.

He has bought a cow and a calf with 54,00 Taka, money that he would have been spent on fertilizer and pesticides before. Some of the money he has invested in his 6 decimal banana garden, and he earned 3,000 Taka in one and a half years from 34 banana plants. He spent 40 Taka to buy compost, only in the first year. He collected seedlings from the neighborhood free of cost. He has one mini pond for fish culture using tube well water where he cultures carp, catfish telapia etc.

**Figure 1.**

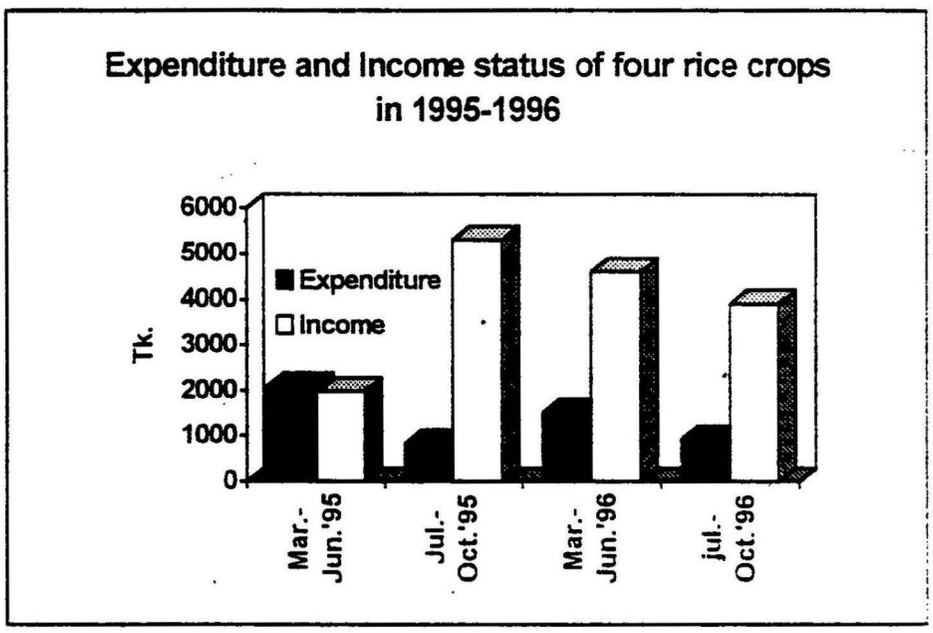
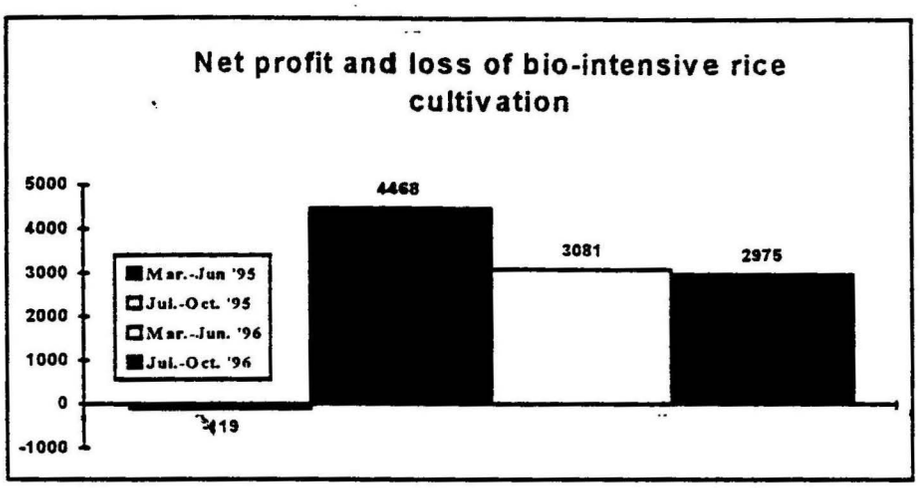


**Figure 2.**




It is noted that he was the only farmer to get a yield in March - June '1995 (12 maunds); other farmers using chemical farming did not harvest any crop due to drought.

