www.rda.gov.bd

ISSN 1019-9624

RDA JOURNAL

বাংলাদেশ পল্লী উন্নয়ন সমীক্ষা
Bangladesh Rural Development Studies

খন্ড ১৫ | ১৪১৯ | সংখ্যা ১

Volume XV | 2012 | Number 1

প্রবন্ধ | Article

Bangladesh Rural Development Studies Volume XV Number 1 201

ADVISORY BOARD

M.A. Matin — Chairman
Director General (In charge)
Rural Development Academy, Bogra
Bangladesh

Mr. Abdul-Muyeed Chowdhury — Member
Ex-Executive Head
Rural Development Academy, Bogra
Bangladesh

Dr. Anwarullah Chowdhury — Member
Professor
Department of Anthropology
University of Dhaka
Bangladesh

Dr. S.M. Altaf Hossain — Member
Professor
Department of Agronomy
Bangladesh Agricultural University, Mymensingh
Bangladesh

বাংলাদেশ পল্লী উন্নয়ন সমীক্ষা

Bangladesh Rural Development Studies

খন্ড ১৫	১৪১৯	সংখ্যা ১
Volume XV	**2012**	**Number I**

প্রকাশক	ঃ	**মহাপরিচালক** পল্লী উন্নয়ন একাডেমী বগুড়া-৫৮৪২, বাংলাদেশ।
Published by	ঃ	Director General Rural Development Academy (RDA) Bogra-5842, Bangladesh Phone: 88-051-51001, 88-051-78602 88-051-78603 Fax: 88-051-78615 Cell: 88-01713-200938, 88-01199-650367 Email: dgrda.bogra@yahoo.com Web: www.rda.gov.bd
মূল্য	ঃ	টাকা ২০০.০০ (প্রতিষ্ঠানের জন্য) টাকা ১০০.০০ (ব্যক্তিগত ক্রয়ের জন্য) মার্কিন ডলার ৪.০০
Price:		Tk. 200.00 (For Institution) Tk. 100.00 (For Individual) US $ 4.00
Cover Design		AKM Zakaria Md. Kamrul Islam
Computer Compose		Md. Foraizul Hoque
Computer Getup and Makeup		Md. Ahsan Ullah Khan
Printed by		Print Media Presspotty, Bogra, Bangladesh

সূচী
Contents

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Potassium Requirements of RDA Vineyard *(Vitis vinifera L.)*

Dr. Ranajit C. Adhikary[1]
Abdullah Al Mamun[2]

Abstract

Environment of Bangladesh is quite fair and broad for production of a large variety of fruits. Some fruits, such as mango, banana, pineapple, jackfruit etc. have world demand. The main problem of fruit production is its seasonal nature. Year round production variety is yet to be evolved and one such fruit is grape. Since special efforts would be made during the Fifth five year plan to produce at least some fruits on a year round basis. Rural Development Academy, Bogra took initiative to conduct research on grape for its adaptation and in long run year round production from1999-2000. Since grape is a potash loving crop, the study was carried out on different doses of potash. The data were collected both in qualitative and quantitative parameters i.e. plant vigor, leaf size, shoot growth, inflorescence formation, cluster formation, berry formation, disease incidence etc.From the experiment it is concluded that plant vigor, leaf size and shoot growth were heavy and strong in T_3 and T_4 treatments where K_2O were applied @ 200 and 250 Kg K_2O/acre. The same was true for Inflorescence, cluster and berry formation also. For grape cultivation potash should be applied in the form of K_2SO_4. The problems facing for the indigenous and exotic grape cultivation in RDA farm is fungal disease particularly anthracnose. The severity observed after hail-storm in the month of April. Among the 15 treatments only the Jakkaw variety under T_2 treatment was found to attack with anthracnose.Thomson was sweeter (TSS 21%) than Jakkaw (TSS 19%) but yield of Jakkaw (5.25 Kg/ vine) was higher than Thomson (1.80 Kg/vine).

Introduction

Grape is one of the crops, whose requirement for potash is very high. It estimated that a vineyard yielding 15 t /acre removes 75 kg of potash (K_2O) through fruit and 12 kg through pruning, totaling to 87 kg per acre every year (Shikhamany, 1999). It is also established that grapevine is a poor utilizer of available potash from the soil. It can utilize to a maximum of 12 percent of the available potash. The exchangeable potash in RDA soil is very low and range between 0.077-0.11meq/100g soils. The exchangeable potash in soil is not totally available to plants. Its availability depends on pH and the relative concentration of other

[1] Director (Research & Evaluation Division), RDA, Bogra.
[2] Joint Director, RDA, Bogra.

cations in the soil, namely, calcium, magnesium and sodium. The contents of calcium (3.33) meq/100g) and magnesium (0.68 meq/100g) are relatively medium in RDA soil. Hence the availability of potassium to crop is impaired. Thus it is clear that, grape needs potash application due to the following reasons:

- RDA Soils have medium contents of calcium and magnesium which reduce the availability of potash from soil to the vines.
- Grapevines can utilize only 12 per cent of the available potash from the soil.
- Grapevine removes 87 kg potash/ac every year.
- Exchangeable potash level present in RDA soils alone can not meet the requirement of grape, without supplementing to the native potash levels.

Recently, potash nutrition to grapevines has been ignored due to the following misconcepts:

- Some soils are rich in potash and therefore, there is no need to apply potash;
- Potash requirements are very little during the growth cycle; and
- Grapevines are sensitive to chloride ions. Hence it is better not to apply muriate of potash (KCl) even when sulphate of potash (K_2SO_4) is not available.

As a result, inadequate supply of potash to vines, inward curling of leaves during May-June (before rains) and marginal yellowing of the leaves in the middle portion of the shoots i.e. recently mature leaves during June-July (after a few heavy rains), delayed and poor cane maturity and poor quality of fruits and cluster tip wilting during the fruiting season have been observed.

Statement of the Problem

Role of Potassium in Grapes: Potassium is taken up as K^+ ion. It is not synthesized but remains in free ionic form within the cells and tissues. Therefore, there have been instances of potassium being leached out from the leaf tissues with rain water due to continuous and heavy rains.

Potassium is essential for translocation of sugars and starch formation. It is required in the opening the closing of stomata by enlarging the guard cells. It encourages root growth and helps in the formation of larger and more uniformly distributed xylem vessels throughout the root system. It increases crop resistance to diseases. It helps in shoot maturity and increase the cane diameter. It helps in the formation of inflorescence primordium and increases its size. It increases the size, firmness and quality of fruits. Based on the role of

potassium in grapes, its association with some disorders observed in vineyard is elucidated below:

Inward Leaf Curling: Potassium regulates the closing of stomata by expanding the guard cells. In the absence of adequate levels of potassium, the stomata remain open, leading excessive transpiration. Inward leaf curling is seen only after 40 days of foundation pruning i.e. during the grand growth period of shoots. Atmospheric temperatures are high and the total leaf area per vine is also high at this stage. As a result, the total quantity of water lost through transpiration will be more than the water absorbed by the roots, particularly when potassium is deficient and vines have a limited root system. Moreover, the water conducting ability of roots will be reduced due to reduced formation of xylem vessels when potash is deficient.

Marginal Yellowing of the Leaves: Typical symptom of potassium deficiency is the yellowing of leaves along their margins, while central portion being green. Symptoms are conspicuous in the youngest mature leaves i.e. the leaves in the middle portion of the shoots, which are physiologically more functional. Moreover, potassium being mobile element, it moves from the mature leaves to young leaves and in the absence of adequate supply from the soil, the mature leaves exhibit the deficiency symptoms. As mentioned earlier, even if the exchangeable potash is high in the soil, its availability is impaired by the high levels of pH and calcium in vineyards. Marginal chlorosis of mature leaves is more pronounced after a few heavy rains, possibly due to leaching of potassium from the leaves by rains and more calcium getting into soil solution.

Delayed and Poor Cane Maturity: Since potassium is required in the translocation of sugars and starch synthesis, its deficiency reduces the formation of starch and translocation of sugars which are required for shoot maturity. As a result, shoot maturity will be retarded and also reduced.

Poor Quality of Fruit: Potassium regulates many vital functions involved in carbon assimilation and translocation of sugars which are the key processes in the quality of berries. Under potash deficient conditions, sugar content and crispness of berries is reduced. Evidences of increased sugar content and berry crispness with the application of potash under deficient conditions are amply available. Increased proportion of water berries in spite of adequate leaf area observed in some of the vineyards is a clear case of potash deficiency.

In view of these facts, it is evident that potassium is deficient in many of the vineyards in different grape growing countries and there is an urgent and acute need to nourish

grapevines with potash to overcome the disorders and disturbances in their physiology. Keeping this view the following **objectives** are formulated:

i) To examine the general practices of grape cultivation in RDA vineyard;
ii) To assess the suitable potassium dose (K_2O) for grape production;
iii) To observe the physiological growth; and
iv) To see the yield performance of grape.

Materials and Methods

Vineyard is a long lasting perennial crop. So in a short time, it was not possible to plant and conduct research in the field. Therefore, research work was done in an established garden. The location of the vineyard was RDA Demonstration Farm which was established in 2004 in nursery -1. Most of the vines were transplanted in 24-27 May 2004. The land was tilled and laid into a plot of 33 m length x 15 m width. Along the length 11 saplings were transplanted maintaining 3 m spacing and in the width 5 saplings were transplanted maintaining the same space. Therefore, a vineyard of 3 m x 3 m spacing with 55 saplings formed the garden. From the garden a totaling of 15 vines with 08 Thomson and 07 Jakkaw varieties were selected for the study.

For general practices of grape cultivation major indicators namely weather for grape, fertility and productivity of soil, characteristics of RDA soil, training and pruning of vines, irrigation, insect and disease attack and hormone application were examined in RDA vineyard.

Weather for Grape

Grape is grown well in warm sunny climate with mild winter and dry periods during fruit ripening. The vines shade their leaves and go down in hibernation in winter, put forth new growth in spring and mature in summer. Generally, grape does not thrive in humid summer. It can tolerate frost and foggy weather during the resting period but succumb to it readily during its growing period. At flowering time bright sky yields more grapes. At blossom and green grape stage low temperature and at ripening high temperature with dry weather are better (Nurujjaman, 1994). More or less the similar weather exists in Bangladesh and favorable for grape cultivation.

Fertility and Productivity of Soil

Fertilizer is one of the main inputs for crop production. It is well understood that the soil's inherent ability to supply sufficient nutrients has drastically decreased with increased intensity of cropping associated with the growing human demand for food and fiber. Use of chemical fertilizers is unavoidable to increase and sustain crop productivity. It is therefore,

very important to develop management packages for the use of nutrients, soils and crops that enhance not only crop yields but also the quality of soil, water and air. If we cannot improve and sustain the productivity of our soils, it will be difficult to meet the food and fiber demands of the population in the near future. The physical and chemical properties of RDA soil are given bellow:

Table-1: Chemical Properties of RDA Soil

RDA Soil	p^H	O.M (%)	N (%)	P (ppm)	K (meq/100g Soil)	Ca (meq/100g Soil)	Mg (meq/100g Soil)	S (ppm)	Fe (ppm)	B (ppm)	Cu (ppm)	Zn (ppm)	Mn (ppm)
1	5.5	0.35	0.07	8.0	0.077	3.10	0.80	4.0	66.0	0.10	1.01	0.6	2.8
2	5.6	0.44	0.06	6.0	0.069	3.70	0.90	6.0	70.0	0.10	1.00	0.5	2.2
3	5.4	0.40	0.09	8.0	0.078	3.20	0.70	5.0	60.0	0.09	1.02	0.4	2.4
Mean	**5.5**	**0.40**	**0.07**	**7.3**	**0.074**	**3.33**	**0.80**	**5.0**	**65.3**	**0.10**	**1.01**	**0.5**	**2.5**
Critical limit	6.6-7.5	1.0-1.7	0.12	8.00	0.12	2.00	0.50	10.00	4.00	0.20	0.20	0.60	1.00

N.B: Soil analysis from BARI Soil Science Laboratory, Gazipur

Characteristics of RDA Soil

Grape grows well in any soil preferences are for moderately fertile soil. It does not like clay and sandy soil. Soils should be well drained as the roots are damaged by a high water table. The RDA soil contains 28.91%, 32.62%, and 38.47%, sand, silt and clay. As a result, soil textural class is clay loam. The pH is acidic (5.5) in nature. The reason for such characteristic is that barind soil is toxic with iron (65 ppm). The level of Organic matter content is (0.40%). The N (0.07%), P (7.30 ppm), K (0.074 meq/100g soil), S (5.0 ppm), B (0.10 ppm) and Zn (0.50 ppm) of same soil shows that all nutrients are bellow critical level except Ca, Mg, Cu and Mn (Table-1). All these indicate that the soil is poor in fertility. Response of fertilizer in this soil is obvious.

Training of Vines

Many training systems are followed in vineyard. The most popular systems are Bower and Telephone systems. In RDA vineyard Telephone system was used.

Telephone System: T-trellis was used in this system of training. With five top wires and 'T' shaped supports, the trellis looks like a telephone pole and wires and hence the name.

Pruning of Vines

Pruning refers to the judicious removal of any plant part to establish and maintain desired vine shape, to increase productivity and facilitate various cultural operations; to distribute

proper amount of bearing wood over the vine and for consistent productivity. Pruning is the most important operation for the maintenance of fruitfulness and quality along with vigor of the vine. Pruning is the most crucial operation and should be done with precision and care (McGrew et. al., 1998).

When to Prune: Depending upon the facilitation of the other vineyard operations, pruning can be done any time during dormant season. It can be started just after leaf- fall but must be completed before the start of growth in spring. There is little or no effect on the amount of food reserves of the vine if prune is done during this period. In RDA vineyard pruning was done in third week of January.

Table-2: Treatment of Potassium (K_2O)

Treatment (K_2O Kg/acre)	K_2O (Kg/ acre)	K_2SO_4 (g/plant)	N (Kg/acre)	Urea (g/plant)	P_2O_5 (Kg/acre)	TSP (g/plant)	Cowdung (Kg/acre)	Cowdung (Kg/plant)
K_2O-00 - T_0	0	00	100	650	150	1000	7000	21
K_2O -100- T_1	100	600	100	650	150	1000	7000	21
K_2O -150- T_2	150	900	100	650	150	1000	7000	21
K_2O -200- T_3	200	1200	100	650	150	1000	7000	21
K_2O -250- T_4	250	1500	100	650	150	1000	7000	21

Experimental Design and Treatments

The experiment was laid out in a randomized complete block design with three replications and 3m x 3m spacing with square diagram. Fertilizer doses of K_2O were applied @ 0, 100, 150, 200 and 250 Kg /acre and N and P_2O_5 were applied @ 100 and 150 kg/acre respectively. In addition to that cowdung was applied 7000 Kg /acre (Table-2). Layout of the experiment and fertilizer amount per plant was shown in Table-3.

Table-3: Layout of the Experiment and Fertilizer Computation

Treatment (K_2O Kg /acre)	R_1 (Urea-TSP-K_2SO_4) (g/plant)	R_2 (Urea-TSP-K_2SO_4) (g/plant)	R_3 (Urea-TSP-K_2SO_4) (g/plant)
K_2O - 00 - T_0	T_0= 650-1000-00	T_1= 650-1000-600	T_4= 650-1000-1500
K_2O -100 - T_1	T_1= 650-1000-600	T_0= 650-1000-00	T_2= 650-1000-900
K_2O -150 - T_2	T_2= 650-1000-900	T_3= 650-1000-1200	T_1= 650-1000-600
K_2O -200 - T_3	T_3= 650-1000-1200	T_4= 650-1000-1500	T_0= 650-1000-00
K_2O -250 - T_4	T_4= 650-1000-1500	T_2= 650-1000-900	T_3= 650-1000-1200

Fertilizer Application

All cow dung were applied in the month of January, 75% urea, all amount of Triple Super Phosphate (TSP) and 50% Sulphate of Potash (SOP) were applied in February and 25% urea and 50% SOP were applied in April.

Irrigation

Compare with other fruit plants, grapevines are more drought-resistant. However, for profitable production adequate amount of moisture during growing season is a must. Any water stress condition hampers growth and productivity of the vine viz., the shoot growth decreases and the internodes become shorter, the tendrils droop, the leaf margins curl and the older leaves turn Yellow. Under severe drought, the growing points may dry up and the young clusters at pre-bloom or bloom stage dry out. The berries shrivel and the leaves droop.

The grape vine should be regularly irrigated. It is necessary to regulate the water supply carefully both when the vine is in flower and bunches are ripening (ICAR, 1980). Too wet a soil during those periods is not desirable. Normally, the vines do not need any irrigation during dormant season. In RDA grape garden per month one time irrigation was made in November and December, two times irrigation in January and February and three times irrigation in March and April.

Insect Attack

The newly grown leaves of grape vines and young shoots must be checked frequently to guard against insect and disease damage. Many grape growers are still under the impression that spraying young vines is not needed. Generally, young vines have very few leaves, so if some or all are attacked or damaged by insects, development of the vines will be slowed. Depending on grape variety, young leaves and shoots must be sprayed frequently if close examinations show signs of insect attack or disease infection. The insects caused damage to grape vines, leaves and berries are leaf roller, red spider, mealy bugs, stem borer, flee beetle, horn worm, termite etc. Mostly after pruning when bud, shoot and young stems are developed the flee beetle eat them. Among the insects mealy bugs cause serious damage to grapes by sucking the sap and secreting copious amount of honeydew on which black sooty mould fungus develops.

Control Measures

To manage the pest effectively, early detection is crucial. Therefore, a constant vigil for the symptom is very much essential. The insects, borer or beetles are generally active in the evenings and in the night and can be detected near light sources. In the daytime they live in

protected areas such as cracks and crevices of bank, underside of leaves and inside the fruit bunches. For good control can be accomplished by using: Ripcord (Cypermethrin 10 EC), Polash (Malathion 57EC), Chloropyriphos 20EC, Dimethoate 40EC etc. In RDA vineyard Red spider, Leaf roller, Horn worm, Flee beetle etc. were controlled by the application of Ripcord and Acktara alternately @ 5.0ml in 10 Liters of water every after 10 days.

Disease Attack

In grapes powdery mildew, downy mildew, anthracnose and black rot have severe incidence during monsoon and winter seasons on leaves and bunches of grapes. Downy mildew an extremely destructive disease of grape vines caused by *Plasmopara viticola* occurs under humid weather conditions. Powdery mildew is another major disease of grapes caused by *Uncinula necator* posses serious problems during fruiting season to grape orchard. This fungus proliferates in dry and cold climate and attacking on leaves, tendrils and young berries. Anthracnose is another grape disease caused by *Elsinoe ampelinae* commonly occur in rainy season. It attacks mainly on young shoots, leaves, tendrils and young berries. Grape rust mostly occurs in rainy season. Bacterial disease is observed in grape growing areas during fruiting seasons.

Control Measures

The first and foremost is field sanitary measures. Fallen leaves and twigs should be collected and burnt. Canes should be kept above ground and free circulation of air should be provided by proper spacing and pruning. For effective control of diseases can be accomplished by using: Bordeaux mixture (1kg $CuSO_4$: 1kg $CaCO_3$: 100Litre water), Cupravit 50WP (Copper Oxychloride), Champion 77WP {$Cu(OH)_2$}, Diethen M-45 (Ditheo carbamate), Knowin (Carbendazim 50WP) at 10-15 days intervals to control the diseases. A regular and systematic spraying program is very essential for the control of those diseases (Chatterjee et. al., 1984). In RDA Vineyard Powdery mildew, Downy mildew and Anthracnose diseases were controlled by the application of Kupravit and Diethen M-45 alternately @ 20 gm in 10 Liters of water every after10 days.

Hormone Application

Gibberellic acid (90% w/w) is a plant growth regulator containing a mixture of Gibberellines. Since Gibberellic acid is not soluble in water, therefore, 1 gm Gibberellic acid is required to be dissolved in 20 ml. acetone or absolute alcohol to make it soluble in water. Gibberellic acid is generally applied separately. Hormone is mainly used for bud break, for sweet and big size fruit formation. For sweetness it is recommended to treat the cluster with GA or girdle the vines only at 4 mm size of the berries. While dipping the cluster in GA solution at 4 mm stage, if the berries on the top do not get the treatment will remain small. Hence,

care should be exercised to dip all the berries in GA solution. In RDA Vineyard 100 ppm Gibberellic acid was used at 4mm sizes of berries to increase sweetness and size of the berries.

Results and Discussions

Grape *(Vitis vinifera L.)* is a rare food item in Bangladesh but it is popular throughout the world. In this country, at the cost of valuable foreign reserves, it is always imported from neighboring countries, mostly from India, Pakistan and sometimes from Thailand and Australia. Thus it is an expensive commodity and generally remains beyond the affordability of common people. Traditionally and occasionally grapes are supplied to patients for their allegedly higher nutritional value. Grapes among other indigenous and exotic fruits are found on the tables of the rich in this country as dessert. People might not have the knowledge of its high nutritional value but the common belief is that this fruit makes a man healthy.

Growth and Yield Parameters of Grape

Plant Vigor: One of the growth parameter of grape is plant vigor that is presented in Table-4. It is evident from the table that plant vigor was heavy with the increase of the potassium dose upto 200 Kg K_2O/ acre for the Jakkaw variety and 250 Kg/acre for the Thomson variety. Different doses of potassium increased the plant growth from moderate to strong and strong to very strong. It was also noticeable that potassium consumption was very high for the exotic variety (Thomson) and less in indigenous variety (Jakkaw). As per physical observation 200 Kg K_2O/ acre is sufficient for Jakkaw but 250 Kg K_2O/ acre is necessary for Thomson. Soil analysis also proves that RDA soil is very poor in K^+ content (0.074meq/100g Soil) and there is a great chance to response of K^+ to grape garden. Practically it is proved from the result.

Table-4: Plant Vigor of the Vineyard

Treatment	R_1	R_2	R_3	Mean
K_2O-00 - T_0	Weak (Thomson)	Weak (Jakkaw)	Weak (Jakkaw)	Weak
K_2O-100- T_1	Average (Thomson)	Average (Thomson)	Medium (Jakkaw)	Average
K_2O-150 - T_2	Moderate (Thomson)	Strong (Jakkaw)	Moderate (Thomson)	Moderate/Strong
K_2O-200 - T_3	Very strong (Jakkaw)	Strong (Thomson)	Very strong (Jakkaw)	Strong/ Very strong
K_2O-250 - T_4	Very strong (Thomson)	Very strong (Thomson)	Strong (Jakkaw)	Very strong/Strong

Leaf Size: Leaf size is another indicator of growth parameter. Percentage of large leaves increased with the increase of the potassium doses those were evident from the Table-5.

Different doses of K_2O increased the leaf size and percentage of large leaves and decrease the auxiliary leaves i.e., auxiliary leaves converted into large leaves and growth was prompt with the increase of the doses. Application of 100, 150, 200 and 250 Kg K_2O/acre showed large leaves formation from 50-60%, 60-70%, 70-80% and 80-90% respectively. With increasing the doses of K_2O helped in formation of large leaves quickly. It is also evident from the table that the percentage of Auxiliary leaves decreased with the increase of the K_2O doses (65-10%). Physically, the leaf size of the Jakkaw was greater than Thomson.

Table-5: Leaf Size of the Vineyard

Treatment	R_1	R_2	R_3	Mean
K_2O-00 - T_0	Large leaves 20% and Medium /small light green leaves 80%(Thomson)	Large green leaves 30% and 70% Auxiliary leaves (Jakkaw)	Large leaves 35% and Auxiliary leaves 65% (Jakkaw)	Large leaves 20-30% and Small light green leaves 65-80%
K_2O-100- T_1	Large green leaves 50% and Medium light green leaves 50% (Thomson)	Large green leaves 50% and Auxiliary leaves 50% (Thomson)	Large leaves 60% and Auxiliary leaves 40% (Jakkaw)	Large leaves 50-60% and Auxiliary leaves 40-50%
K_2O-150 - T_2	Large green leaves 70% and light green small Auxiliary leaves 30% (Thomson)	Large green leaves 60% and Auxiliary leaves 40% (Jakkaw)	Large leaves 70% and Small leaves30% (Thomson)	Large leaves 60-70% and Small leaves 30-40%
K_2O-200 - T_3	Large green leaves 90% and Auxiliary leaves10% (Jakkaw)	Green large leaves 70% and Auxiliary leaves 30% (Thomson)	Large leaves 80% and Auxiliary leaves 20% (Jakkaw)	Large leaves 80-90% and Auxiliary leaves 10-20%
K_2O-250 - T_4	Large leaves 90% and Auxiliary leaves 10% (Thomson)	Large green leaves 80% and Auxiliary leaves 20% (Thomson)	Large leaves 80% and Auxiliary leaves 20% (Jakkaw)	Large leaves 80-90% and Auxiliary leaves 10-20%

Shoot Growth: After pruning buds and shoots started growing in the month of March. Main shoots and branches or auxiliary shoots growth were found slow in treatment T_0 where potassium was not applied and in treatment T_1 where initial dose 100 Kg K_2O/acre was applied. With increasing the doses of potassium main shoot growth and auxiliary shoot growth rate were found high. In treatments T_2, T_3 and T_4 main shoot growth ranged from 4.3- 4.5", 4.5- 4.7", 4.6 -5.0" respectively were as in T_0 and T_1 shoot growth ranged from 3.0-4.0" and 3.6- 4.0" respectively (Table-6). Shoot growth continuously increased with increase of the potassium treatments. The same was true for branch or auxiliary shoots growth.

Table-6: Shoot Growth of the Vineyard

Treatment	R_1	R_2	R_3	Mean
K_2O- 00 - T_0	Main Shoot 3″ and Auxiliary shoot Averaged 2″ (Thomson)	Main Shoot 3.5″ and Auxiliary shoot averaged 1.2″ (Jakkaw)	Main shoot 4″ and Branch shoot averaged 1.5″ (Jakkaw)	Main shoot 3- 4″ and Branch shoot ranged from 1.2 -2″
K_2O-100- T_1	Main Shoot 3.6″ and Auxiliary shoot Averaged 2.5″ (Thomson)	Main shoot 4″ and Auxiliary shoot 2.5″ (Thomson)	Main shoot 4″ and Branch shoot averaged 1.5″ (Jakkaw)	Main shoot 3.6- 4″ and Branch shoot ranged from1.5-2.5″
K_2O-150 - T_2	Main shoot 4.5″ and Auxiliary shoot averaged 2.75″ (Thomson)	Main shoot 4.3″ and branch shoot averaged 1.6″ (Jakkaw)	Main Shoot 4.5″ and Auxiliary Shoot Averaged 2.6″ (Thomson)	Main Shoot 4.3-4.5″ and Auxiliary Shoot ranged from 2.6-2.75″
K_2O-200 - T_3	Main shoot 4.5″ and Branch shoot averaged 2.5″ (Jak)	Main shoot 4.7″ and Branch shoot averaged 2.5″ (Thomson)	Main shoot 4.5″ Auxiliary shoot averaged 1.80″ (Jakkaw)	Main shoot 4.5-4.7″ and Auxiliary shoot ranged from 1.80-2.5″
K_2O-250 - T_4	Main shoot 5″ branch shoot averaged 2.33″ (Thomson)	Main shoot 5″ and branch shoot averaged 2.16″ (Thomson)	Main shoot 4.6″and Auxiliary shoot averaged 1.95″ (Jakkaw)	Main shoot 4.6-5″ and Auxiliary shoot ranged from 1.95-2.33″

Inflorescence Formation: The primordial stage of cluster is inflorescence. The inflorescences of grape came out from last week of February to first week of March and became flower and fruit within mid March to mid April. The inflorescences were developed in all fifteen K_2O treated vines except T_2 treated Thomson variety. The inflorescences numbers were found higher with increasing the doses of potassium (Figure-3). Thomson showed lesser number of inflorescences in comparison to Jakkaw irrespective of treatments. The inflorescences number of Thomson variety varied from 1-30 where as in Jakkaw the number varied from 32-50 (Table-7).