## ALTERNATIVE AGRICULTURE PROGRAMME OF PROSHIKA (ECOLOGICAL AGRICULTURE)

Proshika's pronounced objective is to save the environment from ecological disaster and restore a harmonious relationship between human beings and the bountiful nature (Activity report, 1995-96). According to Proshika, it is a proven fact that the use of green manure and other materials produced with local components helps maintain an ecological balance, regain the natural soil fertility damaged earlier by the use of agro-chemicals and ensure a steady increase in production. Moreover, production cost goes down gradually. Ecological agriculture is also good for retention of bio-diversity and increase in fish resources.

Against this backdrop, Proshika undertook to popularize environment-friendly practices in farming under its Ecological Agriculture Programme. The objectives of the programme are:

I. to increase land coverage by agricultural crops where environment friendly practice will be followed;

II. to increase crop diversification;

III. to improve agricultural products in quantity;

IV. to increase the source of income and employment for the poor; and

V. to improve soil fertility and productivity and reduce pest infestation by using ecological methods.

The Ecological Agriculture Programme of Proshika has three components;

1. Crop agriculture in farm land;
2. Homestead gardening and
3. Seed distribution.

Crop agriculture in farm land is undertaken by Proshika group members either individually or collectively. Homestead gardening enables people to grow vegetables and fruit in organically sound methods in their homestead. Proshika encourages its members to use local varieties of seeds and takes a special initiative for the distribution of such seeds.

## FIELD OBSERVATIONS - PROSHIKA

The Koitta Training Center was mostly low land. A pond was dug and the soil used to make the land higher for a demonstration plot of Ecological Agriculture. The high land is used for vegetable cultivation and the low land for rice cultivation. According to project personnel, conventional agriculture practices makes soil harder, less fertile, and need more tillage, pesticides, fertilizer, and labour. Mulching can increase humus in the soil, which increases the nutrient and ion exchange capacity of the soil, although this is labour intensive. It helps to grow weeds. Living fences (e.g. *Flamingia macrophyla*, Epilipil, *Desmodium*, *Polyendra*, *Glyricidia*) are fast growing, deep rooted plants which can change the vertical agricultural system (i.e. can get nutrients from the deeper part of the soil, can change soil micro environment), and can be used as fuel, fertilizer and fodder.

PROSHIKA uses green manure (pulses), and living mulches. Mulching and green manuring can produce 2 cm organic matter on top of the soil, under that organic matter no weeds can grow and sunlight can not penetrate, resulting in no need for irrigation and tillage. Since the soil is nutrient rich, plants can protect it self from pests attack or any other diseases as mentioned by Proshika

staff. Mono-crops and hybrid seeds are vulnerable to disease, as this type of cropping does not consider the natural soil ecosystem, reduces biodiversity, and causes genetic erosion.

PROSHIKA started organic vegetable cultivation in 1978. They are practicing crop selection by seed, inter cropping, crop mixing. For example, cabbage, onion, and garlic are good companions to grow together, and growing marigold and cilantro can protect soil nematodes.

Rice cultivation was started by PROSHIKA in 1990. They grow rice (BR-11, and local Amon, Aus), along with jute, and mustard in a year. When Amon rice is matured, they grow green peas which is incorporate into the soil as green manure by ploughing it down after harvesting Amon rice. Boro rice is then planted, and before Boro rice flowers *Azolla* is mixed with the soil and *Dhaincha* is grown before harvesting the rice. The land is then prepared for next crop by mixing *Dhaincha* with the soil. This way, the cost of cultivation is reduced by 5% while increasing the yield by 10%. Prior to adopting this methods, 5 ploughings were needed to cultivate rice, whereas now only 2 ploughings are needed, reducing the labour cost.

**INTERVIEW AND GROUP DISCUSSIONS**

One area of Ghatail in Tangail district was visited for PROSHIKA's ecological agriculture programme. There are 14 male groups and 12 female groups at Kusharia village of Ghatail, of which all male and 10 female groups are practicing ecological agriculture. The area visited at Ghatail is mostly hilly and high land, and soils are reddish, called Madhupur clay. PROSHIKA's group members of that area are mostly landless and are living in the *khas* land. According to villagers (group members), they also use *khas* land for cultivation. They lease this land from the government or the authority. Mrs. Nurzahan and her group at Kusharia village have been practicing ecological agriculture for two years. They have received training on ecological agriculture from PROSHIKA training center. She and the other members started growing crops organically in 16 decimal land (1/2 *bigha*). Before practicing ecological agriculture they used to grow one rice crop (Aus) only in a year in this land, but the yield was very low. Now they grow ginger, pineapple, banana, turmeric, yam, pumpkin, (*chal kumra, meetha kumra*), and dhaincha in

one year and the second year they grow rice (aus), jute, and pulses. Previously, they did not know this type of cropping pattern and inter cropping, so did not grow any crops other than rice. Now they prefer to grow other crops to rice, since rice is not as profitable for them. They grow rice in the low land near bide (foot of the hill) and other crops in the high land (homestead). They do not have problems of pests in the rice or vegetable fields. Only this year there were worms in the ginger garden due to heavy rain. In case of pest attacks, they use the urine of black cow rather than any chemical pesticides or fertilizer.

To make the soil fertile the villagers use several methods such as:
Quick compost: Materials they use for quick compost are cowdung, rice bran (kura), ash, oil cake, chicken and duck manure. First they smash the oil cake which is then mixed with ash, rice bran, chicken and duck manure. After 2-3 days this mixture is mixed with cow dung and kept for 15 days to make it suitable for use. It can be preserved for a long time after drying.

**Compost:** Different kinds of bio-degradable organic matter (leaf, rice straw, household garbage mixed with cowdung are used for compost preparation. This type of manure is better than quick compost, and it can make soil soft, moist, and fertile.
**Mulching:** They use shal leaves, rice straw, and other crop remnants as mulching for Ginger.
**Green manuring :** Some of the villagers grow pulses, dhaincha in their field and mix with the soil by tillage before crop cultivation.

There are 15 members in their group, all of them practicing ecological agriculture. Last year they received 35,000 Tk. each for cultivation of 16 decimal land. Most of them spent the money on seeds (ginger, turmeric, yam, etc.), oil cake, *shal* leaves, cowdung and ash. Some money was spent on ploughing the land. For example, Nurzahan got 1,000 Tk. profit after one year out of 35,000 Tk., excluding her family's own consumption. Mrs. Shathi did not make a profit from ginger growing, because of worms, but she got some profit from pumpkin growing and chick rearing. Using this money she paid her loan installment to PROSHIKA. Mrs. Anoara Begum had 2,000 Tk. profit last year from 35,000 Tk. Some of the members had 2,500 or 3,000 Tk. which was double the profit from last year. In the rice field they also use compost or green manure

Some other farmers outside of PROSHIKA are also following this system. The only problem of this area is heavy rain during the rainy season.

As they mentioned, they did not have a problem using this agricultural system, since this was a traditional practice in Bangladesh.

## Ecological agriculture performance of PROSHIKA:

Some Statistics of Ecological Agriculture of PROSHIKA are shown in appendix 3. The following figures (Figures 3, 4, 5) compare the performance of ecological agriculture and chemical practices rice cultivation in PROSHIKA's irrigated command area from 1991 to 1996. It was found that the rice yield was increasing gradually in ecological practices whereas decreasing in chemical practices. Net profit is higher in ecological practices compare to production cost even in the first year of data collection.