Table-7: Inflorescence Formation of the Vineyard

Treatment	R_1	R_2	R_3	Mean
K_2O- 00 - T_0	01 Inflorescence found (Thomson)	20 Inflorescences found (Jakkaw)	20 green Inflorescences found (Jakkaw)	14 Inflorescences
K_2O-100- T_1	03 medium Inflorescences found (Thomson)	No Inflorescences found (Thomson)	32 green Inflorescences found (Jakkaw)	12 Inflorescences
K_2O-150- T_2	03 small green Inflorescences found (Thomson)	36 small Inflorescences found (Jakkaw)	04 Small green Inflorescences found (Thomson)	14 Inflorescences
K_2O-200 - T_3	50 light green color Inflorescences found (Jakkaw)	30 small Inflorescences found (Thomson)	50 Small Inflorescences found (Jakkaw)	43 Inflorescences
K_2O-250 - T_4	12 small green Inflorescence found (Thomson)	08 small Inflorescences found (Thomson)	30 small and medium Inflorescences found (Jakkaw)	17 Inflorescences

Cluster Formation: The synonym of cluster is panicle or bunch. Generally the cluster formed near the trunk is preferable because it will be the largest. The basal cluster gets more food from the trunk so size is bigger. The level of thinning should allow excellent set of berries. Thinning is also practiced in RDA vineyard. The number of cluster formation in Jakkaw was higher than the Thomson. Thomson produced 0, 1, 3, 3, 4, 8, 12 and 30 number of clusters in five different potassium treated 8 saplings and Jakkaw produced 20, 20, 30, 32, 36, 50 and 50 number of clusters in five treated 7 saplings (Table-8). Higher numbers of cluster formation (50 and 30 no.s) are the result of higher yield in Jakkaw and Thomson varieties respectively and it is obviously true in T_3 treatment where 200 Kg K_2O/acre was applied (Figure-1).

Table-8: No. of Clusters per Vine

Treatment	R_1	R_2	R_3	Total	Mean
K_2O- 00 - T_0	1 (Thomson)	20 (Jakkaw)	20 (Jakkaw)	41	14
K_2O-100- T_1	3 (Thomson)	0 (Thomson)	32 (Jakkaw)	35	12
K_2O-150 - T_2	3 (Thomson)	36 (Jakkaw)	4 (Thomson)	43	14
K_2O-200 - T_3	50 (Jakkaw)	30 (Thomson)	50 (Jakkaw)	130	43
K_2O-250 - T_4	12 (Thomson)	8 (Thomson)	30 (Jakkaw)	50	17
Total	69	114	156	339	113

Berry Formation: Commercially grapes are by far the most important fruit crop accounting for about one-quarter of the fruit production of the world. On a world basis, they are listed as having the highest monetary value of all fruits and undoubtedly rank higher in amount

produced and number of people they feed. About 78% of the world's crop is pressed into wine, 14% is dried and 8% is consumed fresh (Rabinson, 1986). Specific cultivars are usually grown for each purpose. The European grape V*itis vinifera (vitaceae)* is grown for wine, raisins and fresh fruit. In RDA garden V*itis vinifera* is cultivated for table purpose use.

Berries are the end product of a grape vine. The varieties which produce large amount of grapes with big size of berries along with sweet taste are supposed to be the good varieties of grape. Berries at the tip of the cluster will be generally smaller than those at the base due to differential availability of metabolites. Hence, it is recommended to clip the cluster by about 1/4th of its length immediately after set. This is actually not practicing in RDA garden but thinning was done regularly. It is evident from Table-9 that total number of clusters and berries production varied from treatment to treatment and variety to variety. Highest number of berries (3981 no.s) were produced in T_3 followed by T_4 (1638 no.s), T_0 (1378 no.s), T_2 (1272 no.s) and T_1 (1076 no.s). Less number of berries were produced in T_2 and T_1. This was because Thomson variety included in those treatments and replicated twice, as a result, less number of clusters producing Thomson effected on total number of berries and even in T_1 one sapling of Thomson did not produce any cluster that was another cause of lower numbers of berry production. In comparison to T_1 and T_2; T_0 produced more number of berries. This was due to Jakkaw variety which was replicated twice and produced more number of berries than Thomson and ultimate effect was more number of berries in T_0. From the study it is concluded that 200 Kg K_2O/acre was sufficient to produce optimum effect both Thomson and Jakkaw varieties (Figure-2).

Table-9: No. of Berries per Vine

Treatment	R_1	R_2	R_3	Total	Mean
K_2O-00 - T_0	32 (Thomson) (Av. 32 no.)	682 (Jakkaw) (Av. 34 no.)	664 (Jakkaw) (Av. 33 no.)	1378	459
K_2O-100- T_1	100 (Thomson) (Av. 33 no.)	0 (Thomson) (Av. 0 no.)	976 (Jakkaw) (Av. 31 no.)	1076	359
K_2O-150 - T_2	115 (Thomson) (Av. 38 no.)	1082 (Jakkaw) (Av. 30 no.)	75 (Thomson) (Av. 19 no.)	1272	424
K_2O-200 - T_3	1529 (Jakkaw) (Av. 31 no.)	952 (Thomson) (Av. 32 no.)	1500 (Jakkaw) (Av. 30 no.)	3981	1327
K_2O-250 - T_4	453 (Thomson) (Av. 38 no.)	277 (Thomson) (Av. 35 no.)	908 (Jakkaw) (Av. 30 no.)	1638	546
Total	2229	3493	4723	10445	3482

N.B: Parenthesis indicates variety name and no. of berries per cluster

Figure-1: Clusters per Vine

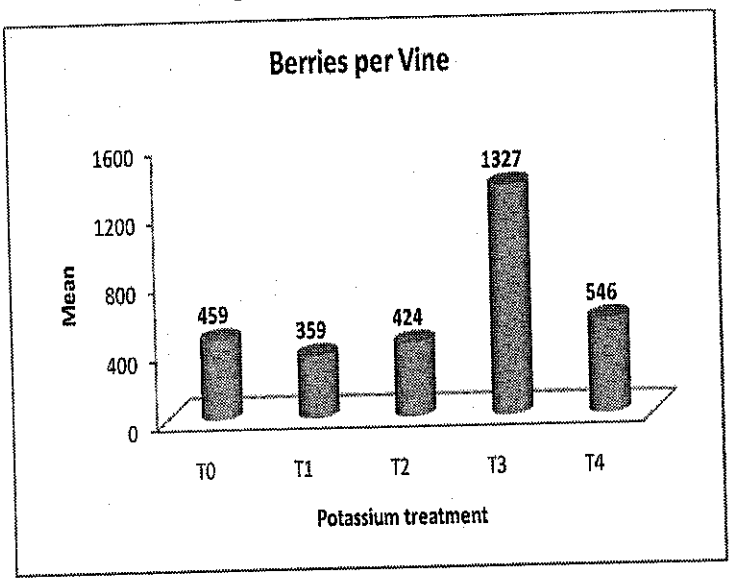


Figure-2: Berries per Vine

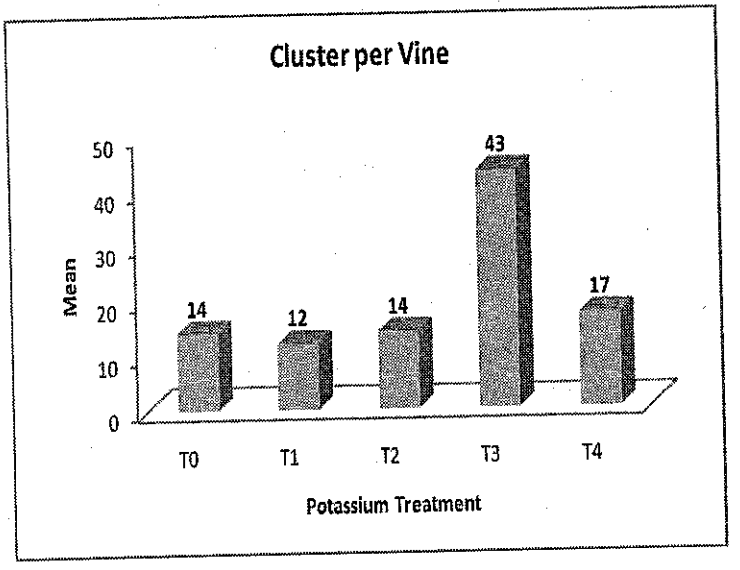
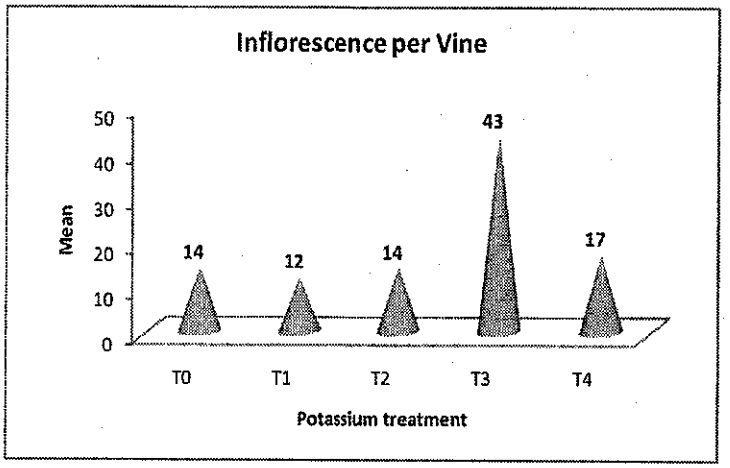


Figure-3: Inflorescence Formation



Disease Observations

The problems facing for the indigenous and exotic grape cultivation in RDA farm is fungal disease particularly anthracnose. The severity observed after hail-storm in the month of April. Among the 15 treatments only the Jakkaw variety under T_2 treatment was found to attack with anthracnose (Table-10).

Table-10: Disease Attack of the Vineyard

Treatment	R_1	R_2	R_3	Mean
K_2O- 00 - T_0	No disease (Thomson)	No disease (Jakkaw)	No disease (Jakkaw)	No disease
K_2O-100- T_1	No disease (Thomson)	No disease (Thomson)	No disease (Jakkaw)	No disease
K_2O-150 - T_2	No disease (Thomson)	Anthracnose (Some holes in the leaves) (Jakkaw)	No disease (Thomson)	Anthracnose disease attack
K_2O-200 - T_3	No disease (Jakkaw)	No disease (Thomson)	No disease (Jakkaw)	No disease
K_2O-250 - T_4	No disease (Thomson)	No disease (Thomson)	No disease (Jakkaw)	No disease

Recommendations

1. Potash is a very essential nutrient and is required in larger quantities for grape.
2. For exotic and indigenous variety 200-250 Kg K_2O/acre should be applied.
3. Of the total dose of potash 50% should be applied during the growth season and 50% during the fruiting season.
4. For grape production potash should be applied in the form of K_2SO_4.

References

Chatterjee, T.K.; Majumder, B.C. and Nandi, A. (1984). Scientific Way Fruit Cultivation. Central Book Publishers, 8/1- Chintamoni Das Lane, Kolikata-700009.

ICAR, (1980). Hand book of Agriculture. Indian Council of Agriculture Research, New Delhi.

McGrew, J.R.; Loenholdt, J; Hunt, A. and Amberg, H. (1998). Growing Wine Grapes. 3667 Morgan Rd. Ann Arbor, MI 48108 USA.

Nurujjaman, M. (1994). Grape Production Technology. 107/4 Mobarok Shah Road, Narayangonj, Dhaka.

Rabinson, Janics. (1986). Vines, Grapes and Wines. Alfred A. Knoph. New York.

Shikhamany, S.D. (1999). Grape Production in India. ICAR. Pune-412307.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Effect of Different Doses of Chemical Fertilizers on the Growth and Yield of Breeder Level Seed Potato Production at RDA Demonstration Farm

Md. Feroz Hossain [1]
Md. Mizanur Rahman [2]

Abstract

The effect of chemical fertilizer on the yield and economic return of breeder level seed potato production was studied at the demonstration farm of Rural Development Academy, Bogra during 2011-12. The yield of tubers per hectare was significantly influenced by different doses of fertilizer. The maximum yield (38.70 ton/ha) of potato was obtained from treatments T_2 (Urea 500 kg/ha +TSP 300kg/ha+MOP 350 kg/ha) and minimum yield (27.63 ton/ha) was obtained from treatment T_3 (Urea 700 kg/ha+ TSP 400 kg/ ha + MOP 500kg/ ha). Besides, the prices of seed potato produced and used seed tubers were determined on market rate basis. The highest net return of Tk. 1159984.00/ha and the lowest net return of Tk.593534.00/ha were obtained from T_2 and T_3 treatments respectively. The benefit cost ratio (BCR) was the highest (2.49) with T_2 and the lowest with T_3. The economic analysis was based on the crop yield input costs and market price of the harvested seed potato.

Introduction

Potato production in Bangladesh has been increased dramatically over the last decade increased from 86.6 thousand hectares in 1970-71 to 402.0 thousand hectares in 2007-08 with a corresponding increase in production from 8.5 lac tons to 66.5 lac tons (BBS, 2009). Consequently, the requirement of seed potatoes has increased noticeably in Bangladesh during the recent years, and there has been a remarkable shortage of quality seed potatoes in the country.

The yield potential and actual yield of potato in Bangladesh, as mentioned by Beukema and Van Der Zaag (1990), are 30.0 and 18.0 t/ha, respectively. However, the national average yield of potato in Bangladesh in the year 2007-08 was 16.54 t/ha (BBS, 2009). One of the most important reasons for the wide variation between potential and actual yields is extensive use of poor quality seed tubers by the potato growers of the country. Considering potato production in about 4.0 lac hectares in the year 2007-08 and a seed rate of 1.5 t/ha, the requirement of seed potatoes in the year was about 6.0 lac t/ha for the country (Rabbani

[1] Director (Project Planning & Monitoring Division), RDA, Bogra.
[2] Deputy Director, RDA, Bogra.

et al., 2010). Out of the total quantity of seed potatoes used in the country in recent years, only about 6 % is of high quality (Supplied by BADC and Private Seed Companies). The rest 94 % is farmers' seed potatoes, which are generally poor in quality.

Application of tissue culture technology in the production of high quality seed potato is gradually increasing in Bangladesh both in the public and private sectors. Commercial exploitation of tissue culture technology started in different countries during 1960s (Chandra and Upadhya, 1998). In this system, disease-free potato plantlets are produced through tissue culture, and then the plantlets are grown in net-house for the production of mini-tubers. Subsequent multiplication of mini-tubers in open fields leads to production of different categories of seed potatoes.

It appears from available information that there is a need for improvement and standardization of practices for the production of breeder level potato seed production. Growth and yield of potato are effected by different factors and among those inorganic manures play the most important role. Judicious uses of manures and fertilizers are important for potato production. The average yield is quite low in Bangladash as compared to those of leading potato growing countries of the world.

Research Objectives

Considering the above stated situation the present study was under taken with following objectives:

i. To investigate the effect of different doses of chemical fertilizers on the growth and yield of breeder level seed potato production; and

ii. To analyses benefit cost of the Breeder level seed potato production.

Research Methodology

The present research will investigate the effects of different chemical fertilizers on the growth and yield of potato. This chapter consists of site selection, other materials and methods of the experiment.

Experimental Site

The experiment was carried out at the demonstration farm of Rural Development Academy, Bogra during the period of November 2011 to February, 2012 to find out suitable fertilizer doses to maximize the production of seed potato of the variety Diamant.

Climate and Soil

The soil of the experimental plot was sandy clay loam belonging to the level barind tract under the Agro-Ecological Zone 25. The selected plot of the land was medium barind tract.

Planting Material

The small grade pre-Breeder seed potato of the variety Diamant was used in experiment. The planting materials were collected from RDA Biotechnology Laboratory.

Design of the Experiment

The experiment was laidout in randomized complete block design (RCBD) with 4 replications.

Fertilizer Treatment

The treatments were given below:

T_1= Urea-300Kg/ha+TSP-200Kg/ha + MOP-200Kg/ha

T_2= Urea-500Kg/ha+TSP-300Kg/ha + MOP-350Kg/ha

T_3= Urea-700Kg/ha+TSP-400Kg/ha + MOP-500Kg/ha

Magnesium Sulphate, Boron and Zinc Sulphate were applied at the rate of 160Kg. 20Kg and 20Kg respectively and Cow dung was 8.89 t/ha for all the treatments.

One third dose of urea and entire doses of other fertilizers were applied during the last ploughing. The remaing two third of urea was applied in two installments at 30 and 45 days after planting.

Land Preparation

The Selected land was opened on the last week of October, 2012 with a tractor and it was exposed to the sun for few days prior to next ploughing. After wards, it was prepared by ploughing and cross ploughing followed by laddering to obtain good tilth, suitable for growing potato. Most of the weeds were uprooted and stubbles were removed from the field. During last ploughing soil was treated with Furadan 5G@ 15 Kg/ha. Irrigation and drainage channels were prepared around the plot.

Planting of Seed Tubers

The seed tubers were planted in furrows on November 2011 maintaining a spacing of 25cm × 15cm. the depth of planting was 6cm from the surface of the soil.

Other Operation

The different intercultural operations such as weeding, mulching were done manually when ever necessary. Irrigation and plant protection measures were taken as and when necessary.

Results and Discussion

The present study was carried out to investigate the effect of NPK fertilizer dose on the vegetative growth and yield of Diamant potato has been presented in Table-1, and discussed

in this chapter. The results of analysis of variance of the data obtained from the present investigation are presented in the Tables also.

Table-1: Effect of Different Doses of NPK Fertilizers on Vegetative Growth of Plants and Yield of Potato Tubers

Treatment (Fertilizer dose)	Average plant height at different DAP (cm)				Average foliage coverage at different DAP (%)			Average no. of stems/ hill	Average fresh wt. of haulm/ hill (g)	Average no. of tubers / hill	Average wt. of tubers/ hill (g)	Average yield of tubers/ plot (kg)	Average yield of tubers (t/ha)
	30	45	60	75	45	60	75						
T1	6.04	12.19	33.34	54.58	66.25	92.50	98.75	1.55	116.75	11.13	107.00	5.21	27.80
T2	6.49	11.91	39.96	63.23	57.50	86.25	97.00	1.53	141.75	15.83	147.75	7.27	38.79
T3	5.94	11.94	32.74	52.58	63.75	90.00	98.75	1.50	119.50	11.93	111.25	5.18	27.63
LSD at 0.05	1.66	3.09	4.16	3.69	16.12	6.61	4.71	0.18	11.00	1.52	12.35	0.51	2.72
LSD at 0.01	2.52	4.68	6.30	5.60	24.42	10.01	7.14	0.28	16.67	2.30	18.71	0.77	4.12
Level of significance	NS	NS	**	**	NS	NS	NS	NS	**	**	**	**	**

Plant Height

The height of the plant was recorded at the different days after planting (30, 45, 60 and 75 DAP). The plant height was significantly influenced by the application of different doses of NPK fertilizer (Table-2). The doses of NPK fertilizer caused significant variation in relation to plant height of potato at 60 and 75 DAP (Table-3).The highest plant height (63.23 cm) was recorded at the 75 DAP and the lowest plant height (5.94 cm) was recorded at the 30 DAP. The tallest plant (63.23 cm) at 75 DAP was obtained from the treatment T_2 (Urea 500 kg/ha + TSP 300 kg/ha + MOP 350 kg/ha) which were better than the treatment T_1 (Urea 300 kg/ha + TSP 200 kg/ha + MOP 200 kg/ha) and treatment T_3 (Urea 700 kg/ha + TSP 400 kg/ha + MOP 500 kg/ha). The plants were the shortest (5.94 cm), which were received from T_1 fertilizer treatment.

Table-2: Analysis of Variance of the Data on Height of Plant (cm) at Different Days after Planting of Potato

Sources of variation	df	Mean Sum of Square			
		Plant height (cm) at different days after planting			
		30	45	60	75
Replication	3	0.677	0.921	8.717	2.150
Treatment	2	0.343	0.093	64.301**	128.163**
Error	6	0.921	3.188	5.766	4.559

Foliage Coverage

There was no significant variation on foliage coverage of potato plant in relation to different fertilizer doses (Table-3). The doses of NPK fertilizer showed no significant variation on foliage coverage at different stages (45 DAP, 60 DAP and 75 DAP) of plant growth. The growth, development and productivity of potato plants are directly related to foliage coverage. Good foliage coverage indicate good yield tuber because it is related to production of higher photosynthetic area, but there was no significant differences were found among three treatments of fertilizer dose incase of foliage coverage.

Table-3: Analysis of Variance of the Data on Foliage Coverage (%) at Different Days after Planting of Potato

Sources of variation	df	Mean Sum of Square				
		Foliage coverage (%) at different days after planting			No. of stem/ hill	Fresh weight of haulm (g)
		45	60	75		
Replication	3	47.222	2.083	3.667	0.010	28.667
Treatment	2	81.250	39.583	4.083	0.003	751.750**
Error	6	86.806	14.583	7.417	0.011	40.417

Number of Stems per Hill

The doses of NPK fertilizer showed no significant influence on the number of stems per hill (Table-3). The output of three treatments was more or less same in case of number of stems per hill.

Fresh Weight of Haulm per Hill

Fresh weight of haulm per hill varies significantly by different doses of fertilizer (Table-3). The maximum fresh weight (141.75 g) of haulm per hill was recorded with treatment T_2 (Urea 500 kg/ha + TSP 300 kg/ha + MOP 350 kg/ha) and minimum fresh weight (116.75 g) of haulm per hill was recorded with treatment T_1 (Urea 300 kg/ha + TSP 200 kg/ha + MOP 200 kg/ha). The fresh weight of stem is directly related to haulm growth of potato plant. The application of different levels of fertilizer significantly influenced the fresh weight of haulm per hill (Table-3).

Number of Tubers per Hill

The doses of NPK fertilizer showed significant influence on number of tubers produced per hill (Table-4).Application of different doses of fertilizer was significantly influenced the number of tubers per hill. The variation in number of tuber per hill was significant due to the different doses of fertilizer (Table-4). The maximum number of tuber per hill (15.83) was obtained from T_2 (Urea 500 kg/ha + TSP 300 kg/ha + MOP 350 kg/ha) and

the minimum number of tuber per hill (11.13) was obtained from T_1 (Urea 300 kg/ha + TSP 200 kg/ha + MOP 200 kg/ha) was recorded on Table-1.

Table-4: Analysis of Variance of the Data on No. of Tubers/ hill of Potato

Sources of variation	df	Mean Sum of Square		
		No. of tubers /hill	Weight of tubers (g)/hill	Yield of tubers (t/ ha)
Replication	3	2.341	294.000	3.382
Treatment	2	25.293**	2007.250 **	163.571**
Error	6	0.767	50.917	2.469

Weight of Tubers per Hill

Weight of tubers per hill varies significantly by different doses of fertilizer (Table-2). The maximum weight (147.75g) of tubers per hill was recorded with treatment T_2 (Urea 500 kg/ha + TSP 300 kg/ha + MOP 350 kg/ha) and minimum weight (107.00g) of tuber per hill was recorded with treatment T_1 (Urea 300 kg/ha + TSP 200 kg/ha + MOP 200 kg/ha). Fresh weight of potato plant stem is directly related to tuber growth and eventually weight of tuber. Application of different treatments significantly influenced the weight of tubers per hill (Table-4).

Yield of Tubers per Plot

Yield of tubers per plant was significantly influenced by different doses of fertilizer (Table-2). The maximum yield (7.27 kg) of tuber per plot was obtained from treatment T_2 (Urea 500 kg/ha + TSP 300 kg/ha + MOP 350 kg/ha) and minimum yield (5.18 kg) of tubers per plot was obtained from treatment T_3 (Urea 700 kg/ha + TSP 400 kg/ha + MOP 500 kg/ha) (Table-1).

Yield of Tubers per Hectare

Yield of tubers per plot was significantly influenced by different doses of fertilizer (Table-2). The maximum yield (38.79 ton) of tuber per hectare was obtained from treatment T_2 (Urea 500 kg/ha + TSP 300 kg/ha + MOP 350 kg/ha) and minimum yield (27.63 ton) of tubers per hectare was obtained from treatment T_3 (Urea 700 kg/ha + TSP 400 kg/ha + MOP 500 kg/ha) (Table-1).

Economic Analysis

Economic analysis was done to evaluate the comparative benefit and cost as influenced by different level of chemical fertilizers treatments. Material and non-material input costs and overhead cost were calculated for unit plot and then converted into per hectare. The prices of seed potato produced and used seed tubers were determined on market rate basis. Details

of economic analysis are shown in Table-5. Inputs and overhead costs were recorded for all the treatments and calculated on per hectare basis. The lowest return was obtained from treatment (T_3) and highest was obtained from treatment (T_2). The highest net return of Tk =1159984.00/ha and lowest net return of Tk. 593534.00/ha. The benefit cost ratio (BCR) was the highest (2.49) with T_2 and the lowest with T_3. The economic analysis was based on the crop yield input costs (seed tubers, labour cost, irrigation, plant protection, manpower etc.) and market price of the harvested seed potato, all these may vary from year to year.

Table-5: Detailed Computation of Cost and Return of Potato (Tk/ ha)

Treatments	Gross return (Tk/ha)		Net return (Tk/ha)	Banefit cost ratio
	Total cost of production	Total return (Tk/ ha)		
T_1	7,38,066.00	13,90,000.00	6,51,934.00	1.88
T_2	7,79,516.00	19,39,500.00	11,59,984.00	2.49
T_3	7,87,966.00	13,81,500.00	5,93,534.00	1.75

References

BBS. (2009). Monthly Statistical Bulletin – Bangladesh, February 2009. Bangladesh Bureau of Statistics, Ministry of Planning, Govt. of the People's Republic of Bangladesh, Dhaka. 184 p.

Beukema, H.P. and Van Der Zaag, D.E. (1990). Introduction to Potato Production. PUDOC, Wageningen, The Netherlands. pp. 35-67.

Chandra, R. and Upadhya, M.D. (1998). Commercialization of tissue culture technology. In: Comprehensive Potato Biotechnology. S.M.P. Khurana.

Chandra, R. and Upadhya, M.D. (eds) (1998). Malhotra Publishing House, New Delhi. pp. 207-233.

Hossain, M.J. and Vecchio, V. (1999). Potential of sprout cutting on the growth, yield and multiplication rate. Italian J. Agron., 3: 1-6.

Hossain, M.M. (2003). Studies on production and utilization of seedling tubers derived from true potato seeds. Ph.D. dissertation, Dept. of Horticlture, BAU, Mymnsingh.