**Figure 3.**

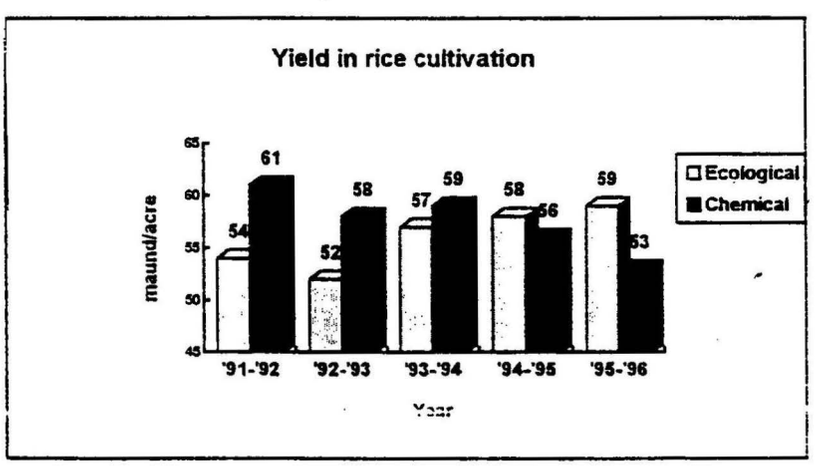


**Figure 4.**

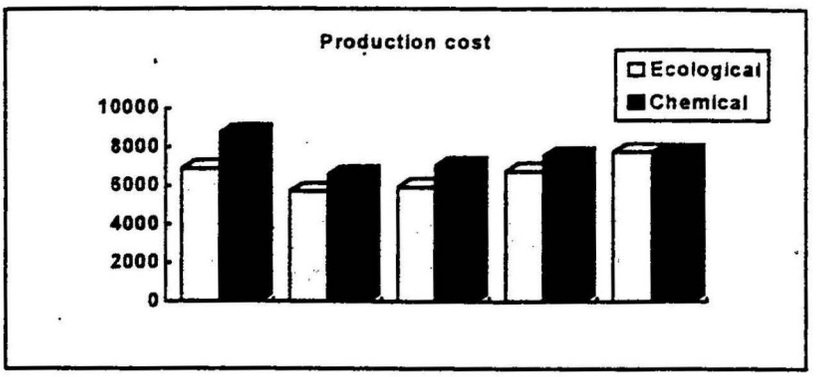
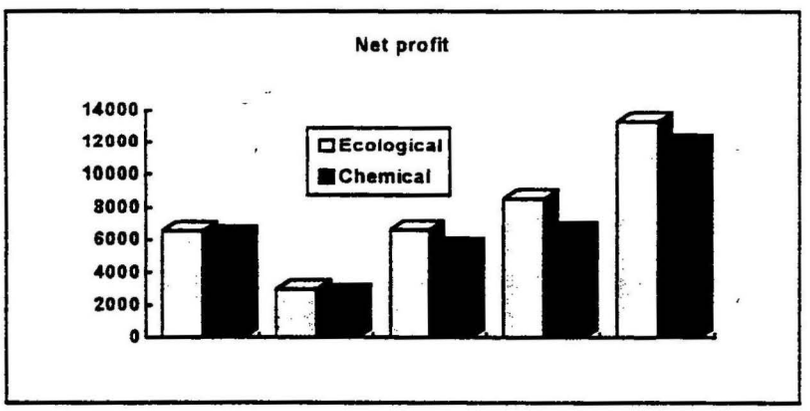



**Figure 5.**




## DISCUSSION

During the field investigations farmers mentioned that they do not have problems using thi agricultural system, since this was a traditional practice in Bangladesh. They pointed out that th quality of crops are good, it is disease free and it can be kept fresh for a long time withou chemical treatment. Taste of the product is also said to be good, so it has a higher demanc Available information (some project records and case studies) relating to these programme suggest that ecological agriculture is comparatively profitable than inorganic agriculture

Respondents mentioned that some other small and big farmers are also following them. They seem to be happy with organic/ecological agriculture since it has reduced their work load (as it requires less ploughing, weeding, and no use of pesticide), income has increased compared to the cost of growing crops, quality of food is better, and soil is regaining its fertility. Farmers said that they were reducing the use of compost or green manure every year gradually, because it has helped to restore soil fertility and to enrich nutrients in the soil.