Islam, M.S.(2009). Personal Communication. Bengal Seeds (Pvt.) Ltd., Ranibazar, Rajshahi.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Labour Migration as a Livelihood Strategy in the Char Dwellers in Bangladesh

AKM Zakaria[1]
Sheikh Saeem Ferdous[2]

Abstract

This study focuses on the relationship between a household's land tenure and labour migration as a livelihood strategy in the river Islands (chars) in Bangladesh. It contains access to land and labour migration and impacts. On the livelihood of char household, motives behind labour migration and some other aspects of agricultural labour migration, such as the timing, duration, destination and employment opportunities at the destination are also depicted. Overall, the results of the field research in the villages Teguri and Borangial in Chauhali char -clearly indicate a positive correlation between land tenure and propensity for labour migration weatheir families, expressed in terms of sufficient land access appeared to be less inclined to migration. Members of households with little land tenure sometimes migrate for work, especially in the times of crisis. Landless housheols comprises the vast majority of the agricultural labour migrants. Besides land access, other factors such as skill and the number of male household members also influence and determine one's propensity for migration,. The result of this study indicate that the main motives behind agricultural labour migration are poverty, lack of land access and unemployment, which can all be interpreted as push factors. The study concluded that char dwellers seem to migrate primarily out of necessity.

Introduction

A large proportion of the Bangladeshi labour migration can be categorized as internal migration (Ali, 2005). Internal labour migration constitutes a very diverse category: it can be for a long or short duration of time, depending on the agricultural seasons or not, undertaken by both landless people and landowners, and potential destinations include a wide range of urban and rural areas. The employment opportunities are also manifold; labour migrants are active in the agricultural sector, such as harvesting rice crops, but also in non-agricultural occupations, like rickshaw pulling, construction and the gaments industry. The literature concerning labour migration from rural areas addresses different motives for labour migration (Ahamad et al., 2011 and Hossain, 2001).

[1] Director (Agricultural Sciences Division), RDA, Bogra.
[2] Deputy Director, RDA, Bogra.

Possible push factors are poverty, economic hardship during a time of crisis, lack of employment opportunities and income in certain periods of the year, natural disasters such as floodings and cyclones, and food insecurity. Pull factors include higher wages, a higher demand for labour in the destination area than in the home area, better employment and education. (Khandher et al., 2011). Labour migration (national and international level) has positive and negative effects (De Haan, 1997).

Furthermore, the familial context of labour migration as a strategy of livelihood is very important. Among others, De Haan (1997) and Khandher et al., (2011) observed that a higher dependency ratio and a younger head of the household increase the chance of labour migration. Labour migration usually increases the income of the household and often improves the livelihood since the earnings through labour migration may reduce tensions related to poverty. Nevertheless, labour migration is an ambivalent practice. Indeed, migrants leave their families behind, without knowing assurance of success. The families of the migrants may therefore find themselves at risk and tensions may arise over the amount and timing of remittances. Moreover, in absence of young member who leave the household for labour selling, reduces the available labour supply which may result in longer and harder labour circumstances for women (Mc Dowell and De Haan, 1997).

Charlands (large landmasses in rivers) in Bangladesh make for an interesting research subject because of their specific characteristics that partly differ from the rural mainland (Barkat et al., 2007; Rahman and Davis, 2005). The literature on rural Bangladesh, however, mostly remains silent on these areas and their inhabitants. Chars are mostly isolated from the mainland, they are highly prone to flooding and riverbank erosion, the provision of education and healthcare is inadequate, and they are characterized by a higher proportion of landless people than in other parts of Bangladesh. One of the key features of charlands is the importance of land tenure, since the dominant form of livelihood for most char dwellers is agriculture [1]. Because of the natural conditions and other contextual circumstances, it is conceivable that the agricultural economy cannot satisfy the needs for survival in the chars. So, diversification of livelihood is an important way to deal with income insecurity, with labour migration as one of the options (Barkat el al., 2007).

In this connection a study was conducted in the villages - Teguri and Borangial in Chauhali char under Sirajganj district. Furthermore, an inquiry was made about the importance of both land access and labour migration for the livelihood of char households, by examining the proportion of income generated from agricultural activities and labour migration.

Objective of the Study

The main objective of the study was to findout the relationship between land tenure and labour migration in the chars.

Methodology of the Study

To answer research questions, a small-scale fieldwork was conducted in two villages namely Teguri and Borangil in Chauhaili Char under the district of Sirajong. Research focus was given at the household level. The research methodology consists of observations, informal discussions and interviews.

Data collection

In total, twenty-six households were interviewed of them fourteen households migrate for labour and twelve households do not. Sixteen of them were from Teguri and ten live in Borangial. Of the total sample, eight households are totally landless. The rest owns land, leases in land and does share cropping with differing sizes of land at their disposal.

Different tools like semi structured questionnaire and guideline were used to collect data and information. Some other useful methods like observation and a focus group discussion were followed too.

Results and Discussions

Findings

Labour migration: It appeared that only male char dwellers decide to migrate. Approximately 20% of the char dwellers in villages under study (Teguri and Borangial) practice labour migration. These migrants are mainly landless people who do not have sufficient land to earn their living. They all go to places located within districs of Sylhet, Manikganj, Rajshahi, Tangail, Sirajgonj and Dhaka, with Sylhet and Manikganj being popular destinations for harvesting rice. In the framework of the study on the char, international migration did not occur.

Migration occurs mainly on a seasonal basis. Most labour migration occurs around April, during August - September and November - December. During these periods people generally migrate to Sylhet, Manikganj and Rajshahi for rice harvesting. Results from other studies confirm that labour migration is related to crop cycles, corresponding to seasonal fluctuations in labour demand and wages both at the places of origin and migration destinies (Ahamad et al., 2011; Rahman and Davis, 2005; World Food Programme (WFP) Food Security Atlas for Bangladesh).

An important feature of labour migration on the char is the fact that employment arrangements often happen through a middleman. It is noticed from Focused Group Discussion (FGD)

that each of the middleman takes 40-50 male char dwellers to the destinations in March - April for the cultivation of rice. Besides employment, the middleman also arranges their transport and accommodation and in return, he gets a share of the earnings of the migrants.

Land ownership: On the charlands, according to a Government of Bangladesh National Survey conducted in 1996, 29% people have no land, 24% have land between 0.01-0.5 acres, 14% have 0.5-1 acre, 20% have 1-2.5 acres, 11% have land between 2.5-7.5 acres and only 2% have land more than 7.5 acres (Rahman and Davis, 2005). According to Barkat et al., (2007), the prevalence of absolute landlessness is three times higher in the chars as compared to the national average. The number of landless households is about 60%.

Access to land is crucial for the subsistence of char dwellers; different kinds of relations to land can be distinguished, which regularly overlap within the same household: land owners, land leasers, share croppers and landless people. Some households are co-owners, which mean that they share their land with other people, and therefore, limited in their capacity to use and benefit from this land. Even though the ownership is not really official because there is no registration or taxation of land. From focused group discussion it is revealed that three rich people own 60-100 bigha but such owners do not appear to be found living in the chars. The middle class, represented by seven households in Teguri, are self-sufficient and own 30-50 bigha. The eight households who are categorised as lower middle class own 10-20 bigha. The poor people i.e. 20 households own 2-5 bigha, and finally the other out of the total 150 households from Teguri and Borangi are landless and hold no land at all.

Some people in the char share their land. Share - cropping is a system of farming in which a landowner allows a tenant to use the land in return for a share of the crop produced on the land. It's quite a common practice between family members or village members to divide the expenditure and harvest on each other's land. Some farmers made a lease agreement with the landlord that permits them to use land in exchange of rent.

Determinants of Labour Migration

Land access: Labour migration is mostly done by landless/poor people. It is a necessary source of income for people with limited land tenure, while larger landowners stay on the char to cultivate their land. Both landless and poor people go for labour migration mainly to Sylhet. Generally rich and middle class people are well-off and do not participate in labour migration. Chowdhury et al., (2009), studying the incentives for labour migration in rural northwest Bangladesh also found that wealthier households are less likely to migrate. Families with limited access to land (poor class) take part in labour migration. Their land is insufficient for their own food security. Moreover, landowners also opt for additional labour migration when they are struck by a crisis like floods.

Education: All respondents except one were either illiterate or poorly educated. Only one interviewee had pursued secondary school. Since all respondents, both migrants and non-migrants, are poorly educated, no correlation could be derived from data between the level of education of a person and the propensity for migration. Similar observations were made by Thomson (2000).

Skills: The study shows that certain skills are a prerequisite for labour migration and that a person's skills determine the kind of labour this person carries out. Since agriculture is the main income generating activity on chars, many char dwellers have skills for agricultural activities. This explains why many migrants perform farming activities at the place of destination. The middleman plays a crucial role in recruiting char dwellers for migration, selects labourers based on their farming skills. He observes potential candidates when they are working on the field, in order to decide who can join and who cannot. Char dwellers who do not have agricultural skills either stay on the char or end up in other sectors on the mainland, e.g. carpentry, rickshaw pulling, or garments industry.

Focus group discussion revealed that only landless families have members who frequently migrate for work. During the household interviews, four (4) out of six (6) landless households indicated to take part in labour migration. In one family that does not migrate for labour, the father used to migrate for work, but since he has a job in a local weaving factory and got married and had a baby, he is no longer interested in doing so. The other reason of the landless family that does not participate in labour migration, the head of the household is simply too old.

Hossain (2001) found that out-migration is generally higher from villages characterized by land scarcity, unequal distribution of land, and a high proportion of agricultural labourers. He also state that landholding of a household plays an important role in determining rural migration in an agrarian economy where the people are mostly dependent on land for their livelihood.

Overall, the data collected during the fieldwork clearly indicated a relationship between land tenure and labour migration. Families that are well-off having sufficient land for their food production do not participate in labour migration. Families with little land (poor class) do migrate for work, especially in crisis periods. The majority, that is, sixten out of total twentysix respondents of the migrating labourers are landless people (Table-1).

Table-1: Land Tenure and Labour Migration

Land tenure of respondents	Number of respondents	Migrates/ Do not migrate	Observation
Landless (No Land)	8	Migrates	-
Less than 1 Bigha	2	Do not migrate	Works in That (weaving)
1 bigha to 5 bigha	6	Migrates	
5.1 bigha to 10 bigha	4	Do not migrate	1.Family self sufficient 2.Own tath factory
10.1 bigha to 15 bigha	2	Migrates	Family size is big; gets low wage in the village.
15.1 bigha to 20 bigha	0	-	-
20.1 bigha to 25 bigha	0	-	-
25.1 bigha to 30 bigha	2	Do not migrate	Much land to work on
30.1 bigha to 35 bigha	2	Do not migrate	Much land to work on

Note: one bigha is 33 decimal or 0.33 acre of land.

Male Members: De Haan (1997) and Khandher et al. (2011) argue that in extensive households it is appeared that male members migrate and women never migrate. Toufique et al., (2002) however argue that there is an ever increasing number of women who leave their families behind to find work. The family composition seems to have an influence on the choice for labour migration as a livelihood strategy. According to Khandher et al., (2011), a higher dependency ratio and a younger head of the household increased the chance of labour migration. In the study it was found that there is a link between the number of male members (sons, brothers) in a household and the possibility to migrate. The family composition has an influence on the inclination to migrate for some households, while it does not really matter for others.

Some men do not want to migrate for practical reasons and because they do not want to leave their families. "*Abdul Majid married some time ago and has a little daughter. Even though his family does not have enough food, he is not interested in migrating because he does not want to leave his family alone on the char. Fakir Ali does not migrate because there is no other member in his household to work on the field. His children are too young but he would be interested in migration together with his son in the future.*" It is noticed that one of the informants wants to migrate nearly permanently and leaves his wife and young children alone on the char because his income out of labour migration is necessary to sustain the family. These findings should also be considered in relation to land tenure, since cultivation of land (owned, leased or sharecropped) requires often male labour.

Women do not face any major social problem following from the migration of their husbands; they are secured on the char. Food security is not insecured during absence of male (mostly 15 days to 1 month), they can get help from other people (e.g. borrow money without interest) and they eat only twice instead of three times a day. This does not really confirm what Mc Dowell and De Haan (1997) wrote, when they say that the absence of young men, who leave the household for labour migration, reduces the available labour supply which may result in longer and harder labour circumstances for women.

Unemployment possibilities: It is already mentioned that employment opportunities are low on chars. The main activities that encountered were agriculture, livestock, small weaving factories and trade. For most of these activities, land tenure is a precondition. The majority of the landless people are therefore working as a day labourer. The wages however, are low on the char. Migrating allows these labourers to work in places where wages are higher. Low employment on the char, together with the opportunity but not guarantee of higher wages elsewhere is a major trigger for landless people to participate in labour migration, as indicated by a large proportion of respondents under study.

Some respondents informed that they migrate for work at times when employment on the char is low and/or in crisis periods (e.g. floods). Others are more attracted to the opportunities posed by labour migration, leaving the char when there is work elsewhere, independent of the employment at home. The latter was confirmed by the owner of a local weaving factory indicating that during the main periods of labour migration he has faced difficulty to find sufficient labourers. In general, there is job security at the place of destination. When people migrate for work via a middleman, he is the one who assures their employment. Others enjoy job security because they frequently return to the same factory or the same farm.

Hossain (2001) found that the availability of job opportunities at the place of destination, whatever the quality, plays a very important role in regards to the process of decision making for migration, while pre-migration occupation also helps to understand the causes behind migration. Ahamad et al., (2011) add the cost of migration and housing conditions at the destination to this decision. From the fieldwork it is evident that migrated char dwellers mainly remained engaged in agricultural activities. Toufiq and Turton (2002) also state that the wage in non-farming activities is generally higher than wages in the agriculture sector.

Conclusion

The findings of the study clearly indicate a correlation between land tenure on the char and the propensity for labour migration. A household owns more land or has access to, the less likely is that the members will migrate for work. Wealthier families expressed in terms of

sufficient land ownership or significant land access, are thus less or not inclined to migrate for work than households with little or no land. Findings show that members of households with little land tenure sometimes migrate for work, especially in times of crisis, and that landless households bring forth the vast majority of the labour migrants. This correlation between land and labour migration is understandable when one takes into account that agriculture is the main income generating activity on the char. Access to land being a prerequisite for agricultural activities, it follows that mostly landless people are in need of income diversification. Landless char dwellers therefore, more often than others, opt for labour migration. Although the study found that there is no clear migration pattern, most of the informants migrated during the months of April and August to December excluding October mainly to Sylhet, Manikganj and Rajshahi, being the most popular destinations. Labour migrants, given their agricultural background, are predominantly employed in rice harvesting at those places.

The indicated relationship between land and labour migration must, however, be carefully interpreted because of other factors, besides land access, also influencing and determining one's propensity to migrate. Indeed, during field work, certain factors were identified that play a significant (and sometimes even decisive) role in one's decision for migration. A lack of skills, for example, may prevent someone from migrating or may determine the kind of employment one performs at the place of destination. Furthermore, a household with many male members is more likely to have migrating members than a household with only one breadwinner. A lack of employment and income diversification on the char, due to specific char-conditions, such as its isolation and the lack of possible off-farm activities can also constitute important incentives for labour migration.

On the whole, the main motives behind labour migration are poverty, scarcity of land (access) and unemployment. Compared and in contrast to dynamics of labour migration in other areas in Bangladesh, char dwellers seem to migrate primarily out of necessity, rather than because of better opportunities elsewhere. Moreover, all motives touched upon by the respondents are push factors with a strong link to the factor of land. Although other factors like skills and number of male members are important, land tenure seems to play a key role in migration on the char.Throughout the report it has become clear that charlands, with their own dynamics and feature entail a specific context for labourer migration.

References

Ahamad, M. G.; Khondker, R. K.; Ahmed, Z. U. & Tanin, F. (2011). Seasonal unemployment and voluntary out-migration from Northern Bangladesh. Modern Economy, 2, 174-179.

Ali, A. (2005). Livelihood and Food Security in Rural Bangladesh. The Role of Social Capital. (Doctoral dissertation). Wageningen, The Netherlands : Wageningen University.

Barkat, A.; Roy, P. K.; and Khan, M. S. (2007). Charland in Bangladesh. Political Economy of Ignored Resource, Dhaka, Bangladesh: Pathak Samabesh.

De Haan, A. (1997). Migration as Family Strategy: Rural-Urban Labor Migration in India during the Twentieth Century. *The History of the Family, 2(4)*, 481-505.

Hossain, M, Z. (2001). Rural-Urban Migration in Bangladesh: *A Micro-Level Study*. Submission of full-length Paper for presentation in Twenty-First Bangladesh Science Conference. Retrieved March 15, 2012, from http:// iussp.org/Brazil2001/s20/S28_P02_Hossain.pdf

Khandher, S.; Baqui, K. and Hussain, S. (2011). Seasonal migration to mitigate income seasonality: evidence from Bangladesh? *Journal of Development Economics, 97,* 244-256. Retrieved from http://www.tandfonline.com/doi/ pdf/10.1080/00220388.2011.561325

McDowell, C. and De Haan, A. (1997). Migration and Sustainable Livelihoods: A Critical Review of the Literature. Institute of Development Studies, Working Paper 65. Retrieved March 17, 2012, from http://www.ids.ac.uk/ files/Wp65.pdf

Rahman, S. and Davis, J. (2005). A survey of rural livelihood and enterprise development opportunities in the chars, Bangladesh. DFID Poverty Oriented Research Programme. Retrieved March 10, 2012, from http://www.nri.org/projects/ reed/mymesinghcharsreview7122006.pdf

Toufique, K. A. and Turton, C. (2002). Hands not land: How livelihoods are changing in rural Bangladesh. The Bangladesh Institute for Development Studies (BIDS) and the United Kingdom's Department for International Development. Retrieved March 8, 2012, from http://www.theidlgroup. com/documents/handsnotlandbook.pdf

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Rural Innovations in Agricultural Production System in Bangladesh

AKM Zakaria[1]

Abstract

From time immemorial farmers have been practicing agricultural production and conserving natural resources with the instruments of rural innovations (RI). The development of RI system, including management of natural environment, has been a matter of survival to the people who generated these systems. Such systems are cumulative, representing generations of experience, careful observation, trial and error experiments and are stored in people's memories and in their activities. RI is expressed in stories, songs, folk lore, proverbs, dances, myths, cultural values, beliefs, rituals, community laws, local languages, taxonomy, agricultural practices, equipments, materials, plant species and animal breeds. Local forms of communication are important to local level decision making processes and for the presentation and spread of RI. This kind of innovative knowledge has developed over generations through the process of man-environment interaction and its continuity depends on its transmission and the ability of the future generations to acquire and practice. Rural innovation used by communities to protect natural resources from unsustainable exploitations.

Introduction

Over several millenniums, Bangladesh has been the treasure land of biological wealth, intellectual knowledge and spiritual wisdom. Over this period arts, science and technology has flourished in various fields. A wide variety of crops, livestock and plants has enriched our country. This amazing variety is not a freak of nature, but as a nature of careful selection and even cross breeding over centuries by our farmers and pastoralists. Hence, our agriculture to such an extent is much traditional and dates to about several thousand years. Bangladesh with its traditional crop varieties and crop production technique was able to feed its population. All of our villages had been self-sufficient, self-sustained and self-reliant units. In contrast to the huge population pressure the country made a reasonable progress in agricultural production in the last 3 decades. By this self-sufficiency in food was some how achieved with the introduction of high yielding varieties, inorganic fertilizers, pesticides, modern implements etc. These were imported from external sources in the name of technological package' without taking much care for their adaptability in our own condition and the possible consequences. The development of modern agriculture production was achieved

[1] Director (Agricultural Sciences Division), RDA, Bogra.

by creating large scale specialized farm production units, increased mechanization and use of chemical inputs. Apart from the substantial increase in the crop yields through green revolution, these modern technologies have made our farmers become poorer as they require heavy investment on costly external resources of uncertain future availability. Further, those technologies with the principle of monoculture resulted in the rapid erosion of crop and livestock diversity, natural soil fertility, biological pest regulation, reduced the nutrition once obtained from wild on-farm, increased the need for expensive and poisonous chemical fertilizers and pesticides and finally made the farmers more dependent on market and external agencies resulting in an imbalanced growth. Analyzing the overall situation a notion has been created that modern agriculture may not be able to meet the requirements of the ever increasing population in future and suggested several rural innovations (RI) centered alternatives such as low external input agriculture, organic farming biodynamic farming etc. which have special advantage over modern agricultural technologies. Also the capital and technical skill requirements in the use of such technologies are generally low and their adaptation requires little restructure. These useful technologies are nothing but rural innovations (RI). By adopting such innovative ideas our ancestors did not face any problem of large scale pest outbreak or economic crisis unlike the today's farmers are facing.

Rural innovations in agriculture are dynamic in nature, donot cause any damage to the air, water, soil and safe to the human being and are free from causing environmental pollution. These practices are dynamic because they are region specific, depending upon soil type, rain fall, topography etc. and often modified by the local farmers. Returns per-unit of cash invested on RI practices are higher than those of modern techniques. Crops with higher RI practices are more productive, i.e these crops are better able to withstand water scarcity thus reduce the risk of the climate change impacts. Further, the fruits and grains yielded from plots having much RI practices are of better quality and taste. Also, more honey bees can be observed in the fields of RI practices.

Statement of the problem

Modern agricultural practices have adversely brought many problems to farmers. Our ancestors though having no benefit of scientific education in the modern sense but possesed adequate common sense and over the centuries had evolved many innovative cultural practices that might seem to us primitive and unscientific today. Moreover, many of the modern technologies have rooted from the RI system. Farmers had knowledge of the soil fertility, selection and treatment of seeds, seasons of sowing and harvesting, crop rotation, maturing and other cultural practices. Hence, RI in agricultural practices, integrated with modern technologies can play a key-role in the design of sustainable and eco-friendly

agricultural systems. Therefore, a quick study was conducted to fulfill the following objective.

Objective

To analyze the use of rural innovations (RI) by the farmers in agricultural production system in Bangladesh.

Methodology

The steps taken to accomplish the task include the use of a more qualitative approach. The research design employed was a cross sectional survey conducted in 3 villages in Shajahanpur upazilla of Bogra district to synthesize farmers RI practices to draw useful lessons. Check lists with open ended questions were developed and administered to thirty key informants in each village. Purposive sampling was used in selecting informants from each village based on their knowledge of the subjects as well as elderly by above 50 years. The elderly were selected because they were thought to possess sufficient information about utilization of RI in agricultural production system. Individual interviews and FGD were also conducted.

Findings of the Study

Crop production constraints: There was little variation in main crops grown across the study sites and almost all crops grown were for both food and earning income without much caring about soil health and environment.The four major constraints in crop production in order of importance were recorded as lack of knowledge on farming methods, inadequate extension services eg, two extension agent could hardly server for the whole union, lack of improved crop varieties and markets coupled with low producer prices and unscrupulous middle men who in most cases exploit farmers in many ways.

Livestock keeping constraints: The livestock considered important and almost all households kept chicken and goats for both home consumption and income. Main constraints in livestock keeping in order of importance were diseases, expensive feeds, theives, wild animals, lack of improved breeds etc.

Use of RI in Agriculture: Farmers employed various RI practices most of which were cross-cutting among the crops grown. Early planting is one of the pillars for both indigenous and improved farming methods practiced. This is especially important in T.aman season when agriculture is rain-fed. Farmers take advantages of early monsoon which also reduce the incidences of pest and disease and finally leading to high yields.

Sources of RI: The study identified different sources of RI. Main sources were reposited as interactions with the elderly, parents, grand parents, relatives and friends. Other common sources of RI are through visits where one finds a technology being applied and picks interest in it. Migration of people from other parts of the country with different ethnicity, radio programs, extension workers and own discoverness were noted as supplementary sources of RI.

Limitations to sustained use of RI

The biggest limitations to sustained use of RI include minimal sharing of "intellectual property rights" i.e selfishness and sometimes limited co-operation amongst farmers, lack of farm records and increased interest in new technologies. In school students are taught modern technologies which are easier to manage. In the past, farmers produced for subsistence unlike today where production is market oriented. While commercial productions have led to move application of modern and convenient technologies, lack of knowledge. Co-operation and sometimes attaching monetory value to provision of RI has reduced its sustainable use. There are no standardized measures for applying RI which discourages its use in today's modern farming. Rural Innovations bearers do not take aggressive steps to discover more tools and practices because it is associated with identity of ignorance, illiteracy and poverty.

Changes in application of RI: A lot of RI has been lost through deaths of elderly people since there is no formal documentation of such knowledges. Some individuals also deliberately refuge to share RI they posses due to selfishness and desire power or control.

Sustained use of RI and adoption of modern techniques

Despite the increased influence of modernization and economic changes, a few traditional agricultural management and knowledge systems are still predominant. These systems exhibit important elements of sustainability. For example, they are well adapted to particular environments, rely on local resources, are small scale decentralized and they tend to conserve the natural resource base.

Integrated improved methods and RI: Extension workers and progressive farmers encourage farmers to use modern agricultural production techniques such as planting in rows, using HYV or hybrid seeds, practicing chemical pest control, mulching etc diversifying their production by growing cash crops including but not limited to jute, maize and spraying and treating animals with recommended veterinary drugs.

Conclusion and Recommendations

RI is used in agriculture, engineering, medicine, soil conservation and in many other fields. For instance, wooden plough out of wood were used for cultivation - farmers knew which trees to get herbs from, fresh foods were obtained from the wilderness and people observed changes in climate by watching the ant's movement. Intercropping is believed to increase crop yield per unit area and also to replenish the soil. Long periods of fallowing land were observed, mulching was practiced and crop rotation was equally important. Management strategies employed by local people have developed over generations through daily observations and practice. The study determined that in many casses, RI systems have sophisticated technical components, which enabled people to survive in the natural as well as the cultural environment.

Rural Innovation based knowledge can hardly cope with the new challenges. Many diseases and pests have emerged and affecting both local and improved crop varieties and livestock breeds. Modern technologies require proper training to apply and maintain it. Current development trends have so far demonstrated that improved technologies are un-affordable for many poor farmers and they continually fall-back on RI. It is therefore paramount that research finds ways of identifying collecting and validating RI practices. Such information must be stored in a form that is retrievable for use and reference by future generations. Farmers showed interest in promoting all aspects of RI application and utilization especially for treating livestock by using local harbs, proper animal feeding, and mechanisms of preventing pests and diseases both when growing crops and in storage, improving yields through crop rotation and fellowing.

Promising RI use in the areas mentioned above can be promoted through training, sensitization on the benefits through exchange visits, field day exhibitions, radio programmes, production of books on RI etc.

References

Ahmed, N. (2000). Indigenous Knowledge and Practices in Bangladesh, Dhaka.

Alullo, D. (2007). Indigenous Knowledge in Agriculture: a case study of the challenges in sharing knowledge of past generations in a globalized context in Uganda, 295 Entebbe, Uganda.

Sundaramari, R. (2005). Indigenous Agricultural Practice for Sustainable Farming, Agrobios, India.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

RDA's Contribution to Safe Water Supply System in Bogra District of Bangladesh

Mahmud Hossain khan[1]
Md. Abid Hossain Mridha[2]

Abstract

Until the end of 2011, Rural Development Academy (RDA), Bogra has already been installed about 300 nos. irrigation and water management schemes with or without water treatment plant for supplying safe water in different water prone areas of Bangladesh. In this study, total five safe water supply schemes have been selected under Bogra district like Sonajhara, Mahasthangar, Vasuvihar, Majbari and Gabtoli safe water supply project. Out of these, household connections for beneficiaries range were 28 to 794 nos. Present status and future coverage for drinking water supply range were 132 to 750 persons and 100 to 2250 persons respectively. Besides these present status and future trends for irrigation users range were 2 to 78 nos. and 4 to 85 nos. respectively. There were two type of investment in the schemes i.e. project supported and implemented agencies (formal/informal/personal) investment. Project and implemented agencies investment range were Tk. 8.4 lakh to 22 lakh and Tk. 0.20 lakh to 20 lakh respectively. Minimum and maximum coverage through irrigation was 4 and 65 acre respectively and average yearly net income for both irrigation and safe drinking water supply purposes was Tk. 1, 90,848/- in the schemes.

Introduction

Rural Development Academy (RDA), Bogra sailed its journey in June, 1974 as a specialized national institution for training, research, action research and advisory services in various rural development activities of Bangladesh. From its inception, RDA was being working various works on irrigation and water management and presently it have already been developed some irrigation and water management models like low-cost DTW, buried pipe irrigation, arsenic mitigation plant, industrial as well as rural water supply models etc. Recently CIWM, mainly dealing with action research to find out appropriate solutions and replicable models for rural development, was established in 2003 to reach rural people with the benefits of RDA-developed irrigation and water management models within a very short span of time. The centre has transferred from project approach to programmatic approach to make the projects outcome sustainable and it is continuing its past project activities. It works for people to upgrade their socio-economic opportunity, reduce poverty and hunger,

[1] Director (Farm Technology, Irrigation & Water Resources Management Division), RDA, Bogra.
[2] Assistant Director, RDA, Bogra.

improve quality of life, regenerate and sustain natural resources, protect environment and keeping water resources at the nucleus level.

Water is essential to all living organisms for their survival on the earth planet. Human civilization and settlement have been developed on the basis of availability of water sources. Though 70% of the earth is composed of water, only 1% of it is suitable for use. Thus water has become a scarce resource in the earth for its beneficial use in drinking, domestic, agricultural and industrial purposes. A few liters of water is sufficient for a person's daily drinking and food preparation requirement depending on climate and lifestyle. But much larger quantities are necessary when water is used for other domestic purposes such as personal hygiene, cleaning, cooking, laundry and home cleaning, etc. Safe, adequate and accessible supplies of water combined with proper sanitation are the basic needs and essential components of primary health care. They can help in reducing many of the diseases which affect under privileged populations, especially those who live in rural and urban fringe areas. Safe drinking water means that the water sources must be free from undue microbiological contamination and unsafe levels of physical and chemical contaminants as per guideline of the World Health Organization (WHO) and the national standard. Safe drinking water is important in the control of many diseases. This is well established for diseases like diarrhoea, cholera, typhoid and paratyphoid fever, infectious hepatitis, amoebic bacillary dysentery, arsenicosis, and skin disease, etc. It has been estimated that as many as 80% of all diseases in the world are associated with unsafe water.

Presently, over 70% of irrigation and about 97% of potable water needs of Bangladesh are being met by groundwater. In Bangladesh, hand tube well (HTW) is mostly used for abstracting groundwater for drinking purposes. The hand tube wells abstract groundwater usually from shallow aquifer and there is risk of biological and chemical contamination and water quality deterioration in many places. Very recently, arsenic contamination of groundwater has emerged as a major public health hazard in the country. The contamination was first detected in 1993 when only four tube wells were found polluted with arsenic in Nawabganj district in the north-west region of Bangladesh. Subsequently in 1994, for the first time, the Department of Occupational and Environmental Health (DOEH) of the National Institute of Preventive and Social Medicine (NIPSOM), Bangladesh identified eight patients suffering from arsenic toxicity. Initially, it was reported that the arsenic contamination was present in eight western border districts of Bangladesh and about 10 million people were at risk. Until 1997, it has been found that the problem exists in most areas of the country except the south-east hilly region and the Barind tract where arsenic contamination in groundwater has not yet been detected. It has been reported that about 35 million people are affected by arsenic contaminated groundwater through drinking and other unknown ways (Khan and Ahmad, 1997; Khan et.al, 1997).

Recently, it has been found from the joint study of Geological Survey of Bangladesh and the British Geological Survey that arsenic concentration was maximum within the upper 50 m depth of aquifer in most locations of Bangladesh (Water Aid, 2000). In many places of the country concentration of iron and arsenic has gone beyond the limit of safe water quality standards of Bangladesh and World Health Organizations (WHO). As a result, some water borne diseases have been found to spread over in these locations. Many adverse effects and health hazards occur due to arsenic toxicity to human body. The maximum permissible limit of arsenic in drinking water is 0.05 mg/litre whiles the recommended value according to WHO is no more than 0.01 mg/liter (WHO, 1996). Higher concentration of arsenic in drinking water causes diseases like arsenicosis, blindness, and physical disability and so on in the long run. Out of 64 districts, hand tube well water in 61districts has so far been affected by arsenic contamination. About 23 million people of these areas have been reported to suffer from various complications and skin diseases due to arsenic pollution.

Objective

The main objective of the study was to identify RDA's contribution on safe water supply system in Bogra district of Bangladesh. The specific objectives were:

i. to assess the HH connections and area coverage both of drinking and irrigation purposes;

ii. to find out the per capita water consumption per day;

iii. to calculate the cost per household per month; and

Justification of the Study

Until the end of 2011, Rural Development Academy (RDA), Bogra has installed about 300 nos. irrigation and water management schemes with or without water treatment plant for supplying safe drinking water in different water prone areas of Bangladesh. These schemes have been installed by RDA experts with the financial assistance from many government organizations (GOs) like JMBA, BPDB, DPHE, REB, JFCL as well as NGOs (e.g. Proshika, BRAC) with a view to supplying water free from iron, arsenic and other contaminants. In fact, no water was ever completely free of iron and arsenic. In this study RDA's contribution on safe water supply system was considered that means how much quantity and quality water to be supplied in Bogra district by implement five sub-projects. The quality of water of RDA filtration plants has been brought up to the standard of Bangladesh as well as World Health Organization. But, no study/ evaluation have yet been carried out to see the RDA's contribution on safe water supply system so far. It is, therefore, necessary to undertake a study in order to judge RDA's contribution on safe water supply system in terms of contribution of drinking water supply, cost, durability, operation and

maintenance and other technical and financial aspects of the system. The results of the study may be useful for those who are dealing with drinking water supply in private and public sectors as well as arsenic mitigation in Bangladesh. It would also be helpful for policy makers, donors, GOs and NGOs for wider replication of RDA-developed irrigation and water management system, if the model is found acceptable.

Scope of the Study

This study has broadly been concentrated on the contribution of safe water supply in Bogra district of Bangladesh. To achieve this purpose data have been covered the following area:

- Extent of involvement of the beneficiaries in safe water supply system in Bogra district;
- Nature of involvement on RDA-developed safe water supply system;
- Different areas they were using and managing;
- Quality and quantity of water in application;
- Changes in the socio-economic improvement, production, income and creation of self-employment highlighting under those area;
- Constraints faced by the Water User Groups (WUG) during application of the system; and
- Suggestions of WUG for further improvement of the safe water supply model.

Methodology

Selection of Study Area

The following five schemes have been covered under this study:

i. Sonajhara water suppy system, Sherpur, Bogra.
ii. Baraidaha irrigation and water management sub-project, Sherpur, Bogra.
iii. Mohasthangar irrigation and water resources sub-project, Bogra.
iv. Vasuvihar sub-project, Shibgonj, Bogra and
v. Majbari sub-project, Gabtoli, Bogra.

Selection of Respondents

Respondents from the beneficiaries have been selected randomly in each scheme based on different water use criteria in the study.

Data Collection

Some data have been collected through interviews, structured & semi structured questionnaire from the beneficiaries. Also rest of data has been collected by House Hold (HH) survey by the set questionnaire. Beside these, some information have been gathered direct observations by the researchers.

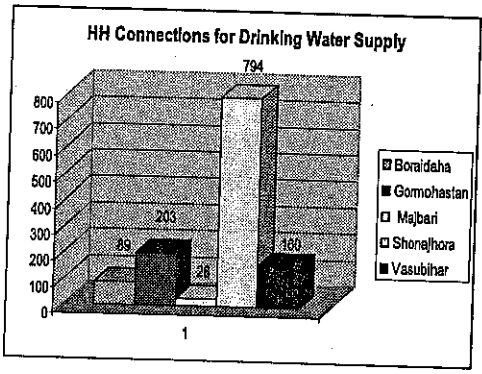


Figure-1

Findings of the Study

HH connections for Domestic Water Supply

This bar diagram mentioned that HH connections in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes for drinking water supply were 89, 203, 28, 794 and 160 nos. respectively. Total connection of those five schemes were 1274 where highest users was 794 (62.32%) in Shonajhora schemes and lowest coverage was 28 (2.02%) in Majbari schemes.

Present Status and Future Trends of Domestic Water Supply

This bar diagram represented that present water users were 300, 700, 132, 750 and 550 numbers and expected users in future would be 800, 800, 750, 2250 and 100 numbers in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes for drinking water supply. Total safe water users were 2432 numbers in five schemes where highest users were 750 numbers in Shonajhora schemes and future users would be 2250 numbers in same site out of those five schemes.

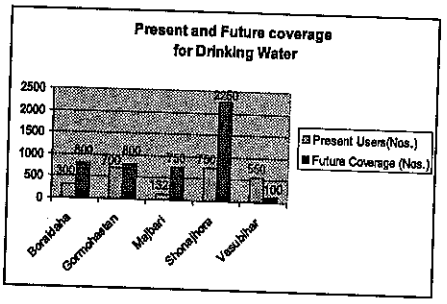


Figure-2

Length of Drinking Water Distribution Network

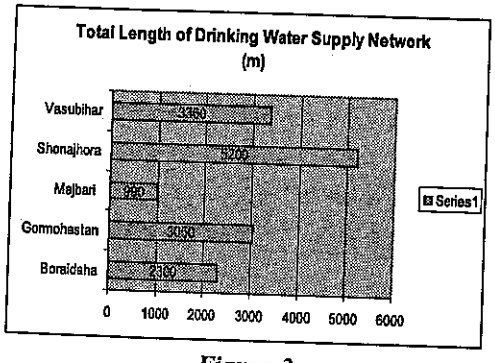


Figure-3

Total length of safe drinking water supply network were 2300, 3050, 990, 5200 and 3360 m in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively for safe drinking water purposes. Total length for safe drinking water supply network in five schemes were 14900 m where maximum pipeline was 5200 m (34.89%) in Shonajhora and minimum pipeline was 990 m (6.64%) in Majbari water supply scheme (Figure-2).

Present and Future Status of Irrigation Water Supply

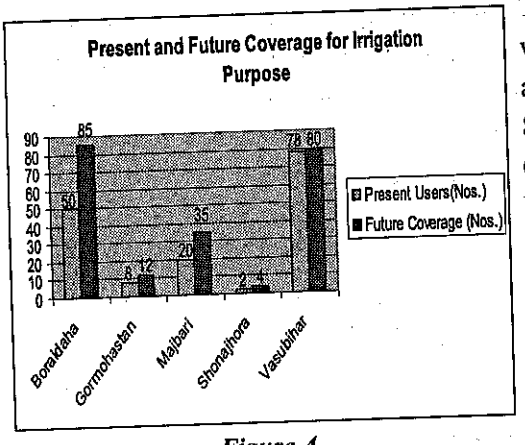


Figure-4

This bar diagram represented that present water users were 50, 8, 20, 2 and 78 numbers and expected users in future would be 85, 12, 35, 4 and 80 numbers in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes for irrigation water supply. Total irrigation water users were 158 numbers in five schemes where highest users were 78 numbers in Vasubihar schemes and future users would be 85 numbers in Baraidaha site out of those five schemes.

Length of Irrigation Water Distribution Network

Total length of irrigation water supply network was 2000, 183, 1646, 550 and 762 m in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively for irrigation water purposes. Total length for irrigation water supply network in five schemes were 5141 m where maximum pipeline was 2000 m (38.90%) in Braidaha and minimum pipeline was 183m (3.55%) in Gormahastan water supply scheme.

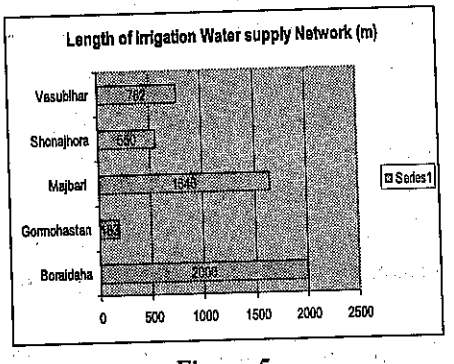


Figure-5

Investment Cost

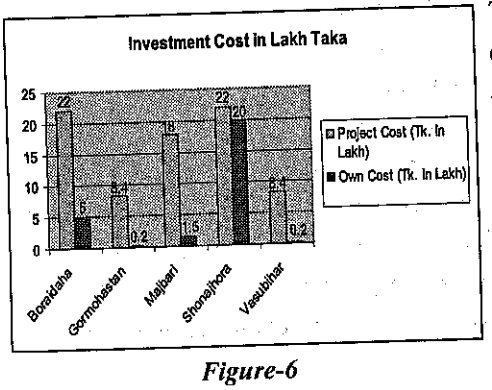


Figure-6

This bar diagram represented that investment cost through project were Tk. 22, 8.4, 18, 22 and 8.4 lakh and own cost by the management were Tk. 5, 0.2, 1.5, 20 and 0.2 lakh in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively both for drinking and irrigation water supply purposes. Out of these, highest investment cost was Tk. 42 lakh in Shonajhora schemes and lowest investment cost was Tk. 8.6 lakh both in Gormahastan and Vasubihar schemes.

Area Coverage through Irrigation

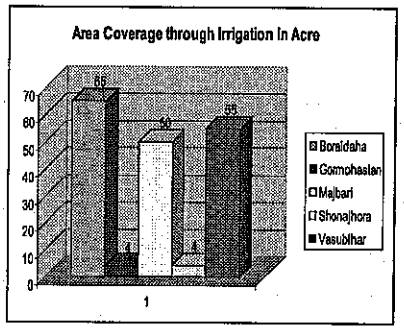


Figure-7

Area coverage through irrigation was 65, 4, 50, 4 and 55 acre in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively. Total area coverage for irrigation in five schemes were 178 acre where maximum irrigation coverage was 65 acre (36.51%) in Braidaha and minimum irrigation coverage was 4 acre (2.24%) both in Gormahastan and Shonajhora water supply scheme.

Irrigation Charge

The following table mentioned, water charge for irrigation purposes was Tk. 3000/- per acre per season which was same in five schemes. But water charge for drinking water was varies from Tk. 50/- to Tk. 100/- per connection per house hold where Tk. 100/- was collected in Boraidaha and Shonajhora, Tk. 50/- was collected in Gormohastan and Majbari and Tk. 60/- was collected in Vasubihar scheme respectively. Beside these, other connections like poultry/dairy firm, nursery was collected from Tk. 100/- to Tk. 200/- per month. Out of five sites, Tk. 200/- was collected per connection per month in Boraidaha and Shonajhora and Tk. 100/- was collected in rest of the sites.

Table-1: Water Charge for Irrigation, Drinking and other Purposes

Sites	Irrigation (Tk. / Acre/Season)	Drinking (Tk. /Connection / HH)	Others (Tk. /Connection/ Month)
Boraidaha	3000	100	200
Gormohastan	3000	50	100
Majbari	5000	50	100
Shonajhora	6000	100	200
Vasubihar	2600	60	100

Gross Income and Returns

The following table showed, yearly gross income through irrigation and drinking water purposes were Tk. 285000/-, 96000/-, 240840/-, 924000/- and 282200/- in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively. Out of these, highest income was Tk. 924000/- in Shonajhora and lowest income was Tk. 96000/- in Gormahastan scheme both irrigation and drinking. Besides, highest income was Tk. 195000/- in Braidaha and lowest income was Tk. 12000/- in Shonajhora scheme through

irrigation. Also highest income was Tk. 900000/- in Shonajhora and lowest income was Tk. 15840/- in Majbari scheme through drinking purpose.

Table-2: Gross Income through Irrigation and Drinking

Sites	Yearly Income through Irrigation (Tk.)	Yearly Income through Drinking (Tk.)	Total Yearly Gross Income (Tk.)
Boraidaha	195000	90000	285000
Gormohastan	12000	84000	96000
Majbari	225000	15840	240840
Shonajhora	24000	900000	924000
Vasubihar	143000	139200	282200

Gross Expenses and Expenditure

The following table mentioned, yearly expenditure such as electricity, labor, O&M and other works for irrigation purposes were Tk. 101000/-, 9000/-, 138000/-, 18800/- and 60000/- in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively . Out of five schemes, highest expenditure was Tk. 138000/- in Majbari and lowest expenditure was Tk. 9000/- in Gormohastan.

Table-3: Yearly Expenditure for Irrigation

Sites	Yearly Expenditure through Irrigation (Tk.)				
	Electricity	Labor	O&M	Others	Total (Tk)
Boraidaha	60000	24000	15000	2000	101000
Gormohastan	6000	2000	1000	0	9000
Majbari	80000	48000	10000	0	138000
Shonajhora	4800	9000	3000	2000	18800
Vasubihar	40000	10000	10000	0	60000

The following table mentioned, yearly expenditure such as electricity, labor, O&M and other works for safe drinking water supply purposes were Tk. 46000/-, 47000/-, 12000/, 402000/- and 40000/- in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively. Out of five schemes, highest expenditure was Tk. 402000/- in Shonajhora and lowest expenditure was Tk. 12000/- in Majbari.

Table-4: Yearly Expenditure for Drinking Water

Sites	Yearly Expenditure through Drinking (Tk.)				
	Electricity	Labor	O&M	Others	Total (Tk.)
Boraidaha	36000	4000	1000	5000	46000
Gormohastan	40000	0	7000	0	47000
Majbari	10000	0	2000	0	12000
Shonajhora	240000	60000	42000	60000	402000
Vasubihar	9600	10000	18000	2400	40000

The following table mentioned, yearly expenditure for both irrigation and safe drinking water supply purposes were Tk. 147000/-, 56000/-, 150000/-, 420800/- and 100000/- in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively . Out of theses, maximum expenditure was Tk. 420800/- in Shonajhora and lowest expenditure was Tk. 56000/- in Gormohastan.

Table-5: Total Yearly Expenditure for Irrigation and Drinking Water

Sites	Total Yearly Expenditure		
	Irrigation	Drinking	Total Expenditure (Tk.)
Boraidaha	101000	46000	147000
Gormohastan	9000	47000	56000
Majbari	138000	12000	150000
Shonajhora	18800	402000	420800
Vasubihar	60000	40000	100000

Net Income/Savings

The following table indicated, yearly net income for both irrigation and safe drinking water supply purposes were Tk. 138000/-, 40000/-, 90840/-, 503200/- and 182200/- in Braidaha, Gormahastan, Majbari, Shonajhora and Vasubihar schemes respectively . Out of theses, maximum net income was Tk. 503200/- in Shonajhora and minimum net income was Tk. 40000/- in Gormohastan.

Table-6: Total Yearly Net Savings through Irrigation and Drinking

Sites	Total income (Tk.)	Total Expenditure (Tk.)	Yearly Net Savings (Tk.)
Boraidaha	285000	147000	138000
Gormohastan	96000	56000	40000
Majbari	240840	150000	90840
Shonajhora	924000	420800	503200
Vasubihar	282200	100000	182200

Conclusion

This study is related to irrigation and water resources management in order to increase safe water use activity and improve the rural livelihood condition. By undertaking this study, RDA has already been made significant contribution towards improving safe drinking water for rural health as well as socio-economic conditions in many areas. Efficient and sustainable safe drinking water model is paramount for boosting supplying safe drinking water and hence food security in order to improve rural livelihoods, especially in a context where climatic effects may result in more frequent and potentially droughts areas under the study. Thus, RDA's contribution to safe water supply system would be accomplished to aforesaid areas in Bogra district of Bangladesh.

Based on litho logy, water scarcity both for potable and irrigation water and local partner NGOs willingness to share, CIWM, RDA, Bogra disseminated five sub-projects of Bogra district through five partner local NGOs. Water management model has been modified according to source of water. Those five sub-projects are totally depend on groundwater both drinking and irrigation.

The types and numbers of structures surveyed found completed successfully and at present being used by the beneficiaries for the right purposes with few exceptions. The subprojects were properly implemented and setting in appropriate locations and providing proper supervision.

For multipurpose use of water, multi-structured facilities (buried pipeline for irrigation and water transmission line for potable water) created by the RDA model while other DTW-model has no provision to address such facilities. In RDA model, water collected during test-boring and tested several parameters for multipurpose use in the laboratory and then recommended for main boring. Quality and quantity is ensured with the lithologic analysis in place in different suitable method and forwarded to laboratory for chemical analysis.

It was observed that the beneficiaries/users of the RDA model are happy for getting facilities with structures in their locality. The inhabitants outside the command area of the model demanded same facilities.

Significant changes in beneficiaries were observed in selected sub-projects for providing proper drinking and irrigation facilities.

Significant changes in sources of potable water use also reported by the respondents. Due to use of DTW pond water, river/khal water pond sand filter decreased due to connection with RDA model.

In most of the sub-projects the respondents has been started different IGAs by using water. The respondents expected that profit generated from the respective IGAs would increase family status, access to information on modern agriculture as well as ensure family food, health and education of children.

Recommendations

RDA's contribution of safe water system should be exposing to the govt. and donor level for better implementation as well as getting more funds to replicate the model large scale. Similar model should be undertaken in water scarce areas of Bogra district addressing climate change to cover a larger section of the farming community who often suffers for potable and irrigation water. Since the model had insignificant impact among the farmers within and outside command area who did not yet receive model benefit, efforts should be made to cover majority of the farmers under the model.

References

Khan, A.W.; Ahmad, S.A.; Sayed, M.H.S.U.; Hadi, S.A.; Khan, M.H.; Jalil, M.A.; Ahmed, R. and Faruquee, M.H. (1997). Arsenic contamination in groundwater and its effect on human health with particular reference to Bangladesh. Journal of Preventive & Social Medicine (JOPSOM) 16, 65-73.

Matin, M.A.; Khan, M.H. and Khan, N.I. (2000). RDA developed low-cost DTW technology for Multipurpose uses (Performance Evaluation), Rural Development Academy, Bogra.

Rural Development Academy, Bogra. (2000). Recommendations for arsenic free water supply in rural Bangladesh. Mimeograph, RDA Bogra, October, 2000.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Establishment of a Day Care Centre (Creche) at Rural Development Academy, Bogra: Towards Ensuring Child and Mother Welfare

Tariq Ahmed[1]
Salma Mobarek[2]

Abstract

The paper is an outcome of the Post Graduate Diploma in Rural Development (PGDRD) – 2012 Course offered at RDA, Bogra. The objectives of the study were to address issues and problems like, assessment of general need for child and mother's safety and wellbeing especially working mothers, the current situation at RDA in meeting their welfare needs, especially in absence of mother or parents. The main points of justification for the study were to examine and analyse the needs for creating provisions for care and safety for the children at RDA campus during the absence of their parents; to encourage particularly mothers (inclusive of fathers) to attend training courses and other events and to honour and implement, provisions laid down in international "Convention on the Rights of the Child" (1989). Twenty five (25) respondents were the Participants from different training courses of RDA and other 25 respondents included faculty members, teachers of laboratory school and college and staff of RDA. Among trainees, *80% viewed that they were not satisfied with the current caring system of their babies, during the duration of their attendance at the training sessions, seminars, etc. They mentioned that they pass their time in training period with anxiety for keeping them at home, because most of the time they don't get their relatives or other dependable persons for taking care of their children. Sometimes maid servants or others can't take care properly in their absence. Interview was conducted with Faculty Members & Teachers of RDA Laboratory School and College & staff of RDA. They (52%) viewed that sometimes their children are cared for by their relatives during office time; they mentioned that they can't manage the relatives because nowadays relatives are very busy and doing job. So they are not happy in present management systems for taking care of their children and viewed a Day Care Centre is an urgent need at RDA at present. All of the parents (100%) replied very positively about its effect in their professional life.*

Introduction

A Day Care Centre concerns child's wellbeing as well as it helps parents by taking care of the child. It can play an important role both for mother and for her children, especially

[1] Director (Rural Governance & Gender), RDA, Bogra.
[2] Assistant Director, RDA, Bogra.

for working mothers. It is a safe home where a number of children can live under care of trained personnel (Caregivers) and with safety, during a certain period of working hours, in absence of their parents. The Caregivers are trained in child keeping, basic health, first-aid, basic literacy and such others and have to go through usual safety checks. A Day Care Centre usually runs under license from a government authority and has to follow the laid down regulations. It could also be organised and run by a recognised institution for its employees and clients, such as a school, research organisation, a factory, a large office and such others following the regulatory safety and health regime. A Day Care Centre is very helpful for mental development of children. The opportunity to develop socialization skills is one advantage that day care centres offer. Positive interactions and experiences in child care can assist a child with their emotional, social and intellectual development (Collin 1996). Day Care Centres generally cater to the needs of children of similar age-group basis. The infants are exposed to situations where he/she can learn how to interact with others. Many day care centres offer pre-school educational opportunities. The employees begin teaching alphabet, digits, colours and other pre-school skills to babies. This gives children, who attend day care centres, an advantage over children who are not taught these skills at home. Results of different study indicate that quality of infant care positively correlate with cognitive development, language development and communication skills (Kunt S. 2006).

Women in Bangladesh still lag behind the men folks. However, education is spreading among women progressively and many of them are working, including in white-collar jobs. At the same time, many are opting for nuclear families. Joint families are becoming difficult to run, in cities particularly. Values of joint families are also changing gradually and a fast pace. Thus has emerged a new situation for working women becoming mothers with no one else to take care of the babies if they continue with jobs outside. A child, if feels insecured, may become abnormal living away from mother for long hours. (Feroz and Mamun, 2008). What to do with these infants? Where to keep them and under whose care? Family elders are not always available and maids may not be reliable. What happens then? Working mothers confront these worries. It is good that the maternity leave for working mothers has been extended to six months. Though there is yet no paternity leave. Then what would the mothers do after the 06-month maternity leave? In absence of a suitable alternative, such as day care centres for babies, many mothers are reluctantly opting for staying home with the babies, disregarding the opportunity of taking up a job. Nevertheless, changes are creeping in gradually. Day care centres, where working mothers can leave their babies on payment and under care both in government and private sectors. Child care services enable parents, especially women to enter the workforce or access further training. (Berger 1995, Berk 1990, Ochiltree 1994).The government currently runs 32 day care

centres across the country. Aparajeyo Bangladesh, an NGO, runs 12 day care centres in capital Dhaka. Of course, Aparajeyo Bangladesh takes acre children of a special category, the poor and the destitute.Costs in the centres vary.