Organic vegetable cultivation is not new or difficult or much of a change, since farmers have been practicing this for household consumption before this type of programme was introduced. But organic rice growing is more complicated. Small farmers can practice it on their land, but other farmers (e.g. large farmers or those not motivated) will practice chemical farming in the adjacent land which may affect the organic farm since run-off containing chemicals can enter the organic farming land. Also, organic crops that are disease free can be infected by pests from other land. Moreover, it is difficult to get materials (e.g. cowdung, oil cake, plant residues) for composting. The poor farmers can not afford to buy these materials or they use those materials for other purposes (e.g. fuel, fodder). Yield of rice may be higher in inorganic agriculture, but the total return is less as the input costs are higher. Moreover, organic/ecological farming is environment friendly. But many of the farmers are still not aware of the long term benefits of organic/ecological agriculture.

It was found that UBINIG is trying to conserve or revive the natural ecosystem or resources through its "Nayakrishi". The organization is practicing ecological agriculture at its training center and also motivating the farmers to practice it. "Nayakrishi" includes herbal medicine practice, collecting native medicinal plants, and native crop variety, and protecting wild animal (*Nungor*, monkey, *shojaru*, squirrel etc.).

CDA is doing farmer-centered research as Regenerative Agriculture, which is mostly concerned about soil conservation. Their activities are confined at Dinajpur district where the soil is hard and dry. The compost preparation of CDA is easier than UBINIG. CDA has no activity to conserve or promote native species of plants or animals, and they do not consider mixed cropping. CDA has started a research on bio-pesticides including the amount of pesticides to use, when to apply, how to apply and which pesticide is appropriate for which disease.

PROSHIKA is trying to restore the original ecosystem through its ecological agriculture programme, and does not believe in composting, tillage operation (ploughing the land), use of pesticides, etc. The PROSHIKA programme aims to promote agriculture as a natural forest ecosystem where no extra care is needed for growing vegetation. However, it was observed that the situation was completely different in the field. In the programme village that was visited (Ghatail thana), farmers were reportedly using compost, doing weeding and tillage operation. PROSHIKA does not have any emphasis on native varieties of crops or biodiversity.

In Bangladesh extensive application of the concept of ecological agriculture or similar activities into practice is very difficult for the following reasons-

i. Lack of sufficient biomass for addition into the soil (cowdung, green biomass etc.) to regenerate and make productive soil. A huge amount of organic materials (at least 9 ton $ha^{-1}$ is needed to maintain the current status of organic matter. It has been estimated (BBS 1986) that at the time of agricultural census about two-third of the cowdung was used as manure and the remaining amount as fuel. This means that more than 20 million tons of cowdung would be available as fertilizers, while the minimum requirements are not less than 70 million tons. This gap can not be filled even if all cowdung was applied as fertilizers. At the same time, it is likely that the number of livestock will be reduced over time due to tillage mechanisation, uneconomic livestock husbandry and other factors. Alternative source of green biomass, e.g. by-products of crops and crop residues, should be explored. Green manuring is not popular due to subsistence nature of farming, and crop residue and crop by-products are also used as fuel with small amounts of biomass being added to the soil for recycling.

ii. Continuous addition of biomass is needed to build up organic resources in the soil, which is difficult to maintain as it degrades very rapidly due to the high temperature, high humidity and high rainfall of Bangladesh's tropical humid climate, and also due to intensive cropping.

iii. The goal of food security will be disturbed at the beginning of any shift to organic agriculture due to low productivity. The country may not be able to afford such a loss at any point in time.

iv. In subsistence farming, the integration of different enterprises like crop, livestock, fisheries and forest plants may help to construct effective production systems for sound ecological balance. These have not been included in the programmes of UBINIG, CDA and PROSHIKA, although UBINIG has initiated some of similar kinds of activities.

On the basis of the data of CDA and PROSHIKA (Appendix 2 & 3), it is very difficult to judge the performance and acceptibility of the concept into practice. However, the results are encouraging.

Inclusion of programme on ecological agriculture or similar activities in the BRAC programme the following points may be considered.

1. 'Ecological agriculture system is a complicated, artificial ecological system. In establishing a highly efficient and sustainable ecological agriculture system, programmes and designs of the original agro-ecosystem have to be readjusted and rearranged in accordance with the principles of ecology and ecological economy and also with modern scientific and technological approaches as to realise an ecological agriculture system with reasonable structure, effective functions, sustainable efficiency and sound environment.'

2. 'The agricultural history of mankind is a history of continuous process of breaking up old balances and establishing new ones. To utilise the function of bio-community to remold environment is also important'. Ecological farming does not mean to go back to the practices of the past but build up a sound ecological balance suitable for sustaining production.

3. The organic farming should not be equated with the concepts like ecological, regenerative farming. Application of organic materials is a tool of ecological or regenerative agriculture.

4. The goal of food security will be disturbed at the beginning of organicisation of agriculture due to low productivity, whether the country can afford such loss at any point of time

***Needs for large scale implementation:***

1. Learn from small scale examples to enhance the process
2. Increase alternative resources e.g. if cattle and poultry increase, food sources for them also need to increase, from cattle can come materials for composting, practice of green manure can provide fodder and fertilizer for the field, etc.
3. In subsistent farming integration of different enterprises like crop, livestock, fisheries and forest plants may help to construct effective production systems for sound ecological balance. Total system has to consider not only farming or soil, but the whole system i.e. ecosystem.
4. Practice of "Farmer centered research" which will help to find the real situation and how to handle in the field.

## CONCLUSION AND RECOMMENDATIONS

The objective of ecological agriculture is to preserve as far as possible the balance between the needs for food and fiber on one hand, and the potential of local ecosystems on the other. General principles of ecological agriculture include mixed exploitation in which both plants and animals have specific functions in the context of their local soil and climatic characteristics. Different types of crop rotation are practiced to optimize mutual interactions between crops, and the varied organic cycles are also optimized within the framework of an organic management in accord with nature. The adoption of alternative agricultural practices will require new attitudes and new training for agricultural workers and extension agents (Diek van Mansvelt, 1992).

Alternative agriculture/ ecological agriculture introduced by UBINIG, CDA and PROSHIKA seems to be a significant step towards bringing back the original biodiversity and ecosystem, conserve the native gene pool and enrich the self-fertility of the soil. According to Wilson (1992), the revitalization of local farming is another aim of biodiversity studies. The goal is to make the practice more economically practical, while conserving the genetic reserves that will contribute to crops of the future.

Ecological agriculture is quite a slow process in terms of soil regeneration. So it would be difficult to start ecological agriculture at a large scale, as it may affect the food security of the poor

Technology alone is not able to cope with different and new pests to control, yet some organizations are still recommending this approach. For example, the Agriculture Department is suggesting the use of fertilizers and pesticides to get better yields, and fertilizer companies are also promoting their fertilizers in different ways. Farmers can find these conflicting messages confusing.

It can be concluded that the practice of ecological agriculture is still in a preliminary/experimental stage. There is a lack of research and initiative on bio-fertilizer and bio-pesticides. Few native leguminous plants are being using as green manure, though there are a lot of leguminous species in Bangladesh. There is lack of initiative from intervening organizations or farmers on using native crop variety.

There is a huge lack of cultivating rice without fertilizers. Most of the farmer are not motivated to cultivate rice organically because they do not want to take the risk of low yields in the first year. This is found mostly in the farmer who has more land than NGO group members, although they like to practice vegetable cultivation organically. But some farmers who grow vegetables on a large scale for marketing use chemicals.