In 1989, many nations came together and adopted the United Nations Convention on the Rights of the Child (UNCRC) of 1989. Bangladesh was one of the first countries to ratify UNCRC. It has become mandatory for all states that accepted the Convention to work together to protect children's rights around the world. In 1994, the Government of Bangladesh agreed to support provision of child care and increase facilities at the work place. Under the 1995 labour laws, an organization employing at least 25 women are to set up day care centres for working mothers' babies. The government is considering lowering this number to 20.

With the passage of time, education is spreading among women and many of them are working out of their homes, including in white-collar jobs. Consequently joint families are breaking up, giving rise to single families. This has necessitated the establishment of Day Care Centres (Crèches) in increasing number, especially to cater to the needs of working women. The Rural Development Academy at Bogra was established in 1974. However, no Day Care Centre was established at Rural Development Academy (RDA) even after 38 years of its establishment. So, it is the high time that a centre to be established at the campus for the well being of the children of the Participants of training course, seminar, workshops, other events, RDA Faculty Members/Support Staff as well as the society.

Justification for Establishing a Day-Care Centre (Creche) at RDA

- Children of the participants of seminar, workshop, training courses and such others will be taken care of even during the short absences of their mother/guardian. And during this duration they will get time to have a pre-school and/or other kind of learning and socialize with other children;
- Mothers/guardians attending seminar, workshop, training course and such others will feel secure to attend such events as their children will not only remain safe but will also spend a useful time with other children when they remain separated.
- The employees of RDA, with children to look after, will work in an anxiety-free mind as the children are taken care of during the office hours.
- The Academy will be able to honour and practice the provisions laid down in international "United Nations Convention on the Rights of the Child" (1989).

Objectives of the Research

The objectives of the study were to address issues and problems like:

- assessment of general need for child and mother's safety and well being especially of working mothers; and
- the current situation at RDA towards meeting their welfare needs, especially in absence of mother or parents.

Methodology of the Research

- A pre-tested questionnaire was administered for assessing and justifying the need of a Day Care Centre (Crèche) among the Parents;
- Twenty five (25) respondents, from among the participants from different training courses of RDA and other twenty five (25) respondents from among the faculty members, teachers of laboratory school and college and staff of RDA constituted the total of 50 respondents interviewed;
- Pre-tested questionnaires were also administered among other stakeholders including the RDA authority, possible donors, etc. for its feasibility, future mode of administration, maintenance and possible sources of fund for setting a Day Care Centre at the Rural Development Academy, Bogra;
- Secondary sources of information were used for assessing the importance of setting up a Day Care Centre (Crèche) and its maintenance at the Academy and compare and construes with such other institutions elsewhere.

Findings and Discussions

For assessing and justifying the need of a Day Care Centre at RDA, a survey was undertaken among the sample of Faculty Members, Trainees, teachers of RDA Laboratory School & College and staff of RDA.

Views from the Trainees/ Participants

Degree of Satisfaction of Current Caring System for Children

During the survey it was found that of the 25 training course participants interviewed 80% were not satisfied for the current caring system of their babies. They mentioned that they pass their time in training period with anxiety for keeping them at home, because most of the time they do not get their relatives or others for taking care of their children. Sometimes maid servants or others cannot take care properly in their absence. When they were asked to give their reaction on RDA Day Care Centre, they provided positive answers regarding this. Their reactions are summed up in Table-01:

Table-1: Effects on Training

Effects on Training	%
Would be able to give more attention in training	36.00%
Would be regular in different training at RDA	32.00%
Can be assured about the child's safety during the maximum time of training period	32.00%
Total	**100.00%**

(N=25)

The responses of the interviewees generally suggest that they were almost equally divided in their opinion about the possible effects of the Crèche. More than one-third or 36% of them viewed that they would able to give more attention in training sessions. Rest equal number of them, 32%, told that if they get security and safety for their child at RDA they would be regular in different training courses at RDA and participate in different training at RDA as they would be assured about the safety of their children during the training period.

Family Members' Support

Attempt was made to assess if other members of the family will support the proposed Day Care Centre and keeping the children there. It was revealed by the interviewees (100%) that the members of the family have support for keeping baby at the Day Care Centre.

Table-2: Others Opinion or Views

Opinion or views	Frequency	%
I am very happy for taking this initiative of establishing a Day care Centre at RDA	17	68.00%
I will be personally benefited	1	4.00%
Thanks to the Authorities for taking the initiative	6	24.00%
No opinion	1	4.00%
Total	**25**	**100.00%**

The respondents were asked to express if they had any other opinion regarding the Day Care Centre. In response, 68% of them told that they were very happy for taking this initiative, 4% viewed they will be personally benefited and 24% offered their thanks to the authorities for taking the initiative.

Views from Faculty Members & Teachers of Laboratory School and College & Staff of RDA

The interviewees (52%) expressed that their children are cared for by their relatives during office time; they mentioned that at times they do not get help of the relatives because

nowadays now days relatives remain busy and/or are engaged doing job. So they are not happy in present management systems for taking care of their children and viewed a Day Care Centre is an urgent need at RDA at present.

Table-3: Caregiver during Office Hours

Caregivers	Frequency	%
Maid servant	9	36.00%
Relatives	13	52.00%
Others	3	12.00%
Total	**25**	**100.00%**

Effects on Profession / Services

All of the parents (100%) replied very positively about its effect in their professional life. They viewed that if it is established then they can pay more attention to their official activities, can come to the office relatively timely and regularly and can be assured about the safety of their children during the office hours. These are some of the advantages they expect to gain from the proposed Crèche at RDA.

As an assessment of the expectations of the respondents from the Day Care Centre, they were asked a number of questions. It was found that 96% of the respondents viewed that it must be safe and comfortable, 76% told Caregiver must be educated, 60% viewed that if food is arranged then it must be safe and healthy. Others expressed expectations for having pre-schooling educational arrangement (52%), should have some baby toys arrangement (36%), baby toys and games facilities (20%).

Table-4: Expectations from the Parents on Day Care Centre at RDA

Expectations	Frequency	%
It must be safe and comfortable	24	96.00%
Caregiver must be educated	19	76.00%
Foods must be save	15	60.00%
Should have educational arrangement for Pre- schooling	13	52.00%
Should have some baby toys arrangement	9	36.00%
A lot of baby toys and games facilities should have	5	20.00%
It should be attractive to the children	2	8.00%
Total	**25**	**100.00%**

* *Note: Multiple answers offered.*

Expected Minimal Requirements for Establishment of a Day Care Centre

Structure

The structure must be child- friendly, clean, safe and well ventilated. The floor should be covered with material which is suitable for children. It should be large enough where more than 10 children could be taken care of. It should be large enough to accommodate a sick bay for at least two children, given the number of children to be 10.

Kitchen

Where food is prepared and offered on the premises, a food preparation, cooking and washing up area must be provided. When the kitchen is in the same area as the playroom it must be cornered off and the safety aspects must be complied with. The kitchen should also comply with the following requirements:

1. adequate storage space
2. adequate washing up facilities and clear drinkable water
3. safe & clean floor
4. adequate natural lighting and ventilation
5. If it has walls, wall surfaces should be child-friendly, have a smooth finish and should be painted with a washable paint
6. have a ceiling
7. all surfaces area must be cleaned regularly
8. cooling facilities (Freeze/Freezer) to be there for storage of perishable food
9. an adequate number of waste bins with tightly fitting lids
10. an adequate supply of water and cleaning agents for the cleansing of equipment.

Separate Room and Safe Water

The same room may be used as a playroom, office and kitchen. Separate provision must be made for taking care of sick children and for hygienic preparation of food. Fresh drinking water should be available nearby.

Toilet facilities

Toilet facilities which are safe for children must be available. In areas where sewerage facilities are not available, sufficient covered chambers ("potties") must be made available for the children. A hand-washing facility for children is required. Facilities for cleaning nappies and chambers must be provided. Toilet facilities must at all times be clean and safe. One potty for every five children should be provided (less than 3 years). For older children (ages 3-6) one toilet and one hand washing facility must be provided for every twenty children, irrespective of gender. A urinal (1 meter wide) is equal to two toilets. Urinals

should not replace more than 25% of the total toilet facilities. Facilities for the washing or bathing of children must be provided. Separate toilet facilities must be provided for the staff in terms of the National Building Regulations.

Outdoor playing space

Outside playing space per child must be provided. This may consist of lawn, sand pits, shady areas and hard surfaces.

Bottle feeding

Where children are bottle-fed and cared for, suitable facilities must be provided for cleaning the bottles.

Furniture and Equipment

Adequate seating and working surface must be provided. Beds and mats for sleeping and resting purposes must be safe and clean. Water-proof sheets and blankets must be available. There must be sufficient and adequate age-appropriate indoor as well as outdoor play equipment and toys, books and print material and other materials. Play apparatus must be safe so that children cannot be injured. Sufficient safe, clean and appropriate eating utensils must be provided. If there is a sandpit it should be covered overnight so that animals cannot soil it. Sprinkle it with coarse salt every six weeks or so and replace the sand at least once a year.

Feeding of infants under one year of age

In instances where the mother is healthy, bottle-feeding is not recommended for the general well-being of the baby. If it is not possible to breast-feed the baby, the directions for preparing the artificial (formula) food should be followed very carefully .Do not add salt or sugar to the food. Parents should be kept informed about the dietary intake of their babies.

Responsibilities of supervisors/caregivers to child health care

Every supervisor and caregiver at a place of care should:

(a) Be healthy in body and mind;

(b) Be checked for their track record and possible Police report;

(c) Watch out for possible indispositions, illnesses and diseases in the children;

(d) In case of any illness, indisposition or problem, notify the parent or guardian immediately;

(e) In urgent cases, and if the parent or guardian has given the necessary permission, call the family doctor or the doctor appointed by the place of care;

(f) Allow an ill child to remain away from the other children and inform the parent or guardian;

(g) Keep a proper record of any medicine that is given to a child.

(h) Place the names of children who are allergic to certain substances or products in prominent places in the place of care and inform all staff;

(i) Notify the medical officer in cases of communicable disease or diseases that must be reported;

(j) Keep careful note and a record of any injury, trauma, biting, blood, knocks to head, or where treatment is applied and diseases incurred while the child is in the place of care, including the wounds and bruises with which it was admitted;

(k) Ensure that enough soap, towels or paper towels are available at the wash-basins at all times;

(l) Ensure that caregivers are neat at all times; and

(m) Ensure that each caregiver undergoes regular health tests annually, particularly for tuberculosis.

The following registers should be kept in place at the Creche

1. The Head of the place of care must keep an admission and discharge register. The date of admission and the date on which a child left the place of care must be entered in this register. This register may be combined with the daily attendance register.
2. A daily attendance register in which each child's presence or absence is noted.

In fact, it is parent's duty to ensure that the child remains happy and safe in an environment that will encourage proper growth, impart knowledge and develop to become a responsible human being from day care centre and become the best person possible. So, it is very important to take necessary steps to establish of a Day Care Centre at Rural Development Academy, Bogra for ensuring mother and child's welfare.

References

Berger, E.H. (1995). *Parents as parents in education families and schools working together* (4th Ed.) Englewood Cliffs, NJ: Prentice Hall.

Colin, V.L. (1996). *Human Attachment.* Philadelphia: Temple University Press.

Feroz, H. and Mamun, A.A. (2008). Bangladesh Research Publications Journal, ISSN: 1998-2003, Volume: 5 issue: 4, Page: 359-367, July- August, 2001

Kunt, S. (2006). " Examining Swedish Profit and Non-profit Child Care: The Relationships between Adult –to- Child Ratio, Age Composition in Child Care Classes, Teaching and Children's Social and Cognitive Achievement", Early Childhood Research Quarterly, 15, No. 1, 91-114 (2000) ISSN: 0885-2006.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Production Performance of Hybrid Pullet at RDA Demonstration Farm, Bogra

Samir Kumar Sarkar[1]
Dr. Sk.Fazlul Bari[2]

Abstract

An experiment was conducted with 1000 day-old chick (DOC) ISA (Institut de Sélection Animale) Brown hybrid chicks at demonstration farm of Rural Development Academy (RDA), Bogra to find-out overall production performance in the context of Bangladesh. The ISA Brown hybrid strain were reared in a conventional pullet rearing floor pens upto 18 weeks and transferred to the laying shed. The collected chicks were beak trimmed at the age of 10th & 18th week before transferring into cage system. Pullets were distributed randomly with 3 birds per cage pen. All birds were fed manually using feeding trough and provided through water trough. Nutrient content of the feed (Table 2) followed recommendations of the NRC (1994) and management guides (ISA, 2000). All birds were reared with 9 h of light per day, which was increased to 14 h at 18 wk with an intensity of 5 lx throughout the experiment. Temperature and relative humidity (RH) were between 21°C - 32°C and 70% - 80%, respectively. All birds were vaccinated following a typical vaccination program of the region. The pens were built of wire and hens could see their flock-mates in other pens. Saw dust was used as litter on the floor. Throughout the experiment, litter quality was maintained by adding new husk monthly. During rearing from 0 to 18 wk of age and laying from 19 to onwards, the number of birds per pen was 3. At the beginning of the laying period, mean weight of per pullet was 1,443 gm. Feed in restriction but water were provided for ad-libitum consumption. Temperature was decreased each week by 5° F from 95° F in week 1 to a constant value of 70° F from week 5 onwards. At the onset of the experiment, the following light scheme for ISA Brown pullet was provided. Light was on during 24 h per day for the first 3 days, followed by a gradual reduction to 12 h per day in wk 6, and this pattern was maintained until wk 17. At 18 wk of age, light schedule was targeted to gradually extend by 30 minutes per week to a 16 h at the age of 25 week. However, it is evident that the performance of rearing hybrid pullet at farm level as an IGA initiative leads profit, while maintaining the comparative advantages of nutritional stress, better fine-tuning of feed intake, medicine-vaccine, lighting and other relevant management practices.

[1] Deputy Director, RDA, Bogra.
[2] Director (Training), RDA, Bogra.

Introduction

Poultry plays a vital role in the socio-economic development of Bangladesh. Poultry meat and eggs are important sources of quality protein, vitamins and minerals. A poultry product has an importance as supplementary nourishing food, particularly in the diets of growing children, pregnant women and nursing mothers. Poultry farming is an important Income Generation Activity (IGA). It provides supplementary income and employment to a large number of small and medium farmers in Bangladesh. It is also a rich source of organic manure for crop production.

There are many types of poultry farming systems in Bangladesh e.g. hybrid pullet production, cockrel production, hybrid layer rearing for egg production, broiler rearing etc. Three decades ago (early 1980), arrival took place of hybrid poultry birds in Bangladesh and poultry farming become very popular IGA (Income generation activity) both for rural and urban areas of the country. But in course of time, the price of day old chicks, poultry feed, vaccines and medicines, profit margin of this business started to decrease. Now days, many poultry farmers are found to stop the poultry farming due to high cost of all the necessary inputs and low price of products in terms of eggs and meat. But actual information regarding all these farming systems is not always available at the farmers' community. It is possible to improve the performance of the system while maintaining the comparative advantages (Huque, 1999).

Most of the farmers do not follow the proper feeding, lighting and needful management steps for raising hybrid pullet. These practices give us low productivity with high investment. However, to address these problems a uniform rearing system need to be developed and popularized amongst the hybrid pullet raisers. So, the findings of the study will be useful for popularizing the production and rearing technology to the poultry farmers of Bangladesh. The findings of the study will also be useful to the trainers and researchers in the field of hybrid poultry. The poultry farm owners will be encouraged to produce more vigor- pullet to have sufficient eggs and meat. As a result, hybrid pullet production technology will significantly be increased leading to high income and improved livelihood of the poultry farmers. With this backdrop this study has been undertaken.

Apart from this the findings of the study will be used as training materials at the concerned training courses of Rural Development Academy (RDA). The experience of this study will also be used to different action research projects of RDA, Bogra.

Objectives

The major objectives of this study were:

- To determine a standard rearing technology of hybrid pullet at farm condition;
- To identify the constraints of raising hybrid pullet from day old to layer bird; and
- To asses the prospect of hybrid pullet rearing at farm level as an IGA initiative.

Justification of the Study

To achieve highest production efficiency of egg and meat of raising pullet through improved and modern technology; high yielding hybrid species has to be introduced. A standard rearing technology for hybrid poultry is essential and can play a vital role in getting expected production. But the high production cost especially the food cost is one of the major constraints for hybrid chicken production in Bangladesh. To overcome this problem and to capture highest economic benefit a standard/ uniform hybrid chicken production technology to be introduced in Bangladesh.

Materials and Methods

An experiment was conducted with 1000 one-day-old (DOC) ISA Brown hybrid chicks at demonstration farm of RDA, Bogra to find-out overall production performance for the period of 18 weeks from November 2011 – March 2012. In total 1000 chicks of ISA Brown hybrid strain were reared in a conventional pullet rearing floor pens up to 18 weeks and then transferred to the laying shed. Data related to different parameters were studied from 0 to 18 week.

Data Collection

Necessary primary data of related parameters were recorded and collected from the record book of RDA Demonstration Farm, Bogra. Relevant secondary sources of data were also consulted for preparation of this study report.

Record Keeping

Records were kept in order to helping in management decisions:

- Successfully analyze current flock performance parameters
- Feed and water intake
- Body weights
- Mortality
- Incurred production cost etc.

Results and Discussions

Pullet Management

ISA brown day-old-chicks (1000) collected from the hatchery and that were randomly assigned to the brooding cum growing sheds of RDA Demonstration Farm. All chicks were brooded in the same floor during the entire 17 wk rearing period. Paper was placed on the litter floor for the first 5 days within each of the chick guards. Room thermometers for recording brooding temperature were set in with chick guards. Each DOC started with floor space of 310 cm^2 (48 inches), 4.7 cm (1.8 inches) of feeder space/bird and 1:50 drinkers to bird ratio. The room dividers were removed for this test so that all birds were essentially reared in a contiguous house.

Floor Brooding

Preparations for brooding not only involves temperature control but also adequate sanitation, bio security, ventilation, humidity, water and feed. Sanitation and bio-security measures were covered extensively. If producers are looking for maximum return on their investment, they should use the time and effort needed to provide the right brooding procedures for chicks.

The following management guidelines were followed in order to ensure low mortality and targeted live weights throughout the rearing period:

1) A complete cleaning and disinfection of the rearing shed
2) Place hanging type brooders units approximately 4 feet (1.2 m) from the floor
3) Pre heat (88-92 F) house at least 6 hours prior to chick arrival
4) Avoid temperature in excess of 95 F
5) Record all temperature readings at chick level in the brooding area.
6) Reduce temperature by 5 F per week until birds no longer need additional heating.
7) Maintain humidity between 70 - 80 % in order to avoid dehydration
8) Place "Side Curtains" for and eliminate dirt's.
9) Cover litter with News paper for first week
10) Fill and place waterers prior to the arrival of the chicks.
11) Provide chicks with mixed glucose-water 1 to 2 hours before feed is provided.
12) Offer best quality crumbles pullet starter feed.

13) Provide adequate drinker (1 to 50 birds), floor (10 chicks to 1 sq. m) and feeding space (1 feeder to 100 birds) for the first 5 days to reduce density stress.

14) For the first 48 hours provide all night lighting (30 – 40 Lux), begin control lighting program after 2 days.

15) Watch chick behaviors closely; chicks huddled under brooder = Temperature too low, chicks pressed against the ring = Temperature too high, chicks evenly distributed around the heat source indicates comfortable conditions.

16) Remove news paper after 3-5 days

17) Move waterers and feeders' daily, loosening litter and removing clumps where necessary

Beak Trimming

This operation is normally performed for two reasons:

1) To prevent feather pulling and cannibalism.
2) To reduce feed wastage

Poor beak trimming leads to:

1) Unevenness in pullet weight. (Due to poor feed and water intake)
2) Unevenness in pullet sexual maturity (Due to the effect of body weight)

For production in cages or on the floor with "open house" beak trimming should be carried out twice, at about 8 to 10 days and again no later than 16 weeks. Based on our experience in RDA a single beak trim at 10 weeks has been found to be sufficient.

Before Beak Trimming

1) Trim beaks only healthy flocks

2) Add Vitamin C (20 mg per gallon), Vitamin K (4 mg. Per Gallon) to water 24 hours before trimming pullets recover their appetites.

3) Keep temperature of the trimming blade is high enough (62 oC) to cauterize and prevent continued bleeding, but not so high as to form a fleshy bulblike growth at the end of the beak, this growth is very sensitive and will cause below average performance later.

4) The debeaking blade and cutting bar must be in perfect alignment. The blade should fall on the highest part of the bar.

Three common methods of debeaking pullets are: (1) Block debeaking in which one-third of both the upper and lower mandibles are removed in one operation (baby chicks),

(2) Removal of two-thirds of the upper mandible only (between 12-17 weeks) and (3) Removal of one-third of the upper mandible and the tip of the lower mandible.

The following procedure is recommended for debeaking older pullets:

1. A debeaking team should consist of at least two well trained workers
2. Two birds at a time should be handed (feet first) to the operator
3. Insert the index finger into the bird's mouth to force the beak open and the tongue down and back; burned or severed tongues often will result in culled hens.
4. Place the top mandible on the cutting bar, lower the head to achieve a 20 to 30 degree slant back toward the roof of the mouth and cut the mandible 1/8 to 3/16 of an inch in front of the nostril. Cut slowly, allowing the blade to cauterize the tissue.
5. Place the lower mandible on the bar and cut so that it will be 1/8 to 3/16 inch longer than the upper. Cut the lower mandible in a straight block form.
6. Each mandible should be rolled against the blade to round the edges and further cauterize it.
7. Carefully inspect each mandible and "touch it up" if improperly cut.

The cauterization time is usually about 3 seconds for each beak. The following picture illustrates the properly trimmed beak.

Immediately after Beak Trimming leads to:

1) Make it easy for the birds to drink, increase the water levels in the drinkers or reduce the pressure in the pipes for nipple/cup systems.
2) Be sure that the feed depth is adequate, at least 1 inch (2.5 cm.)
3) Do not allow empty feeders to occur for a week following beak trimming.
4) Use liquid aspirin-sodium salicylate 50g/1000 kg. Flock body weight.
5) Debeaking should be checked frequently to assure proper crew performance.

Growth Management

The objective of rearing is to prepare the pullets for egg production. In order to achieve these pullets should attain layer recommended live weight targets especially at certain critical points of the growth cycle. The achievement of correct body weight at 4 weeks and steady growth between 4 and 16 weeks is correlated with an acceptable final weight at 18 weeks. The aim is to produce a uniform flock that attains the correct weight, consistent with

the strain used, at sexual maturity for a given age. However, under commercial conditions, significant delay beyond their genetic potential in attaining sexual maturity is inevitable if enough attention is not paid to nutrition and light management. The observed versus expected weight gains provides a useful tool in determining the uniformity to the nutrition component of the sexual maturity goal.

Weighing must be done at a fixed time, preferably in the morning, beginning at 14 days and weekly thereafter. The weighing procedure for floor-reared pullets involves moving slowly through the flock cornering a group of birds in a catch pen. A random sample of 100 birds will give a good idea of flock weight and uniformity regardless of the flock size.

Body Weight

It is useful to plan actual flock performance and compare it to the breed standard provided by the Company. Weight data is used to calculate bird weight uniformity within a flock. Uniformity is an excellent measure of flock quality. High uniformity however must always be interpreted in conjunction with flock average weight as birds within a flock may also be uniformly below target weight. A flock is considered uniform when 80% or more of the pullets weighed are within ± 10% (20% range) of the average of all weights.

Health Management

Immunization: Different factors must be considered and rational in order to design a particular vaccination program. A "Good" program is not that which contains the maximum number of vaccines and vaccinations but the right choices to counteract the field challenges and specific conditions of your geographic area (Montiel & Contreras). The following factors were considered for this study.

The reason for vaccination

a) To prevent morbidity and mortality e.g. Infectious Bursal Disease (IBD), Newcastle Disease (ND), Mareks, Fowl Pox

b) To prevent immunosuppressant (e.g. IBD, Mareks)

Table-1: Vaccination Schedule

Day	Type of vaccine	Route of administration
01	Marek's, Intervet	SQ Injectible - Hatchery
03	BCRDV, DLS	Eye drop
14	IBD (Mass-Conn, D78), Intervet	Eye drop
18	IBD (Mass-Conn, D78), Intervet	Eye drop, booster
21	BCRDV, DLS	Eye drop, booster
28	Fowl Pox, DLS	Wing web
60	ND Lasota, Intervet	Drinking water
120	ND Lasota, Intervet	Drinking water, booster

(A vaccination program followed by this study is presented in table form)

Risk of exposure

If the risk is severe, vaccination should be performed as soon as possible. If risk is minimal, then it may be possible to delay or to use a route of administration that would lessen the immune reaction.

Source: Vaccines used should come from reputable company, whose products are produced under strict standards. They should be transported in insulated, secure packaging maintaining cool chain. Keep stored under the conditions specified by the manufacturer.

Observation: Note any unusual procedures, difficulty or flock condition observed during the vaccination procedure on the permanent flock record.

Discard: Discard all empty vaccine containers in the manner recommended on the vial or package insert. Incineration or other sterilization procedures will avoid contaminating the environment. Do not leave the containers in the chicken house.

Health Status: Vaccinate only healthy birds, if their health status is questionable, delay vaccination.

Use Promptly: Do not hold mixed or opened vaccine vials over from one day to the next. The vaccination program for Infectious Bursal Disease (IBD) must have two goals. One is prevention of the morbidity and mortality usually occurring in young birds affected between three and six weeks of age. The other is to prevent the sub-clinical form which results in atrophy of the Bursa and immunosuppressant in chickens infected younger than three weeks of age. This can cause maternal antibodies lasting four to five weeks in the chicks and interfere with active immunization with live attenuated strains to prevent the clinical form.

The use of live attenuated vaccine followed by an oil emulsion vaccine provides good immunity. The mixed vaccination of a live attenuated vaccine and an inactivated vaccine on the first day provides satisfactory results in countries where the virulence of the Newcastle disease is very high.

Wing web administration is required for fowl pox vaccination, the following is recommended for successful vaccination.

1) Use the proper applicator for the product administered. A special two pronged applicator with needles calibrated to deliver a specific dose is most commonly used.
2) Mix the vaccine according to the manufacturer's directions and mix only one bottle at a time per vaccinator.
3) Vaccinate the bird only through the skin in the wing web area avoiding the muscles and joint
4) Dip only the needle tips in the vaccine and pierce skin once.
5) Catch (100 pullets) and examine vaccinated birds one to two weeks after vaccination. A scab, swelling or raised area at the site of the injection is evidence of a "take" which indicates the birds have been properly vaccinated.

Drinking Water Application

1) Turn off the water one to two hours before vaccination so birds will be thirsty.
2) Estimate the amount of water the birds will consume in two hours.
3) Mix the correct number of doses in the anticipated amount of water,
4) First calculate the amount of water required to fill the system. The following formula has been used to calculate the volume: Volume (Gal) = Diameter of pipe inches^2 x Length of total pipe in feet x 0.0408
5) The anticipated amount of water that will be consumed in two hours.
6) Drain the water lines by pulling the end plugs and let the water flow until the milky vaccinating water appears then replace the end plugs.

Feed and Nutrition

Feeding is normally done '*ad libitum*'. However, care was taken to ensure that feeders are regularly emptied, in order to avoid a build up of feed, not to turn into sour and unpalatable. Careful timing of feeding was followed, in order that feeders were filled at an appropriate time, and were not empty for undesirably long periods.

Feeding practiced as that feeder filled at the start, and towards the end of the day, and emptied during the middle. Balance feed formulated and used for this study according to managemental guide suggested by the company shown in Table 2. Provision of feed late in the day was essential, both to ensure that the birds were not hungry during the dark period, but also to develop appetite at that time of day.

Feed consumption and body weights were monitored on weekly basis. The mortality was recorded daily, mortality attributed during study shown in Table 3 but accidental deaths from a replicate have been excluded from the Report.

Table-2: Feed Formulations for the Starter-Grower Periods

Ingredient	Starter % (0- 8 wk)	Grower % (9-18 wk)
Corn	50.05	53.90
Rice polish	21.00	28.00
Soybean meal	14.00	07.00
Protein concentrate	06.00	04.00
Mustard oil cake	08.00	06.00
DCP	0.30	0.35
Vit. Premix	0.05	0.05
Min. premix	0.10	0.10
Mold Inhibitor	0.10	0.10
Salt	0.40	0.50
Total	100	100
Crude Protein%	21	14.8
ME kcal/kg	2800	2809
Calcium %	1.02	1.05
T. Phos. %	0.79	0.79
Lysine %	0.85	0.85
Methionine%	0.40	0.40
Crude fibre%	3.00	3.50

Source: Ready feed (Mash form) collected from Sherpur Market, Bogra.

Each pullet provided with Starter feed during the initial brooding period, followed by Grower mash that are shown in the feed formulation section Table 2. Thus, the birds were

given the starter and grower feed to achieve the layer recommended body weights at each weigh interval. Pullets were shifted on to the next tier rearing feed at the point of achieving target body weight goal or after an every week time interval to satisfy the uniformity test. Expected feed shift intervals were; starter 0 to 8 weeks; grower 9 to 18 weeks. The Starter and Grower rations were administered in order to maintain a growth pattern and target weights as closely as possible to the layer recommendations. Feeder management should not be neglected:

1) Overfilling should not occur, or wastage will result.
2) Depth of feed, in all types of feeder, requires close control. Increased depth of feed (except after beak trimming) does not increase consumption.
3) Feeders should be adjusted to the height of the birds as measured from ground to the back line, to prevent feed wastage.

The amount of feed fed should be recorded, and this amount should be similar to the quantities stated in the table of uniformity (Table-3). If quantities are in excess, and bodyweights are close to target, then either wastage has occurred, or the density of the ration is too low.

If pullets become overweight by more than 100 gm., (which is unusual) it may be necessary to control the nutrient intake. However, before taking any action, consider the stresses that the birds may encounter, e.g., vaccination (particularly if the birds have to be handled), beak trimming and hot weather.

If stresses are anticipated, make no change to the feeding policy. Also consider the age and maturity of the flock. If the pullets are 14 weeks of age or more no reduction in nutrient intake should occur. Nutrient intake may be controlled by feeding a lower density ration, or by limiting the intake of a particular ration. Under no circumstances should daily feed intake be reduced.

It is important to emphasize that the feeding program recommended for all strains is a "feed to weight" rather than "feed to age". It is important to know at what age rapid growth occurs so that we can be particularly sure not to stress the pullets during the period of rapid growth.

Approximately 34 percent of the pullet's growth occurs during the first six weeks. Another 46 percent of the pullet's growth takes place the next six weeks (6-12 weeks of age). This means that 80% of the pullet's growth takes place within the first 12 weeks with the majority occurring from 6 to 12 weeks of age. Stress during this period should be avoided

and feeding a high quality grower diet is essential. The pullet's growth rate should be carefully monitored during this period. If the pullet does not obtain her growth properly during the first 12 weeks, then she will never lay up to an optimum level and her profit potential will be reduced drastically. These findings are similar to Hy-Line pullets and are relevant to other strains as well (Miles, 1993).

Trying to correct a growth problem after 12 weeks of age may become very expensive. During the first 12 weeks the pullet eats (3.12 Kg) of feed, which accounts for approximately 55 percent of her total feed consumption. During the next 6 weeks she consumes (2.5 Kg) of feed, which is 45 percent of her total consumption. During the growth shoot period the pullet achieves 80 percent of her growth on 55 percent of her total feed intake. The last 20 percent of her growth occurs using 45 percent of the feed. The prime objective is to obtain target bodyweight and uniformity (Table 3) This will only be achieved if the rations are suitable and optimum during each period of the pullet's growth.

Starter feed is fed from 1 day old to 500 gm body weight achieved. The birds must achieve 500 grams before switching over to grower ration. Feeding program is also measured by feed cost per unit of body weight gain therefore growers who achieve this weight at 6 weeks would have much better feed efficiency than those who have to hold the flock on the starter feed for longer periods. A good husbandry practices like brooding, lighting program, feed equipment, disease prevention, water quality and beak trim all play their part in achieving this weight for age point.

Table-3: ISA Brown Pullet Production Performance Up to 18 Week of Age (N=1000)

Age in Week	Feed Consumption			Pullet	
	Gram per bird/day	Per batch (kg)	Cumulative (kg)	Weight gram per bird	Mortality (%)
1st	11	077	077	70	-
2nd	19	133	210	140	-
3rd	25	175	385	190	-
4th	33	221	606	280	-
5th	35	245	851	387	-
6th	43	289	1140	509	-
7th	49	328	1468	520	-
8th	53	363	1831	610	-
9th	60	379	2210	637	-
10th	65	487	2697	730	-
11th	85	397	3094	703	37.60
12th	69	302	3396	680	3.70
13th	72	307	3703	734	0.34
14th	79	284	3987	903	-
15th	84	320	4307	1042	-
16th	89	333	4640	1206	-
17th	94	343	4983	1330	-
18th	100	357	5340	1443	-

Source: Field data at RDA Demonstration Farm, Bogra.

For ISA brown strain grower ration is fed from 500 grams to 1050 grams body weight. The pullet must achieve 1050 grams at 12th week and achieve not less than 1360 grams at 16th week before switching over to the layer ration. The layer ration should be fed before transferring to the laying house. When the maturity target is met, layer ration should be fed during weeks 17 and 18 at about the same time the birds are light stimulated.

Lighting Program

The objectives of the program were to encourage growth, to control sexual maturity and to achieve the recommended weight. In the absence of photo stimulation, the age of start of lay is determined by body weight. Weight can vary according to climate conditions and the day length experience during rearing. Once photo stimulation has started, age at start of lay is no longer influenced by the pullet's body weight. Egg weight is to a large extent dependent on body weight. For that reason, it is important not to start the light stimulation

until pullets have achieved target body weight. At all latitudes and irrespective of the type of poultry house three rules should be observed.

- Start pullets with a maximum of 48 Hours continuous light
- Never increase day length between 8 and 14 weeks
- Never increase day length when body weight is below the strain recommendations (1400 gm.) for ISA Brown
- Never decrease day length at start of lay.

The bird has been shown to infer day length by the occurrence or lack of occurrence of light during a "photosensitive period" which occurs 11-16 hours after dawn in a 24-hour day. If after a "dawn" or lights on, the hen perceives light during the photosensitive period, she will infer a long day. If no light is perceived during this photosensitive period, then the pullet infers the day as a short day (Hester, et. al., 2011).

Perception of day length in the pullet house will be the same if either natural or artificial light is utilized as long as the intensity of light is adequate to create sufficient contrast between the light and dark part of the day. The light part of the day must be greater than the minimum threshold level of light intensity for the pullet. The exact minimum threshold level is unknown, but we would suggest a minimum of 2 to 5 foot candles of incandescent light (Poultry Management Guide, 2010).

Complicating all of the above is the fact that pullets within a house are not identical in their response to light. Though, in order to increase feed intake, promote growth and limit the influence on sexual maturity from natural daylight. Good light management has the effect of initiating the final elements of sexual maturity essential to managing flock placement times (Gous R.M. et al., 2011). The lighting program would be followed for this study shown in Table 4.

Slowly decreasing light programs only encompass a small effect on regulating sexual maturity. However, in warm climates, sexual maturity depends more on successfully achieving target bodyweight. Increases in daylight (artificially) should not be started before 18 weeks of age in these climates.

Table-4: Lighting Program for ISA Brown Pullet

Age (Week)	Duration (Hours)
1st	24
2nd	22
3rd	20
4th	16
5th	14
6th to 17th	12
18th	12.5
19th	13.0
20th	13.5
21st	14.0
22nd	14.5
23rd	15.0
24th	15.5
25th to onward	16.0

Over the years customers have developed a perception that fresh poultry meat purchased as live bird and slaughtered on site in their presence is better in quality.

Additionally, poor transport, infrastructure and lack of cool chain facilities currently limit the feasibility of handling significant volumes of chilled or frozen products.

As poultry is sensitive to both income and price, the recent trends towards faster growth in per capita incomes; as well as declining real prices of poultry are likely to contribute to more rapid growth in poultry customers.

Table-5: Costs in Pullet Production Up to 18 Week of Age (Taka)

SL No.	Cost Item	Per Batch	Per Bird (%)
A	**Variable Cost**		
1	Feed	169812	296 (66)
2	Medicine & Vaccine	19439	34(7)
3	Litter	6555	12 (3)
4	Labor	5535	10 (2)
6	Electricity	7789	14 (3)
7	Repairs and maintenance	9950	17 (4)
8	Miscellaneous	3208	6 (1)
	A-Total	**223286**	**389 (92)**
B	**Fixed Cost**		
1	DOC	30000	30 (7)
2	Depreciation	2000	4 (1)
	B-Total	**32000**	**34 (8)**
	Grand Total	**255286**	**445 (100)**

Note: Figures in parenthesis indicate percentage to the grand total

Conclusions and Recommendations

The intensive rearing system of hybrid pullet at farm condition has been impressive. However, this may not last if the high chick losses are not dealt with. The performance of hybrid pullet varied widely due to variations in management and pointed to higher production with a little more improvement in management in terms of nutritional stress, better fine-tuning of feed intake, medicine-vaccine, lighting and other relevant management practices. With such improved management, indications are that the hybrid may perform better than the crossbreed bird. Thus to ensure higher productivity and profits from an intensive system in farm condition, farmers should be encouraged to rear hybrid supported by an effective disease control program, better nutrition and rearing techniques. On the basis of findings, it may be concluded that there is a great prospect of hybrid pullet rearing at farm level as an IGA initiative.

References

Anonymous. (2010). ISA Brown Management Guide

Begum, I. A. (2005): An assessment of vertically integrated contract poultry farming: A case study in Bangladesh. *International Journal of Poultry Sciences,* 4(3): 167-176

Ciacciariello, M. and Gous, R.M. (2005). *A comparison of the effects of feeding treatments and lighting on age at first egg and subsequent laying performance and carcass composition of broiler breeder hens. Br Poult Sci.* 46(2):246-54.

Gous, R.M; Bradford, G.D; Johnson, S.A. and Morris, T.R. (2000). *Effect of age of release from light or food restriction on age at sexual maturity and egg production of laying pullets.;* Br Poult Sci. 41(3):263-71.

Hester, P.Y; Wilson, D.A; Settar, P. Arango, J.A. and O'Sullivan, N.P. (2011). *Effect of lighting programs during the pullet phase on skeletal integrity of egg-laying strains of chickens:*

Huque, Q.M.E. (1999). Nutritional status of family poultry in Bangladesh. *Free communication 14. First INFDP/FAO Electronic Conference on Family Poultry.*

Karaim, M. R.; Kabir, H. and Rahman, M. M. (2001). Profitability analysis of broiler farming under contract farming system. *Bangladesh Veterinarian,* 18(2): 153-159. *Marketing,* February 2007, XXXVII: 2.

Miles, R. (1993). *Feeding Management of Laying Hens for high Quality eggs and Lower Production cost,* Univ. Florida.

Millward, D.J. and Jackson, A.A. (2004). *Protein/energy ratios of current diets in developed and developing countries compared with a safe protein/energy ratio: implications for recommended protein and amino acid intakes.* Public Health Nutr. 7(3):387-405.

Montiel & Contreras. (2001). *Vaccination Programs in Layers.*

Merial Müller, O. and Krawinkel, M. (2005). Malnutrition and health in developing countries. CMAJ. 2; 173 (3):279-86.

Yeshoda, D. and Kanchan, V. S. (2006). Study of chicken consumption pattern and consumer preference for processed chicken in Coimbatore. *Indian Journal of Marketing,* February 2007, XXXVII: 2.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Breeding and Culture of Ornamental Fish at RDA Fish Hatchery

Md. Nurul Amin[1]
Macksood Alam Khan[2]

Abstract

Ornamental fish keeping is one of the most popular hobbies in the world today. The growing interest in aquarium fishes has resulted in steady increase in aquarium fish trade globally. Bangladesh is lagging behind in this trade. But there is ample scope for Bangladesh to export ornamental fish if sufficient quantities are produced. The earning potential of this sector has hardly been understood and has not been exploited in a technology driven manner. An attempt was taken to produce some ornamental fishes by breeding in the aquarium at RDA fish hatchery. Overall objective of the study was to adapt the breeding technology of ornamental fishes at RDA Fishery Unit to disseminate the technology to the rural area. Specific objectives of the study were to - culture of Ornamental fishes in the aquarium, breeding and production of fish fry, rearing of ornamental fry and fingerlings for marketing. Four species which are livebearer and breed in the winter season, were selected viz, Guppy (Singapore), Red Sword Tail, Platy and Molly. The experiment was done in ten aquariums at RDA hatchery complex. For the study sixteen pairs of Singapore Guppy, eight pairs Black Molly and six pairs of Marvel Molly, eight pairs of Red Sword Tail, seven pairs Platy and Brood was purchased from breeder house with the help of businessman of Dhaka Katabon Fish market. The study was started from the mid of January and continued upto 30 of March, 2012. This duration was short. During this period all females did not produce fries. Guppy produced 200 fries (average 25 fries per female), Black Molly 85 fries (average 21 fries per female), Marvel Molly 35 fries (average 17 fries per female), Sword Tail 72 fries (average 18 fries per female), and Platy 60 fries (average 15 fries per female). Several brood and fries were dead during the period. In this experiment, due to some major limitations, the researcher did not get good production, but reviewed literature shows, the production should be more. Culture and fry production technology of these livebearers is comparatively simple, easy and also profitable. Small capital and very little space is needed for this activity. Though the activity is profitable on, RDA should conduct more researches on culture and breeding of ornamental fishes and should develop training module on this trade.

[1] Deputy Director, RDA, Bogra.
[2] Deputy Director, RDA, Bogra.

Introduction

Fish keeping in captivity is an age-old practice. Chinese used a variety of containers for the purpose such as dishes, bowls and small tanks that permitted viewing from the top. First public aquaria were established in London and Paris in 19th century. In India first public Aquaria "Taraporewala" was established in the mid 20th century. Now the aquaria has entered in houses, schools, tourist places and laboratories, offices, markets, colonies for amusement (Shajib 2011).

Ornamental fish keeping is one of the most popular hobbies in the world today. The growing interest in aquarium fishes has resulted in steady increase in aquarium fish trade globally. The trade with a turnover of US $ 5 billion and an annual growth rate of 8% offers a lot of scope for development. Singapore is the highest among ornamental fish exporting countries followed by Hong Kong, Malaysia, Thailand, Philippines, Sri Lanka, Taiwan, Indonesia and India. The largest importer of ornamental fish is USA followed by Europe and Japan. The emerging markets are China and South Africa. Over US $ 500 million worth of ornamental fish are exported to USA each year (Bristol Aquarists Society 2007).

Bangladesh does not export but import ornamental fish. There is an ample scope for Bangladesh to export ornamental fish if sufficient quantities are produced. There is very good domestic market too, which is mainly based on domestically bred exotic species. The elite people keep the aquarium with ornamental fishes in their houses. Besides, the elite people, middle class families also keep the aquarium in their houses. Commonly used aquarium fishes are gold fish, guppy, molly, platy and sword tail, koi carp, gourami, zebra fish, honey gourami, rosy barb, glass fish, etc. Most of the ornamental fishes are imported from Thailand and Singapore. Started in 1980 the Kataban market in Dhaka is the biggest aquarium fish market in Bangladesh, where more or less all kinds of aquarium fish are available. Breeding and culture techniques of some ornamental fishes are simple. In Bangladesh, some ornamental fishes can be produced commercially for keeping in aquarium and thus a considerable amount of foreign exchange can be saved. The earning potential of this sector has hardly been understood and has not been exploited in a technology driven manner (Shajib 2011). Considering these facts, an attempt was taken to produce some ornamental fishes by breeding in the aquarium at RDA fish hatchery. Feasibility of breeding and culture of ornamental fish at RDA Fishery Unit may create new avenue in the field of ornamental fish production in this northern region of Bangladesh. The overall objective of the study was to adapt the breeding technology of ornamental fish at RDA Fishery Unit to disseminate the technology to the rural area. Specific objectives of the study were to:

- Culture of ornamental fishes in the aquarium
- Breeding and production of fish fry
- Rearing of fry and fingerlings of ornamental fish for marketing.

Materials and Methodology

Materials Used

The basic requirements for successful breeding and rearing of ornamental fish are adequate space, quality water and sufficient feed. Considering this the following materials were used for this study.

Aquariums

Ten aquariums of 2.5ft × 1ft×1.5ft were used for culture and breeding purpose. For aquarium construction 6 mm thickness glass was used. The aquariums were set on cock-sheet over angle stands. Another four small size (1.5ft × 1ft×1.5ft) aquarium was made for fry rearing.

These aquariums were shedded by wooden hoods. A proper hood, offers more protection against intruders, keeps wiring tidy and accommodates lighting. Light was also set under the hoods. Within the aquarium stones, gravels and some aquarium plants were used.

Aeration and Filtration Equipments

An aquarium air pump with network of tubes for aeration is a must. For aeration 'Sobo Aquarium air pump' was used. For filtration Under- Gravel Filter (UGF) was used in each aquarium. The UGF works by drawing water down through the gravel substrate, which is supported by a grid on the floor of the aquarium. External air pump produces a rinsing stream of air bubble in an uplift tube, circulating the water back to the aquarium surface. Gravels used in the system functions as a biofiltration medium and UGF acts as a mechanical filter drawing suspended particles down into the gravel.

Thermostat/Heater

To keep the aquarium fish healthy, maintaining the aquarium within a constant temperature range is almost needed. For this study, sometimes upto 30^0 C temperatures was maintained. Considering water volume and others a standard heater size of 200W was used in each aquarium.

Internal Power Filter

Internal power filter was used in each aquarium. This filter usually draws water through sponge media, which acts as a mechanical and biological filter medium.

Electricity Supply Arrangements

An arrangement for electricity supply networks was done for this experiment.

Methods

A beginner should start the work on breeding of any live-bearer aquarium fish. Livebearers are small ornamental fishes that give birth to live young. The most popular livebearers

belong to Family Poeciliidae. They are not aggressive, require small space and are suitable for small-scale backyard rising and easy to breed round the year. For this study, four ornamental fish species such as - Guppy (Singapore), Red Sword Tail, Platy and Molly were selected. A total sixteen pairs of Singapore Guppy, eight pair's of Black Molly and six pairs of Marvel Molly, eight pairs of Red Sword Tail and seven pairs of Platy brood were purchased from breeder house with the help of businessman of Dhaka Katabon Fish market on 29 January, 2012. The four types of species were kept in separet aquariums upto their sexual maturity. Ground water was supplied to the aquariums with 20-25 % exchange weekly. They were kept in one aquarium and were reared for breeding. By the help of thermostat machine, water temperature of the tank was kept at 28°C, and enough Dissolved Oxygen (more than six ppm) in the water was ensured and the P^H of the water was around 7.5. They were feed commercial ready feed named 'Optimum' three times a day. Nutritional composition of this feed is Crude Protein-28%, Crude Fibre- 4%, Crude Fat 3% and Moisture-10%. Female of Molly, Platy and Red Sword Tail female was transferred to another ready aquarium for releasing fry when they got over matured. Platy and Sword tail brood fish sometimes eat its offspring, for breeding of platy and Red sword tail, a small nylon made cage was also used to keep the brood so that the fries could go outside of the cage through the small mesh of the cage. After hatching, the brood were transferred to another aquarium and the fry was remain in that tank. Crushed powder of readymade supplementary feed was fed to the fish fry. Water quality especially P^H and Dissolved Oxygen of all aquarium was tested weekly. The study was started from 10 of January and data was collected upto 30 March, 2012.

Limitations of the Study

Following limitations were faced during the study:

- Duration of the study was short.
- During the experimental period some brood and fish fries died.

Results

This study was conducted to know the breeding and rearing technology of the most popular four livebearers (guppy, swordtail, platy, and molly). The investigated fishes were ornamental fishes and were exotic species in aquaculture in Bangladesh, which was introduced only for aesthetic purpose by private entrepreneurs. Description of the brood used in this study is stated in table-1.

Table-1: Description of the brood used in the study

SL. No.	Name	Initial average length (cm)		Initial average weight (g)		Age (months)	Remarks
		Male	Female	Male	Female		
1.	Guppy	4	4.5	1.2	1.9	12	All broods did not give fry
2.	Black Molly	4.5	6.5	1.5	3.75	10-11	"
	Marvel Molly	6	7	2.4	7	10-11	"
3.	Swordtail	10	6.5	3.6	6	10-11	"
4.	Platy	4.6	6.2	1.9	5.6	11-12	"

Livebearers are omnivous which eat plant and animal based feed. Females (2.5 – 5 inches) are generally larger than males (1.5 to 3 inches). Males are more colorful than females. They give birth to successive batches of live young at an interval of few days. Since all livebearers use internal fertilization of the eggs as part of their reproductive strategy, they have to evolve a method of transferring sperm from the male to the female. In poeciliids the anal fin of the male is developed into a gonopodium, a sexual organ formed by the fusion of the third, fourth, and fifth rays of the fin. At its tip there are various spines and hooks which are often called "holdfasts" and are used by the male to hold on to the female during mating. At this time the gonopodium is directed forwards and groove formed down which the sperm is channeled to the cloaca of the female.

In all livebearers, the young fishes develop in their body cavity of the female and are born fully formed and able to fend for themselves. Since they are so well advanced at birth it is not necessary for them to produce hundreds of young at a time; broods vary but 20 to 40 seems to be the average . Interestingly enough, females of most, if not all species of the Poeciliidae are capable of storing sperm. So many successive broods can be produced from a single mating. Experience on culture, breeding and fry rearing of the four species at RDA are described below:

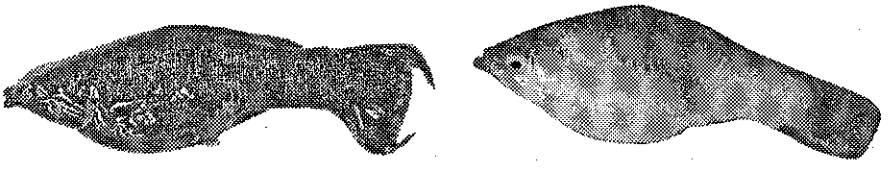
Guppy *(Poecilia reticulata)*:

Guppy fish

Guppies are small fishes; the males have splashes of colour on their bodies and the females are a dull gray/brown with a dark triangular "gravid spot" near their vent and originated from Central America and Brazil. In this study, Guppy first produced fry at 10 of February, 2012. On that day, about 40 very small fries were seen in the aquarium. And on the next day more about 100 fries were seen. These fries were kept with the brood in the same aquarium for 3-4 days. On the 7th day the length and weight of the fry was about 1.5 cm and 0.057 g consecutively. Then they were transferred into another aquarium. Water temperature of the transferred tank was kept at 28°C, and enough Dissolved Oxygen in the water was ensured. After one week more 60 fries were seen in the brood aquarium. They were also transferred into the fry tank after 3-4 days. Crushed powder of readymade supplementary feed was fed to the fries. In total eight female produced fry during the experiment. And the rest didn't produce fries. After fry production, temperature of the aquarium water was ensured between 24 to 26°C. From the month of March the thermostat machines were stopped, as the air temperature was more than 24°C.

During the experimental period 15 brood and 20 fries died. At the end of the experiment, about 180 healthy fries were at the hatchery and the fry needed more than another one month to be the marketable size. On the other hand, the brood may produce fry again within 2-3 weeks.

Molly (*Poecilia sp*):



Black Molly Marvel Molly

Molly is native to the southern USA and down into Mexico, and tolerates lower temperatures than are considered normal for "tropical" fishes (20-24°C). There are several color varieties, for example, gold, black, marvel, and albino (Sean. E. 2006). For this study we used Black and Marvel Molly.

The Black Molly first produced fry at 20 February, 2012. On that day, about 60 very small fries were seen in the aquarium. These fries were kept with the brood in the same aquarium for 2 days. Then they were transferred into another aquarium. On the 4th day the length and weight of the fry was about 1 cm and 0.1 g consecutively. Water temperature of the tank was kept at 28°C, and enough Dissolved Oxygen in the water was ensured. After five days

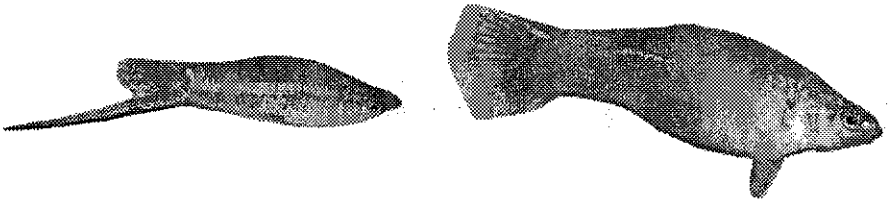
more 25 fries were seen in the brood aquarium. They were also transferred into the fry tank after 2 days. Crushed powder of readymade supplementary feed was fed to the fries.

On the other hand, Marvel Molly first produced fry on 26 February 2012. On that day about 35 very small (0.5 cm size) fries were seen in the aquarium. These fries were kept with the brood in the same aquarium for 2 days. Then they were transferred into another aquarium. They were also transferred into the fry tank after 2 days. Crushed powder of readymade supplementary feed was fed to the fries.

After fry production, temperature of the aquarium water was ensured between 24 to 26°C. From the month of March, the thermostat machines were stop, as the air temperature was more than 24°C. All the purchased brood did not produce fry during the experimental period. But they seemed matured. Only four Black molly and two Marvel molly produced fry during the study. During the experimental period seven broods and 12 fries of Black molly and six broods and five fries of Marvel molly died.

At the end of the experiment, about 73 healthy Black Molly and 30 Marvel Molly fries were at the hatchery and it seems that more than another one to two months are needed to be the marketable size. The rest brood may produce fry again within 3-4 weeks.

Sword tail (*Xiphophorus helleri*):



Sword tail (Male) Sword tail (Female)

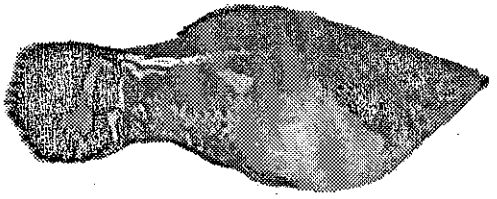
The Swordtail, one of the "classic" aquarium fishes, has maintained its popularity throughout the years. They are originated from Central America and easy to care for and is pleasant to the eye.The males are elongated, with the adults having a long sword shaped Caudal fin extension formed from the eight lowermost fin rays. Females are more robust and lack the sword. In both sexes the Dorsal fin has a straight outer edge. There has been much cross breeding within the family to produce many different colors and fin shapes. The coloration of the sword itself can be Green, Yellow, Orange, Red or any combination of these colors (Sean, 2006).