Since most of the farmers are economically marginal, they do not take the initiative to do the experiments. Another observation is that ecological farming is successful, but it is still being done on a small scale. Large scale practice is still absent except UBINIG's Nayakrishi village which could be an example of large scale organic rice cultivation. It is difficult for NGOs to extend an ecological agriculture system on a large scale as their members are either landless or marginal farmers who do not cover much of the land in a village.

This study was conducted only in few areas of Manikganj, Tangail, and Dinajpur. Therefore, it is not possible to give precise recommendations or draw a clear conclusion with this quick study. It is necessary to have an in-depth and comprehensive study on ecological agriculture for specific conclusions on prospects and large-scale adoption of ecological agriculture in Bangladesh.

## SOME TENTATIVE RECOMMENDATIONS

1. **Social mobilization:** There is a need for social mobilization to make this programme successful.
2. **Research:**
    - There should be a tool developed to bring together the small scale (ecological) farmer and large scale (adjacent) chemical farmer.
    - Impact study/ research on transfer technology of ecological farming from micro (small scale farmer) to macro (large scale) or micro to micro farmer. For example; why they are motivated or not motivated? How to motivate (social mobilization)?
    - Research on bio-pesticides, cropping pattern.
    - Native leguminous inventory.
    - Native crop practice.
    - Extension of rice cultivation organically: possibilities, difficulties etc.
    - Alternative source of green biomass, by product of crops and crop residues should be explored.

3. **Institutional cooperation:** Government organisations have good extension support, expert and NGOs have extension work with the grassroots people. Therefore, NGOs and GO should work together in promoting/ experimenting with ecological agriculture. Network with different organizations for specific technology and support programme e.g. training information transfer.

4. **Pilot experimentation** of alternative agriculture (both rice and vegetable) in a wider area may generate sound ideas about how farmers can adopt this system. Several types of pilot projects may be undertaken, such as, a project on organic farming for rice and vegetable crops, an integrated project on a sustainable village or eco-village where a sustainable agriculture, land use and alternative energy uses (which includes fisheries, poultry, agroforestry, native species cultivation, conservation, biogas, sloar, wind, etc.) will be in practice.

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Appendix 1. CDA, example of expenditure and income : **(source: Mr. Sadequl Islam CDA)**

Season : March - June '1995 'AD (Falgun - Jaistha 1401 Bangla)
Land area : 33 decimal (double cropped land)
Crop name : Transplanted Boro - IR8

| Sl | Expenditure | TK. | Income | TK. | Remarks |
|---|---|---|---|---|---|
| 1. | Ploughing & leveling | 190.00 | Rice produced: 12 Mds x@140.00 (*) | 1680.00 | Lower yield then Pre Yr.'s due to excessive dr and market price was low. |
| 2. | Dike preparation | 25.00 | | 200.00 | |
| 3. | Compost(94 *Bhar*) | 112.00 | | | |
| 4. | Oil cake (45 Kg.) | 270.00 | | | |
| 5. | Seeding | 150.00 | | | |
| 6. | Irrigation | 720.00 | | | |
| 7. | harvesting (9 labour) | 280.00 | *Straw used in compost & roof.* | | |
| 8. | Others | 12.00 | | | |
| TOTAL | | 2099.00 | | 1980.00 | |

**Net loss: 2099.00-1980.00=119.00 Tk.**

(*) it is noted that he was the only one who got 12 mounds rice. other farmer who had chemical farmin did not have any crop due to drought.

Season : July - October '1995 AD (Ashar - Kartik 1402 Bangla)
Land area : 33 decimal
Crop name : Transplanted Aman- BR11

| Sl | Expenditure | TK. | Income | TK. | Remarks |
|---|---|---|---|---|---|
| 1. | Ploughing & leveling | 190.00 | Rice produced: 20 Mds x@250.00 | 5000.00 | Weather was favou & Market price high |
| 2. | Transplantation 4 labour @ 30.00 | 120.00 | | 300.00 | |
| 3. | Compost (160 *Bhar*) | 160.00 | | | |
| 4. | Seeding | 150.00 | | | |
| 5. | Harvesting | 200.00 | *Straw used in compost & roof.* | | |
| 6. | Others | 12.00 | | | |
| 7. | | | | | |
| | | | | | |
| | TOTAL | 832.00 | | 5300.00 | |