They first produced fry at 8 March 2012. On that day, about 20 very small fries were seen in the aquarium. But most of them were killed by the brood fish. Only three of that batch

was alive. Sword tail needs enough vegetative plants for successful breeding, and to be hiding the fry from the broods. But in this experiment enough plants was not arranged. Again on 12 March, about 52 live fries were seen in the aquarium. At that time, all the brood was transferred into another aquarium. Fries were reared in that tank. After this time, matured brood was kept into a small nylon made cage so that the produced fries can go outside of the cage through the small mesh of the cage. But after keeping brood in cage, no fry was produced during the experimental period. In total four female produced fry during the experiment. And the rest didn't produce fries. Crushed powder of readymade supplementary feed was supplied to the fries.

After fry production, temperature of the aquarium water was ensured between 24 to 26°C. From the month of March, the thermostat machines were stop, as the air temperature was more than 24°C,During the experimental period, only two broods died. At the end of the experiment, about 55 healthy fry was at the hatchery and more than another two months is needed to be the marketable size. On the other hand, the brood may produce fry again within next six weeks.

Platy (*Xiphophorus sp*):



Platy

The Platy fish is originated from Central America and comes in many different color varities. Platies can be very active tropical fish if given good water conditions. The female Platy is usually larger than the males of the same age. Breeding of them is fairly easy since they are livebears (Sean, 2006).

In this study they first produced fry at 15 March 2012. On that day, about 60 very small and live fries were seen in the aquarium. Brood of Platy and sword tail has the same nature to kill the young fry. Experience from Sword tail, over matured Platy female was replaced in another tank to avoid the killing of fry. After hatching the brood was transferred immediately into earlier aquarium. Fries were reared in that breeding tank. In total four female produced fry during the experiment. And the rest didn't produce fries. Crushed powder of readymade supplementary feed was feed to the fries.

After fry production, temperature of the aquarium water was ensured between 24 to 26°C. From the month of March, the thermostat machines were stop, as the air temperature was more than 24°C. During the experimental period, only one brood and two fries died.

At the end of the experiment about 58 healthy fries were at the hatchery and more than another two months is needed to be the marketable size. On the other hand, the brood may produce fry again within next six weeks.

Table-2: Summary of fry production

Name of the fish	No. of total females	No. of fry producing females	First date of producing fry	No. of total fries produced	No. of total alive fries at the end	Average fry production
Guppy	16	08	10 February	200	180	25
Black Molly	08	04	20 February	85	73	21
Marvel Molly	06	02	26 February	35	30	17
Sword tail	08	04	08 March	72	55	18
Platy	07	04	15 March	60	58	15

5. Conclusions and Recommendations

The study was taken to adapt the breeding and culture technology of ornamental fishes at RDA Fishery Unit to disseminate the technology to the rural area. Period of the study was in winter. During winter season four livebearers (Guppy, Sword Tail, Platy and Molly) under the family Poeciilidae can produce fry. For the study sixteen pairs of Singapore Guppy, eight pairs of Black Molly and six pairs of Marvel Molly, eight pairs of Red Sword Tail, seven pairs Platy and brood were purchased from breeder house with the help of a businessman of Dhaka Katabon Fish Market. The study was started from the mid of January and continued upto 30 March 2012. This duration was short. During this period all females did not produce fries. Guppy produced 200 fries (average 25 fries per female)

Black Molly 85 fries (average 21 fries per female), Marvel Molly 35 fries (average 17 fries per female), Sword Tail 72 fries (average 18 fries per female), and Platy 60 fries (average 15 fries per female). Several brood and fries were dead during the period.

In this experiment, due to some major limitations the researcher did not get good production, but reviewed literature shows that the production should be more. Culture and fry production technology of these livebearers is comparatively simple, easy and also profitable. As a beginner, the researcher could not follow all the required procedures in time. Experience from this trial may enrich the researcher for next trial and also may create opportunity to be involved in culture and breeding of other ornamental fishes. RDA should conduct more researches on culture and breeding of ornamental fishes and should develop module on this trade.

References

Baily, M. and Standford, G. (1999). *The Ultimate Aquarium*, Annes Publishing Limited, Blackflairs road, London

Bristol Aquarists Society (BAS). (2007). Background information about goldfish. *Bristol-aquarists.org*. Retrieved November 23, 2007.

McNulty, E. and Park, E. (2003). The effect of stocking and feeding rates on growth and production of feeder goldfish in pools. *North American Journal of Aquaculture,* 65: 82-90.

Shajib, M. S. H (2011). Effects of Density on the Growth Rate of Gold Fish (*Carassius auratus*) Fry Reared in Hapa, M.S Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh

Sean, E. (2006). *Tropical Aquarium*, New Holland Publisher, Cape Town, South Africa.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Effects of Climate Change and Good Governance in Bangladesh

Dr. Mohammed Asaduzzaman[1]
Dr. AKM Motinur Rahman[2]
Mahbubul Arfin[3]

Abstract

Awareness has been mounting about the needs for protecting the environment, however, natural disasters, environmental degradation and pollution is widespread in Bangladesh. In fact, in the coming years, the country is braced for a series of serious environmental problems like climate change, sea level rise, depleting groundwater table, the persisting menace of arsenic contamination of groundwater, deteriorating water and air quality, alarming level of soil degradation, etc. Therefore, Bangladesh is at the frontline in the battle to protect environmental degradation. This paper intends to examine the initiatives of the governments in order to protect the country and the nation from the rigorous environmental problems i.e. what measures are taken by the governments during the last decade and how they are implemented? Does good governance matter to protect environmental degradation and climate change? In this paper, we will try to find the answer of these questions based on secondary information. It is widely believed that good governance is the key to protect environmental degradation and climate change in general and Bangladesh in particular. We assume that a corruption risk is one of the most vital obstacles in Bangladesh in implementing environmental policies. Here we also assume that good governance will help ensure the success of the impact of climate change policy and using foreign funds. Protection, improvements and conservation of the environment can only take place within the framework of good governance, we believe.

Introduction

During the last three decades and more, it has been repeatedly claimed that the poor nations are especially vulnerable to climate change because of their geographic exposure, low incomes and greater reliance on climate sensitive sectors, particularly agriculture. People exposed to the most severe climate-related hazards are often those least able to cope with the associated impacts, due to their limited adaptive capacity (Stern et. al. 2006).

[1] Associate Professor, Department of Politics and Public Administration, Islamic University of Kustia, Bangladesh (E-mail: asaduzzaman.mohammed@gmail.com)
[2] Associate Professor, Department of Politics and Public Administration, Islamic University of Kustia, Bangladesh
[3] Associate Professor, Department of Politics and Public Administration, Islamic University of Kustia, Bangladesh

Third Assessment Report of IPCC claimed that South Asia is the most vulnerable region of the world to climate change impacts (McCarthy et. al., 2001).

Bangladesh is a young state of South Asia with a very small land and a big population. Currently, impact of climate change is a big threat for Bangladesh for its sustainable development and poverty alleviation. Bangladesh is ranked in the top five most vulnerable countries to climate change and hunger, with devastating predictions for much of Bangladesh over the coming years (Mahmood, 2012). The international community also recognizes that Bangladesh ranks high in the list of most vulnerable countries on earth (Action Aid, 2011). Bangladesh's high vulnerability to climate change is due to a number of hydro-geological and socio-economic factors that include: (a) its geographical location in South Asia; (b) its flat deltaic topography with very low elevation; (c) its extreme climate variability that is governed by monsoon and which results in acute water distribution over space and time; (d) its high population density and poverty incidence; and (e) its majority of population being dependent on crop agriculture which is highly influenced by climate variability and change (Ahmed, 2006).

As of April 2011, rice and wheat prices in Bangladesh were 42 per cent higher than they were a year ago. With nearly half of Bangladesh's 135 million people already living below the poverty line, higher food prices will have a severe impact on poor people's ability to buy enough food. Only 7.65 per cent of the national budget is devoted to agriculture and more resources are needed to help boost agriculture. Estimates suggest that Bangladesh will need to produce 30 million more tones of rice each year to achieve self-sufficiency in food production (Action Aid, 2011). Due to climate change, it has been predicted that rice production will fall by 3.9 per cent each year due to a more erratic monsoon season caused by climate change (Action Aid, 2011).

In terms of water resources, Bangladesh faces serious challenges due to climate change, including scarcity of fresh water, increased incidents of flooding and river bank erosion, frequent and prolonged drought, as well as wider areas affected by salinity. The country's early warning system for floods, cyclones and storm surges is considered state-of-the-art (Action Aid, 2011). In terms of per capita water availability the country fares well compared to many other countries. However, due to high seasonal variability in terms of water availability, ecosystem and human activities suffer considerably because of reduced availability of water in the dry season. It is anticipated that the current sufferings due to lower water availability in the dry season will be accentuated not only by climate change, but also by increase in demand exerted by increased population (Ahmed, 2006).

Bangladesh is well known to the world for its floods. During the last two decades flood becomes a part and a recurring phenomenon for the country. Flooding in Bangladesh is the result of a complex series of factors. These include a huge inflow of water from upstream catchment areas coinciding with heavy monsoon rainfall in the country, a low floodplain gradient, congested drainage channels, the major rivers converging inside Bangladesh, tides and storm surges in coastal areas, and polders that increase the intensity of floodwater outside protected areas. Different combinations of these various factors give rise to different types of flooding (Ahmed and Mirza, 2000).

It has been crystal clear that at present climate change and its impact is one of the leading threats to the way to achieving good governance or to alleviating poverty in Bangladesh. Therefore, Bangladesh is at the frontline in the battle to protect environmental degradation. This paper intends to examine the initiatives of the governments in order to protect the country and the nation from the rigorous environmental problems i.e. what measures are taken by the governments during the last decade and how they are implemented? Does good governance matter to protect environmental degradation and climate change?

In this paper, we try to find the answer of these questions based on the secondary information. We have interpreted and reinterpreted the secondary information collected from World Wide Web, news papers, journals, and research reports. It is widely believed that good governance is the key to protect environmental degradation and climate change in general and Bangladesh in particular. We assume that a corruption risk is one of the most vital obstacles in Bangladesh in implementing environmental policies. Here we also assume that good governance will help ensure the success of the impact of climate change policy and using foreign funds. Protection, improvements and conservation of the environment can only take place within the framework of good governance, we believe.

This paper has been divided into four sections. Theoretical explanation of the key concepts such as good governance and climate change has been discussed in the first section. The second section deals with the initiatives and policies taken by the government in order to protect environmental degradation and climate in Bangladesh. Findings are discussed in the third section and concluding remarks is presented in the fourth and final section.

Operational Definitions of key concepts: Climate Change and Good Governance

Good Governance

The concept 'Good Governance' has emerged as a keyword in the development discourse in Bangladesh. Citizens, analysts, political leaders,, civil society organizations, professionals, administrators and academics seem to suggest that the cause of all problems facing the country is a lack of good governance and the remedy is to establish it. As a concept 'Governance'

is not new. It was utilized and defined in the 14th century, as an action, method, or function of governing (Halfani 1994). For Landell and Serageldin (1991), governance denotes "how people are ruled, how the affairs of the states are administered and regulated, as well as a nation's system of politics, and how this functions in relation to public administration and law." The following useful definition was given by John Graham, Bruce Amos and Tim Plumptre (2003). For them, "governance is the interaction among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how citizens and other stakeholders have their say." Therefore, it is about power, relationship, and accountability: who has the influence, who makes the decisions, and how decision-makers are held accountable. The term 'governance' has received extra flavor in the current discourse of development in developing countries by having the term 'good' added to it. 'Good Governance' entered the vocabulary of development administration and international development cooperation in the 1990s.

Interpreting and reinterpreting the literatures, we could say that there is no straightforward definition of the term 'good governance'. However, the factors that make institutions and rules more effective, such as transparency, participation, responsiveness, accountability and the rule of law, may be regarded as the characteristics of good governance. The world leading institutions such as the World Bank (1994, 1997), UNDP (1997, 2002), and the OECD (1995) have become the great proponents and frequent users of this concept, especially for the aid receiving countries, to promote democracy, decentralization, accountability, transparency, rule of law and people's participation in their development.

The World Bank (1997), from its lending experience in many developing countries, has realised that good governance is central in creating and sustaining an environment which fosters strong and equitable development and its essential complements to sound economic policies. The World Bank has also identified a number of aspects of good governance, such as political accountability, freedom of association and participation, rule of law and independence of the judiciary, bureaucratic accountability, freedom of information, a sound administrative system, partnership between the government and the civil society organisations etc.

The UNDP's apprehension of good governance is fairly similar to that of the World Bank. According to the UNDP (1997), good governance means equal participation of all citizens in decision-making. It is transparent, accountable, and equitable and it promotes the rule of law. It allows the local people and the most affected to be heard when decisions are being made and when resources are handed out. In fact, unlike other aid agencies, the UNDP emphasizes more on identifying the basic characteristics of good governance.

These characteristics are: participation, power decentralization, rule of law, transparency, responsiveness, consensus orientation, equity, effectiveness and efficiency, accountability, strategic vision, et cetera.

It needs to be pointed out from the above that the notion of good governance is still developing in terms of its definition, its ethical connotations and its usefulness (Kruiter 1996). As a result, its meaning could not be confined in a timeframe. Cultural heritage, traditional values, environmental realities, political culture, and economic structure have to take into account in defining and determining characteristics of good governance for a particular country such as Bangladesh. Similarly, we think that good governance is the key to protect environmental degradation and climate change in Bangladesh. We also believe that a corruption risk is one of the most vital obstacles in Bangladesh in implementing environmental policies. Furthermore, we assume that good governance will help ensure the success of the impact of climate change policy and using foreign funds. Protection, improvements and conservation of the environment can only take place within the framework of good governance, we believe.

Climate Change

"This Climate Change Science Compendium is a wake-up call. The time for hesitation is over. We need the world to realize, once and for all, that the time to act is now and we must work together to address this monumental challenge. This is the moral challenge of our generation". Ban Ki-Moon 2009.

Albeit 'Climate Change' has been considering as one of the leading threats to both developed and developing world, is not new at all. The discussion of climate change started since 300BC. Following is a look at how the world discovered global warming and international steps to try to address it[3].

Before defining the term climate change, it is better to distinguish it from weather. Weather is the specific condition of the atmosphere at a particular place and time and is measured in terms of wind direction, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. Weather also describes the short-term state of the atmosphere. According to ICA (2011) the weather is a set of all the phenomena occurring in a given atmosphere at a given time. Climate, on the other hand, is the average pattern of weather for a particular region, usually taken over a 30-year time period. Climatic elements can include precipitation, temperature, humidity, wind velocity, fog, frost, hailstorms, and other measures of weather[4].

[3] http://bdnews24.com/details.php?cid=1&id=212707 accessed on 02.12.2011

[4] See for details. http://www.enviroliteracy.org/nsfmod/ClimateChange.pdf, Global climate change: resources for environmental literacy / by Environmental Literacy Council and National Science Teachers Association, 2007, accessed on 05.10.2011.

Climate change implies a significant change from one climatic condition to another, including changes in temperature, precipitation, wind, and humidity. Because it affects other climate patterns, the aspect of climate that receives the most attention from scientists and policy makers is that of global temperature change. Global warming refers to a particular climate change, namely, the increase in the Earth's average surface temperature. The Earth's surface includes the land areas, the atmosphere, all liquid water on the Earth's surface and underground, and all of the frozen water on the Earth's surface, including glaciers, sea ice, and the Antarctica and Greenland ice sheets[5].

The term climate change is a long-term shift in the statistics of the weather (including its averages). For example, it could show up as a change in climate normals (expected average values for temperature and precipitation) for a given place and time of year, from one decade to the next[6]. Although climate change is a dynamic phenomenon, changes will occur over time, and implications will only be understood in future, it is not possible 'to define a changing climate' that might occur 'within a defined period in future'. In order to appreciate changing climate over a geographic region and/or a country, efforts are made to 'define one or more scenarios of a changing climate' in relation to the area in question (Ahmed, 2006).

Therefore, we can say that climate change refer to a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It can be happened be due to internal processes and/or external forcing. Some external influences, such as changes in solar radiation and volcanism, occur naturally and contribute to the total natural variability of the climate system. Other external changes, such as the change in composition of the atmosphere that began with the industrial revolution, are the result of human activity (Hegerl, G.C. et. al., 2007).

Effects of Climate Change: Brief Notes on Global and Regional Perspectives

We all know that the global climate is currently changing. The last decade of the 20th Century and the beginning of the 21st have been the warmest period in the entire global instrumental temperature record, starting in the mid-19th century. It is quite visible that climate change is increasing the frequency and intensity of climate-related hazards, and hence the level and patterns of often inter-related risks, exacerbating levels of vulnerability for poor and excluded people. Poverty and social impacts, though generally not well-

[5] See for details. http://www.enviroliteracy.org/nsfmod/ClimateChange.pdf, Global climate change: resources for environmental literacy / by Environmental Literacy Council and National Science Teachers Association, 2007, accessed on 05.10.2011

[6] http://www.nws.noaa.gov/om/brochures/climate/Climatechange.pdf accessed on 10.10.2011

understood, are likely to be profound and will impact humans through a variety of direct (changes in climate variables) and indirect pathways (pests and diseases; degradation of natural resources; food price and employment risks; displacement; conflicts, negative spirals) (Heltberg et. al., 2008). It is widely known that climate change is one of the single most critical threats faced by the human species for advancing progress, development and good governance. It is one of the major obstacles in eradicating poverty of developing countries.

In 2010 about 42 million people around the world were forced to flee their homes because of natural disasters (UNCHR report in New Age, 2011). The number of internally displaced people in 2010 was 42 million is equal to the entire population of Argentina and almost 50% more than the total population of Canada. The Internal Displacement Monitoring Centre of the UNHCR highlighted mega disasters like the floods in China and Pakistan, and the earthquake in Chile, and Haiti were responsible for the massive increase in the internally displaced people from 17 million in 2009 to about 42 million in 2010. It also noted that weather related hazards like floods, and storms were responsible for more than 90% of the disaster displacements (UNCHR report in New Age, 2011).

Compare to other continents, Asia is the most affected continent due to climate change. The region faces formidable environmental and socio-economic challenges in its effort to protect valuable natural resources. Land and ecosystems are being degraded, threatening to undermine food security. In addition, water and air quality are deteriorating while continued increases in consumption and associated waste have contributed to the exponential growth in the region's existing environmental problems. Furthermore, the region is highly subject to natural hazards, such as the 1987, 1988 and 1998 floods in Bangladesh, the 2004 Indian Ocean Tsunami, the 2005 Pakistan Earthquake and flood in 2009, the 2006 landslides in the Philippines, the latest Tsunami in Japan 2011 and flood in Thailand 2011 (Cruz *et al.* 2007).

It is widely known that global warming is causing the melting of glaciers in the Himalayas. In the short term, this means increased risk of flooding, erosion, mudslides and GLOF in Nepal, Bangladesh, Pakistan, and north India during the wet season. Because the melting of snow coincides with the summer monsoon season, any intensification of the monsoon and/ or increase in melting is likely to contribute to flood disasters in Himalayan catchments. In the longer term, global warming could lead to a rise in the snowline and disappearance of many glaciers causing serious impacts on the populations relying on the 7 main rivers in Asia fed by melt water from the Himalayas. Throughout Asia one billion people could face water shortage leading to drought and land degradation by the 2050s (Christensen *e.t al.*, 2007, Cruz *et. al.*, 2007).

The principal impacts of climate change on health become epidemics of malaria, dengue, and other vector-borne diseases[7]. The global burden of climate change-attributable diarrhoea and malnutrition are already the largest in the world in Asian countries including Bangladesh, Bhutan, India, Maldives, Myanmar and Nepal in 2000. An increase in the frequency and duration of severe heat waves and humid conditions during the summer is likely to increase the risk of mortality and morbidity, principally in the old and urban poor populations of temperate and tropical Asia (Epstein *et al.*, 1995) and high temperatures and poor urban air quality, such as in Chongqing, China and in Jakarta, Indonesia, could contribute to widespread heat stress and smog induced illnesses in urban populations (Cruz *et al.*, 2007).

Climate Change Effects in Bangladesh

Notwithstanding the least contributor to the causation of climatic vulnerability, Bangladesh is one of the worst victims, and is exposed to serve and frequent floods, typical cyclones, storm surges and droughts. Climate change poses significant risks for Bangladesh, yet the core elements of its vulnerability are primarily contextual. Between 30-70% of the country is normally flooded each year. The huge sediment loads brought by three Himalayan rivers, coupled with a negligible flow gradient add to drainage congestion problems and exacerbate the extent of flooding.

The societal exposure to such risks is further enhanced by Bangladesh's very high population and population density. Many projected climate change impacts including sea level rise, higher temperatures (mean temperature increases of 1.4°C and 2.4°C are projected by 2050 and 2100 respectively), evapo-transpiration losses, enhanced monsoon precipitation and run-off, potentially reduced dry season precipitation, and increase in cyclone intensity would in fact reinforce many of these baseline stresses that already pose a serious impediment to the economic development of Bangladesh (Agrawala et. al. 2003). A subjective ranking of key climate change impacts and vulnerabilities for Bangladesh identifies water and coastal resources as being of the highest priority in terms of certainty, urgency, and severity of impact, as well as the importance of the resources being affected (see for details Agrawala et. al., 2003). We already mentioned that Bangladesh is ranked in the top five most vulnerable countries to climate change, with devastating predictions for much of Bangladesh over the coming years. In the following texts, we are presenting impacts of climate change in Bangladesh briefly.

---

[7] http://unfccc.int/resource/docs/publications/impacts.pdf, accessed on 05.10.2011, Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries, United Nations Framework Convention on Climate Change,

Floods

Due to climate change, floods become common natural hazards of the country. Normal floods are expected and generally welcomed in many parts of the world as they provide rich soil, water and a means of transport, but flooding at an unexpected scale (damaging flood) and with excessive frequency causes damage to life, livelihoods and the environment. The *Fourth Assessment Report* (2007) of the Intergovernmental Panel on Climate Change (IPCC) predicts that 'heavy precipitation events, which are very likely to increase in frequency, will augment flood risk'. These floods will affect life and livelihoods in human settlements in all areas, e.g., coastal zones, river deltas and mountains[8].

Bangladesh generally experiences four types of floods. *Flash floods* occur during mid-April before the on-set of the south-westerly monsoon. *Rain-fed floods* generally happen in the deltas in the south-western part of the country and are increasing in low-lying urban areas. *River floods* are the most common; the areas are inundated during monsoon season along the river and in cases far beyond the riverbanks. *Storm surge floods* occur along the coastal areas of Bangladesh, which has a coastline of about 800 km along the northern part of Bay of Bengal. In case of important cyclones the entire coastal belt is flooded, sometimes causing great loss of lives. Coastal areas are also subjected to *tidal flooding* from June to September.

During the last half-century, at least eight extreme flood events occurred affecting 50% of land area. These extreme events are generated by excessive rainfall in the catchments. When water levels in the three major river systems rises simultaneously and cross the danger marks (usually starting from mid-July and continuing until mid-September), an extreme flood situation usually occurs all over the country. Duration of these extreme events normally extends from 15 days to 45 days. This was observed during those which occurred in 1987, 1988 and 1998, the latter having been the severest one in terms of magnitude and duration[9].

Cyclone

Due to climate change, it is expected that future tropical cyclones will become stronger. Cyclones are expected to become 10 to 20% more powerful if sea surface temperatures rise by of 2 to 4°C in South Asia, therefore the number of devastating cyclones will increase. Cyclones are expected to have 3% to 12% faster wind speeds by the 2020s, rising to 4% to 20% faster by the 2050s (Tanner TM et al 2007). In November 2007, the tropical cyclone Sidr, with a 100 mile long front covering the breadth of the country and with winds up to 240km per hour, hit Bangladesh.

[8] http://www.alnap.org/pool/files/ALNAP-ProVention_flood_lessons.pdf, accessed on 15.10.2011
[9] http://www.apfm.info/pdf/case_studies/bangladesh.pdf, accessed on 05.10.2011

Damage and loss from Cyclone Sidr was concentrated on the southwest coast of Bangladesh. Four of Bangladesh's thirty districts were classified as "severely affected" and a further eight were classified as "moderately affected".3 Of the 2.3 million households affected to some degree by the effects of Cyclone Sidr, about one million were seriously affected. The number of deaths caused by Sidr is estimated at 3,406, with 1,001 missing, and over 55,000 people sustaining physical injuries. The Joint Damage, Loss, and Needs Assessment (JDNLA) estimated the total damage and losses caused by the cyclone to be Bangladesh Taka (BDT) 115.6 billion (US$ 1.7 billion)[10].

Droughts

Drought has long been considered to be a hazard responsible for ups and downs of many civilizations in the world. In Bangladesh, drought in the northern districts is very common. In Bangladesh where agriculture is the largest sector of the economy, agricultural production is under pressure from increasing demands for food. A large percentage of the population is already vulnerable to a range of natural hazards with increasing climate variability and climate change expected to aggravate the situation further by causing more frequent and intense droughts and increasing temperatures. General Circulation Model (GCM) data project an average temperature increase in Bangladesh of 1.0°C by 2030 and 1.4°C by 2050. Between 1960 and 1991, a total of 19 droughts including four major occurred in Bangladesh (Agrawala S et al 2003). The area affected is also expected to get larger during droughts, for example the area severely affected by *Rabi* droughts could increase from 4000 km² to 12000 km² as global warming increases.

From the above discussion it can be said that climate change has a consequential impacts on the development of Bangladesh. Due to the effects of climate change, floods, cyclone and droughts have become common natural hazards in the state of Bangladesh and all these hazards adversely affects to the agriculture, health, fisheries, water resources, biodiversity and particularly to the poor. Climate is changing and we can't deny its impacts and more importantly the impacts of climate change could not be overcome in coming centuries. However, in order to adopt with the changing situation essentially every nation has to take internal policies. In the following, we will briefly discuss what kind of policies has been taken by the Bangladeshi government in order to adopt the climate change situation during the last decades and more.

---

[10] http://gfdrr.org/docs/AssessmentReport_Cyclone%20Sidr_Bangladesh_2008.pdf, accessed on 01.10.2011, Cyclone Sidr in Bangladesh Damage, Loss, and Needs Assessment for Disaster Recovery and Reconstruction, A Report Prepared by the Government of Bangladesh Assisted by the International Development Community with Financial Support from the European Commission, 2008

Government Initiatives/Policies

Bangladesh is a member to various international environmental conventions, including the UNFCCC[11], UNCCD[12], UNCBD[13] and the Ramsar Convention on Wetlands. Although Bangladesh is one of the most vulnerable countries due to climate change, before 2005 there was no national policy to address the adverse affects of climate change. With the help of the international community, in 2005, the government has formulated the National Adaptation Programme of Action (NAPA).