**Net Profit : 5300.00-832.00=4468 Tk.**

Season : March - June '1996 AD (Falgun - Jaistha 1402 Bangla)
Land area : 33 decimal (double cropped land)

Crop name : Transplanted Boro - IR8

| Sl | Expenditure | TK. | Income | TK. | Remarks |
|---|---|---|---|---|---|
| 1. | Ploughing & leveling | 200.00 | Rice produced: 22 Mds x @200.00 | 4400.00 | Lower yield then previous Yr.'s and market price was low. |
| 2. | Dike Preparation & Transplantation | 120.00 | | 200.00 | |
| 3. | Compost (160 *Bhar*) | 234.00 | | | |
| 4. | Oil cake & other trace elements | 110.00 | | | |
| 5. | Seeding | 150.00 | | | |
| 6. | Irrigation | 570.00 | | | |
| 7. | Harvesting | 80.00 | Straw used in compost & roof. | | |
| 8. | Others | 15.00 | | | |
| | TOTAL | 1519.00 | | 4600.00 | |

**Net profit: 4600.00-1519.00=3081.00**

Season : July- October '1996 AD (Ashar- Kartik 1403 Bangla)
Land area : 33 decimal
Crop name : Transplanted Aman- BR 11

| Sl | Expenditure | TK. | Income | TK. | Remarks |
|---|---|---|---|---|---|
| 1. | Ploughing & leveling | 190.00 | Rice produced: 20 Mds x @250.00 | 3600.00 | Weather was favourable & Market price low |
| 2. | Transplantation 4 labour @ 30.00 | 175.00 | | 300.00 | |
| 3. | Compost (160 *Bhar*) | 160.00 | | | |
| 4. | Seeding | 150.00 | | | |
| 5. | *Harvesting | 200.00 | *Straw used in compost & roof.* | | |
| 6. | Others | 50.00 | | | |
| 7. | | | | | |
| | | | | | |
| | TOTAL | 925.00 | | 3900.00 | |

**Net profit: 3900.00-925.00= 2975.00 TK.**

Appendix 2. Some Statistics of Ecological Agriculture of PROSHIKA (**source: Activity report, 1995-96**):

Economic Performance of Ecological and Chemical Practices in Rice Cultivation in Proshika's Irrigated Command Area (from 1991-92 to 1995-1996) : A Comparison

| | Methods | 1991-92 | 1992-93 | 1993-94 | 1994-95 | 1995-96 |
|---|---|---|---|---|---|---|
| **Production cost** | Ecological | 6,885 | 5,715 | 5,943 | 6,724 | 7,758 |
| **(Tk./Acre)** | Chemical | 8,709 | 6,585 | 7,037 | 7,531 | 7,720 |
| **Performance of Eco Practice** | | 21% Less | 13% Less | 16% Less | 11% Less | 0.5%More |
| **Gross Income** | Ecological | 13,405 | 9,705 | 12,556 | 15,237 | 14,797 |
| **(Tk./Acre)** | Chemical | 14,974 | 9,274 | 12,558 | 14,041 | 13,272 |
| **Performance of Eco practice** | | 10% Less | 6% Less | Equal | 9% More | 11% More |
| **Net Profit** | Ecological | 6,520 | 2,990 | 6,613 | 8,513 | 13,317 |
| **(Tk./Acre)** | Chemical | 6,265 | 2,685 | 5,521 | 6,510 | 11,945 |
| **Performance of Eco Practice** | | 4% more | 11% more | 20% More | 31% More | 11% More |
| **Yield** | Ecological | 54 | 52 | 57 | 58 | 59 |
| **(Md./Acre)** | Chemical | 61 | 58 | 59 | 56 | 53 |
| **Performance of Eco Practice** | | 11% less | 10 Less | 3% Less | 4% More | 11% More |