National Adaptation Programme of Action (NAPA) 2005

The basic approach to NAPA preparation was along with the sustainable development goals and objectives of the country where it has recognized necessity of addressing environmental issue and natural resource management with the participation of stakeholders in bargaining over resource use, allocation and distribution. Therefore, involvement of different stakeholders was an integral part of the preparation process for assessing impacts, vulnerabilities, adaptation measures keeping urgency and immediacy principle of the NAPA. NAPA suggested future adaptation strategies are[14]:

1. Reduction of climate change hazards through coastal forestation with community participation;
2. Providing drinking water to coastal communities to combat enhanced salinity due to sea level rise;
3. Capacity building for integrating climate change in planning, designing of infrastructure, conflict management and land water zoning for water management institutions;
4. Climate change and adaptation information dissemination to vulnerable community for emergency preparedness measures and awareness raising on enhanced climatic disasters;
5. Construction of flood shelter, and information and assistance centre to cope with enhanced recurrent floods in major floodplains;
6. Mainstreaming adaptation to climate change into policies and programmes in different sectors (focusing on disaster management, water, agriculture, health and industry);
7. Inclusion of climate change issues in curriculum at secondary and tertiary educational institution;

[11] United Nation Framework Convention on Climate Change
[12] United Nations Convention to Combat Desertification
[13] United Nations Convention on Biodiversity
[14] See for details http://unfccc.int/resource/docs/napa/ban01.pdf, accessed on 01.11.2011, NAPA, Ministry of Environment and Forest, GoB, 2005

8. Enhancing resilience of urban infrastructure and industries to impacts of climate change;
9. Development of eco-specific adaptive knowledge (including indigenous knowledge) on adaptation to climate variability to enhance adaptive capacity for future climate change;
10. Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in future;
11. Promoting adaptation to coastal crop agriculture to combat increased salinity;
12. Adaptation to agriculture systems in areas prone to enhanced flash flooding in North East and Central Region;
13. Adaptation to fisheries in areas prone to enhanced flooding in North East and Central Region through adaptive and diversified fish culture practices;
14. Promoting adaptation to coastal fisheries through culture of salt tolerant fish special in coastal areas of Bangladesh;
15. Exploring options for insurance and other emergency preparedness measures to cope with enhanced climatic disasters.

In fact, NAPA has been prepared the adaptation measures as a set of actions complementary to national goals and objectives of other multilateral environmental agreements to which Bangladesh is one of the signatories. For example "Strategic Block II: Critical Sectors for Pro-poor Economic Growth" section of PRSP has identified climate change as one of the important concerns for water resource management[15]. Climate change, particularly sea level rise is identified as a matter of grave concern for Bangladesh. The Policy matrix under the "Comprehensive Disaster Management towards Poverty Reduction and Growth" in the document has recognized NAPA as an ongoing activity to address some of the pertinent climate change issues. The NAPA was also clearly closely related to other environment related policies and programmes in particular the National Action Plan on Biodiversity.

Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2008

As the threat of climate change and global warming is mounting, the government of Bangladesh kept its efforts up in order to save the nation. As a result, in 2008, the present government has taken a comprehensive climate change policy called Bangladesh Climate Change Strategy and Action Plan (BCCSAP). The Climate Change Action Plan has been developed through a participatory process involving all relevant Ministries and agencies, civil society, research organisations and the business community. This is a 10-

[15] See for details http://unfccc.int/resource/docs/napa/ban01.pdf, accessed on 05.10.2011

year programme (2009-2018) to build the capacity and resilience of the country to meet the challenge of climate change. The needs of the poor and vulnerable, including women and children, will be mainstreamed in all activities under the Action Plan. However, during the first five years (2009-13), the programme is based on the six pillars[16]. Such as:

1. Food security, social protection and health: to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programmes focus on the needs of this group for food security, safe housing, employment and access to basic services, including health.

2. Comprehensive disaster management: to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities.

3. Infrastructure: to ensure that existing assets (e.g., coastal and river embankments) are well-maintained and fit-for-purpose and that urgently needed infrastructure (e.g. cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change.

4. Research and knowledge management: to predict the likely scale and timing of climate change impacts on different sectors of the economy and socioeconomic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change.

5. Mitigation and low carbon development: to evolve low carbon development options and implement these as the country's economy grows over the coming decades.

6. Capacity building and institutional strengthening: to enhance the capacity of government ministries and agencies, civil society and the private sector to meet the challenge of climate change.

In addition to these two comprehensive climate change adaptation policies, the government of Bangladesh has made a number of sectoral policies and plans such as:

(a) *The National Water Policy 1999;*
(b) *National Water Management Plan 2001;*
(c) *National Environmental Management Plan 1995;*
(d) *National land Use Policy 2001;*
(e) *Coastal Zone Policy 2005;*
(f) *Tsunami Vulnerability Map 2005;*
(g) *Coastal Development Strategy 2006;*
(h) *National Forest Policy 1979, 1994; and*
(i) *National Tourism Policy 1992*

[16] See for details http://www.sdnbd.org/moef.pdf, accessed on 10.10.2011

Moreover, the government has taken some specific projects in order to avoid flood related vulnerability. Some of them are mentioned below:

(a) *Khulna-Jessore Drainage Rehabilitation project (KJDRP);*
(b) *Coastal Embankment Rehabilitation Project;*
(c) *Noakhali khal Re-excavation Protection Project, and*
(d) *Megha estuary Study- phase I&II etc.*

Observations

Although Bangladesh started its climate change policies later, we can at least say that better late than never. Since 1971, the Government of Bangladesh, with the support of development partners, has invested over $10 billion to make the country less vulnerable to natural disasters. These investments include flood management schemes, coastal polders, cyclone and flood shelters, and the raising of roads and highways above flood level. In addition, the Government of Bangladesh has developed state-of-the-art warning systems for floods, cyclones and storm surges, and is expanding community-based disaster preparedness. Climate resilient varieties of rice and other crops have also been developed. The challenge Bangladesh now faces is to scale up these investments to create a suitable environment for the economic and social development of the country and to secure the well-being of our people, especially the poorest and most vulnerable groups, including women and children. The Government of Bangladesh's is to eradicate poverty and achieve economic and social well-being for all the people. This will be achieved through a pro-poor, which priorities adaptation and disaster risk reduction, and also addresses low carbon development, mitigation, technology transfer and the provision of adequate finance.

Since its independence, Bangladesh has been facing tremendous governance or good governance problems. Among them administrative and political corruption, conflicting political culture, lack of coordination, partisanship, lack of people's participation are the leading problems. Corruption has been escalated as a fatal disease and extended at every part of the society (Khan M.M nd)[17]. It has become a part of national culture. It is assumed that corruption is much more threat and danger than the climate change. Transparency International of Bangladesh (TIB 1999:2)[18] states that "Corruption in Bangladesh originates from both politics and administration. In most of the cases it takes place in the form of bribery. Besides, misuse of power, nepotism, fraud and patron-client relationship also gives rise to corruption. If the political process becomes corrupt, then naturally, administrative corruption also rises".

[17]Khan M.M (nd) Political and Administrative Corruption: Concepts, Comparative Experiences and Bangladesh case, TIB, available at: www.ti-bangladesh.org/index.php?page_id=373, accessed on 01.10.2011

[18]see for details 'Corruption in Public Administration' TIB, www.ti-bangladesh.org/index.php?page_id=373,

It is obvious that the political culture of a country is the most important factor in the success or failure of any national policy. However, it is very disappointing that democratic political culture, either within, or among the political parties has not yet been developed since the independence. Albeit in 1991, the country began its transition to democracy through great popular uprisings and hopes, it has not been able to consolidate its democracy even after three general elections (1991-2001). Despite regular elections under the caretaker non-party government, democracy has become largely ineffective in the country due to contentious politics between two major parties – the Awami League (AL) and Bangladesh Nationalist Party (BNP) (ibid). According to Time Magazine (2006, April 10:16 in Asaduzzaman 2008), "Democracy is strangled by a poisonous political war between Zia's right-of-centre BNP and the left-leaning AL. Rejecting any notion of bipartisanship, both parties seem to keep the nation perpetually on the verge of chaos alternating between state repressions or crippling national strikes aimed at toppling the government, depending on who is in power. With politics often reduced to little more than a big brawl, violence infects much of daily life. Gangs armed with barbers' razors roam city streets, extortion is wide spread, beatings are routine. The bilious feud Bangladesh's leading women also hobbles the country"). The confrontational political culture between the political parties, thus have been identified as a significant source of potential instability and political uncertainty that has adversely affected the implementation of climate change policies in Bangladesh. Moreover, the problems of coordination in another leading threat in implementing climate change policies and projects. The coordination problems at both national and local levels are not new in the country. However, since 1991, it has been institutionalized at all levels of governance due to confrontational political culture and bureaucratic elitism. It seems that this situation is posing increasing threat to implement national climate change policies in Bangladesh. Lack of people's participation is another major threat to implement climate change policy. Again, this problem has been created due to the above reasons and partisanship. Since the very inception with few exception, it has been seen that the ruling parties are serving the interest of party fellows rather that the interest of the nation.

In addition to the above, there are a number of barriers to the implementation of actions for adaptation to climate change in Bangladesh[19]. For example:

Lack of awareness: lack of awareness exists at all levels from national level policy makers to sectoral and local level officials as well as amongst civil society and the most vulnerable communities themselves. Therefore, awareness raising is clearly a major area of initial action to be prioritized.

[19] See for details http://www.sdnbd.org/moef.pdf, accessed on 10.10.2011

The lack of incorporation: of climate change impacts in developing policies, plans and programmes in some of the most climate sensitive sectors (e.g. water management, agriculture, disaster management, etc). True the need for such integration is being slowly realized. Yet, the actual integration in planning, designing and implementation of then policies is still a far cry and therefore needs to be accelerated considerably.

Lack of adequate tools: knowledge and methodologies to provide guidance and advice to the people making their decisions. This is equally applicable at the technical level in different sectors, e.g. water management but also at the grassroots levels for the vulnerable communities themselves. Thus, generating good knowledge, data, methodologies and tools (and then disseminating them) will need to be an important activity in the short term.

Lack of adequate funding: another big challenge to face climate change is lack of funds. There is no straightforward estimate of how much funding is needed. However there are some global estimates of available adaptation financing which might be possible to tack Bangladesh. To UNFCCC the requirement is $28bn to $67bn by 2030. But according to UNDP this should be $86bn by 2015 while according to Oxfam the requirement is at least $50bn[20]. The irony is that the Bangladeshi government could not be able to provide this huge amount of money. As a result we are completely dependent on foreign aid or assistant in order to face the climate change hazards.

Concluding remarks

It has been learned and well known that although the developing countries have contributed least to the emission of greenhouse gases, they are the most vulnerable countries to the effects of climate change and they have the least capacity to adapt to these changes. They are suffering from natural disasters such as floods and droughts due to climate change. The developing countries lack the necessary institutional, economic and financial capacity to cope with climate change impacts and to rebuild the infrastructure damaged by natural disasters (Sokona and Denton, 2001 in Huq S. et al 2003). They are dependent on external aid, as they do not have the necessary funds available to deal with the problems themselves. The Intergovernmental Panel on Climate Change (IPCC, 2001) describes the requirements that need to be met for a country to have a high adaptive capacity: a stable and prosperous economy, a high degree of access to technology at all levels, well delineated roles and responsibilities for implementation of adaptation strategies, systems in place for the national, regional and local dissemination of climate change and adaptation information, and an equitable distribution of access to resources[21].

---

[20] http://www.unnayan.org/reports/Climate.Change.Policy.Brief.pdf, accessed on 01.11.2011

[21] http://www.un.org/special-rep/ohrlls/ldc/LDCsreport.pdf, accessed on 28.12.2011

In this paper we have focused on the domestic issue of climate change rather than international issues. Of course, like many other developing countries, Bangladesh is not responsible for the climate change or global warming. However, irony is that we are the most victim country of the world. This has been repeatedly agreed by the world community. As a result, in order to protect Bangladesh from the adverse affects of climate change and global warming, international communities should take necessary policies. In addition, we do believe that not only the international community, the government of Bangladesh should be very careful and take very positive and long term strategy to protect the nation from the adverse affects of climate change.

The IIED research team has identified a number of lessons for the developing countries to bear in mind as they prepare their respective climate change policy (Huq S. et. al. 2003) They are as follows;

1. Information on climate change impacts needs to be translated from the scientific research domain into language and time scales relevant for policy makers;
2. Research on potential impacts of climate change needs to be supported in-country to enable information to be improved and passed on to policy makers;
3. All relevant stakeholders need to be involved, but their needs for information may vary and thus information must be suited to the stakeholder group being engaged with;
4. Sectoral level policy makers, planners and managers are relatively more likely to mainstream adaptation to climate change into their on-going and planned work (provided the information on impacts is given to them in a suitable form);
5. High-level policy makers need to be especially targeted (with suitable material);
6. National and international experts and researchers need to share their knowledge with people making decisions and plans on the ground more effectively.

All the above issues are very important particularly for Bangladesh in order to make an effective climate change policy. In doing so, creating a good governance atmosphere is an essential to make and implement climate change policy. If not, corruption will be eating up all the resources. Despite ideological differences, all political parties must attend and participate in order to face the challenges of climate change and adaptation policies. Therefore, at present, political willingness is perhaps one of the most important factors for creating good governance situation and thus facing climate change hazards in Bangladesh. In addition, participation of all stakeholders, civil society and NGOs are essential both at the time of making climate change policy and its implementation.

---

[22] See for details http://www.un.org/special-rep/ohrlls/ldc/LDCsreport.pdf accessed on 28.12.2011

On the other hand, it is true that Bangladesh alone is not capable to face the climate change hazards due to lack of its institutional, financial and economic capacity. At present, two things are very important to keep in mind. They are (a) whether developed countries will commit sincerely to cut green house emission, and (b) commitment of funds to developing countries. Experience shows that there is hardly any possible of a binding commitment to reduce greenhouse gas and funding assurance may end up only in papers and promises. Since both issues are uncertain, the government of Bangladesh has to make a long term climate change policy based on its own capacity through the participation of its all development partners through creating a good governance atmosphere at all levels of the state. Finally, we would like to conclude that a key feature of any adaptation action to climate change proposed to be undertaken is that they need to be well integrated with other ongoing activities so that they can build upon the synergy among them to be cost effective rather than stand-alone activities at higher cost[23].

References

Action Aid, (2011). On the Brink: Who's best prepared for a climate and hunger crisis, http://www.actionaid.it/filemanager/cms_actionaid/images/DOWNLOAD/Rapporti_CIBO_pdf/hungerfree_scorecard.pdf, accessed on 20.09.2012.

Agrawala, S.; Ota, T.; Ahmed, A.U.; Smith, J. and van Aalst, M. (2003). Development and Climate Change in Bangladesh: Focus on Coastal Flooding and the Sundarbans, OECD.

Ahmed, A.U. (2006). Bangladesh: Climate Change Impacts and Vulnerability A Synthesis, Climate Change Cell, Department of Environment Component 4b, Comprehensive Disaster Management Programme, Bangladesh Room 403, Paribesh Bhabhan, Agargaon, Dhaka-1207 Bangladesh

Ahmed, A.U. and Mirza, M.M.Q. (2000). 'Review of Causes and Dimensions of Floods with Particular Reference to Flood '98: National Perspectives'. In Q.K. Ahmad, A. K. A.

Action Aid, (2011). On the Brink: Who's best Prepared for a Climate Change and Hunger Crisis, http://www.actionaid.org/sites/files/actionaid/scorecard_without_embargoe.pdf, accessed on 20.01.2013

Asaduzzaman, M. (2008). Governance in Practice: Decentralization and People's Participation in the Local Development of Bangladesh, Tampere University Press

[23] See for details http://unfccc.int/resource/docs/napa/ban01.pdf

Chowdhury, S.H.; Imam, M. and Sarker, E. (1998). *Perspectives on Flood*, The University Press Limited, Dhaka, pp.142.

Christensen, J. H. (2007). Regional Climate Projections, In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt K B, Tignor M and Miller H L (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Cruz, R.V. (2007). Asia. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Parry M L, Canziani O F, Palutikof J P, van der Linden P J and Hanson C E (eds), Cambridge University Press, Cambridge, UK. pp. 469 – 506.

Davies, M.; Oswald, K. and Mitchell, T. (2007). Climate Change Adaptation, Disaster Risk Reduction and Social Protection Policy Brief, POVNET Task Team on Social Protection and Empowerment Climate change Adaptation, Disaster Risk reduction and Social Protection Final Version, Institute of Development Studies, University of Sussex, Brighton, UK

Epstein, Y; Sohar, E. and Shapiro, Y. (1995). Exceptional heatstroke: a preventable condition. Israel *Journal of Medical Science*, Vol. 31: pp. 454 – 462

FAO, January-April (2011). Price Monitoring and Analysis Country Brief – Bangladesh, http://www.fao.org/docrep/014/am563e/am563e00.pdf World Bank, (1997) *World Development Report 1997* (http://www.decentralization.ws/srcbook/ overview.pdf, downloaded on 13-10-2004, Decentralization: An Overview).

FAO, (2010). The State of Food Insecurity in the World: Addressing food security in a protracted crisis, http://www.fao.org/docrep/013/i1683e/i1683e.pdf, p. 10.

Halfani, M. (1994). Towards and Understanding of Governance: The Emergency of an Idea and its Implication for Urban Research in Developing Countries, The Center for Urban and Community Studies, University of Toronto, Toronto.

Hegerl, G.C.; Zwiers, F. W.; Braconnot, P.; Gillett, N.P.; Luo, Y.; Marengo Orsini, J.A.; Nicholls, N.; Penner, J.E. and Stott, P.A. (2007). Understanding and Attributing Climate Change. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.

Huq, S.; Rahman, A.; Konate, M.; Sokona, Y. and Reid, H. (2003). Mainstreaming Adaptation to Climate Change in Least Developing Countries (LDCS), The International Institute for Environment and Development

IAC, (2011). What is the definition of Weather? Available at: http://uk.ask.com/question/what-is-the-definition-of-weather, accessed on 24.03.2013

Kruiter, A. (1996). Good Governance for Africa: Whose Governance? Unpublished Paper, Maastricht, European Center for Development Policy Management.

Landell, M.P. (1991). Governance and External Factors, Proceeding of the World Bank Annual Conference on Development Economics, Washington D.C., World Bank.

Mahmood, S.A.I. (2012). Impact of Climate Change in Bangladesh: The Role of Public Administration and Government's Integrity, *Journal of Ecology and the Natural Environment* Vol. 4(8)223-240

McCarthy, J.J. (2001). Climate Change 2001: Impacts, Adaptation. and Vulnerability, Inter-Governmental Panel on Climate Change (IPCC), Work Group II Input to the Third Assessment Report, Cambridge University Press, Cambridge.

New Age, (2011). Climate change and Poverty, Available at: http://newagebd.com/newspaper1/editorial/ 23687.html, accessed on: 14.06.2011

Rahman, M. (2011). Dialogue on State of the Bangladesh Economy – Analysis of the National Budget FY 2011-2012, Centre for Policy Dialogue, http://www.cpd.org.bd/downloads/Budget per cent20FY12.pdf.

Stern, N. (2008). *Key Elements of a Global Deal on Climate Change* London: London School of Economics and Political Science, London, UK

Tanner T.M. (2007). *ORCHID: Piloting Climate Risk Screening in DFID Bangladesh,* Detailed Research Report, (Draft), Institute of Development Studies, University of Sussex, UK

UNDP, (1997). Good Governance and Sustainable Human Development, A UNDP Policy

Documents (www.magnet.undp.org/Docs/cricis7monograph.htm.)

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Natural Disaster and Community Based Initiatives in Bangladesh: An Analysis

Mohammad Zulfiquar Hossain[1]
Mohammad Selim[2]

Abstract

Natural disasters severely hamper the progress and achievements of the objectives of development. Various kinds of physical infrastructure may itself constitute a source of risk in the event of future disasters. From the perspectives of environmental degradation, human intervention, and security aspects, disaster management is an emerging issue for all of us and should be undertaken on a comprehensive basis. The approach seeks communities at risk get engaged in all of its phases: prevention, mitigation, preparedness, response and recovery. In order to build disaster-resilient communities, they first need to be empowered so that community members can cope with the adverse effects of natural hazards and disasters. This is the most effective approach to achieving sustainability in dealing with natural disaster risks. Government of Bangladesh is also carrying out various community-based programmes to establish disaster prevention. Its activities include improvement of the safety levels of core community facilities such as schools; the dissemination of best practices in disaster risk management at the community level; and the formulation of integrated programmes for sustainable development through disaster risk management initiatives. The paper presents analysis of the role of community based initiatives, government action and the programs which engage communities to deal with disaster risks.

Introduction

Disaster risk is on the rise throughout the world. Numbers of people who have been affected by natural disasters have increased more rapidly. The physical, social and economic losses caused by these disasters are particularly harsh for developing countries since they have a long-range effect in the development process. To minimize the damages caused by hazards and disasters, various efforts have been taken by government, international communities including donor agencies. However, in spite of participation of these sectors during the project period, it has been observed that many of the disaster management programmes have

[1] Associate Professor, Deprtment of Politics and Public Administration, Islamic Univesity, Kushtia
[2] Associate Professor, Deprtment of Politics and Public Administration, Islamic Univesity, Kushtia

failed to be sustainable at local level after the completion of the project. A critical element of sustainable disaster management is communities' participation in these activities. The most common factors of community based involvement are partnership, participation, empowerment and ownership by the local people. The emphasis of disaster management efforts should focus on communities and the people who reside between the communities. It is difficult to reduce the losses and scale of the tragedy without the involvement of community effort. There needs to be an opportunity where people can be involved from the initial programming stage of disaster management activities.

Natural hazards and natural disasters may sound like the same thing but there is a small but vital difference. Natural hazards are things like earthquakes, volcanic eruptions, landslides, tsunamis, floods and drought — any physical event that happens naturally. They are caused by changes in the atmosphere, the earth's surface or the sea or other body of water. They can happen over smaller, local areas or affect countries, regions or the whole world – some even happen in space, on the sun for example.

Natural disasters happen when the effects of a natural hazard cause serious problems for the people they affect, either in maintaining or improving their standard of living. This can be an economic effect (destroying crops for example), a social one (e.g. families being separated), or both.

We can't stop natural hazards; they are a feature of our planet. We can stop many natural disasters. Natural disasters are easier to prevent than many other environmental problems. Today, there is more scientific knowledge and technological know-how than ever before to predict the effects a hazard might have before it strikes. After we find out the risks of a hazard and we can often take effective actions to reduce them, e.g. replace trees in deforested areas. The cost of doing this is normally far less than the cost of clearing up after a natural disaster. Community-based approach is a method of education and public awareness in disaster management in which community members are involved in the planning and implementation of the awareness programmes

Disaster Management

Disaster management is more than just response and relief which assumes a more proactive approach. It is a systematic process and based on the key management principles of planning, organising, and leading which includes coordinating and controlling. It aims to reduce the negative impact or consequences of adverse events (i.e., disasters cannot always be prevented, but the adverse effects can be minimised).

Community Empowerment

While disasters can strike wide region or a nation, its impact is felt at the community level although it may hit one or several communities at once. Communities need to have capacity to respond to threats themselves. It is for this reason that communities should be involved in managing the risks that may threaten their well-being.

Government, non-government and international organizations implement various programmes before and after the disasters. Most of them are very successful during the project period, but gradually diminish as the years pass. Lack of effective participation and capacity building of the local communities to peruse the program remains major factor for this failure. It is accepted that governments have the prime responsibility for managing disasters and for taking into consideration the roles played by different players. Community, as the primary stakeholder and recipient of the direct impact of disasters, was not given the chance to participate in the process of decision-making and implementation of activities. On the other hand, communities if left alone have limited resources to fully cope with disasters. In many developing and underdeveloped countries, those who suffer the most are the poor, who, in the first place have limited survival resources and do not enjoy adequate infrastructure and access to social services. Community empowerment for disaster risk management demands their participation in risk assessment, mitigation planning, capacity building, participation in implementation and development of system for monitoring which ensures their stake.

Community Based Disaster Management (CBDM)

Most of the disaster response can be characterized as command and control structure one that is top down and with logistic centre approach. Because lack of community participation that results into failures in meeting the appropriate and vital humanitarian needs, unnecessary increase in requirement for external resources, and general dissatisfaction over performance despite the use of exceptional management measures.

All governments are responsible for protecting their citizens and endorsing the 2005 Hyogo Declaration which states that: "strengthening community level capacities to reduce disaster risk at the local level is especially needed, considering that appropriate disaster reduction measures at that level enable the communities and individuals to reduce significantly their vulnerability to hazards." Recognizing these limitations, the Community Based Disaster Management (CBDM) approach promotes a bottom-up approach working in harmony with the top - down approach, to address the disaster challenges. To be effective, local communities must be supported to analyze their hazardous conditions, their vulnerabilities and capacities as they see themselves. They have the best knowledge about their local

surrounding in terms of the most disaster-prone areas, the demography of their community and their social and traditional organisation. It is important that they have the capacity to cope with the impacts of a disaster and are involved in the development of disaster management activities right from the initial planning stages.. This bottom-up, participatory approach can make community members more receptive of new knowledge and information presented to them. Local residents who speak or understand their native language only may be hesitant to accept non-native people conducting education and awareness programmes for them.

In times of disasters, the community level people are the ones directly affected by disasters. They are the first ones to become vulnerable to the effects of such hazardous events. On the other hand, they have the most to gain if they can reduce the impact of disasters on their community. This concept gave rise to the idea of community-based disaster management where communities are put at the forefront. Through the CBDM, the people's capacity to respond to emergencies is increased by providing them with more access and control over resources and basic social services. Using a community-based approach to managing disasters certainly has its advantages. Through CBDM, it is hoped that communities will be strengthened to enable them undertake any programmes of development including disaster preparedness and mitigation. The CBDM approach provides opportunities for the local community to evaluate their own situation based on their own experiences initially. Under this approach, the local community not only becomes part of creating plans and decisions, but also becomes a major player in its implementation. Although the community is given greater roles in the decision-making and implementation processes. Many stakeholders as needed should be involved in the process, with the end goal of achieving capacities and transferring of resources into the community, at which level who would assume the biggest responsibility in disaster reduction.

Every country is at the risk of exposure to some type of disaster, whether natural or man-made. In order for each country to prepare for any kind of disaster, it must inform its citizens about the different types of disasters. The local residents must also be aware of how they can effectively participate in preparing for a disaster, mitigating potential impacts of a disaster and the recovery process after a disaster. One of the most effective mechanisms for a country to prepare for a disaster is by conducting education and public awareness programmes at the local community level. Public awareness is the process of transmitting information to the general population to increase their levels of consciousness about disaster risks so they can prepare appropriately to cope with a disaster.

Stakeholders' Roles and Responsibilities

An effective and successful community-based approach in reducing disaster risks is often attributed to the spontaneous participation and involvement of the following stakeholders: 1) Government, 2) Non-governments (NGOs), 3) Regional and International Organisations/ Donor Agencies, 4) Island council (Local government), 5) National/Local Organisations (women committees, youth groups, schools, etc), 6) Community workers, 7) Trainers, 8) Disaster Managers (Local and National), 9) Policy Makers, 10) Grass-roots people, and 11) Religious Denominations.

The stakeholders Must

- Develop a strong governance framework through legislation and policies;
- Mainstream disaster risk management and capacity building into decision making, the Budget process, and sector, provincial an community development plans;
- Strengthen, empower and support local and national structures; and
- Understand and recognize that disaster management and disaster risk reduction are environmental, humanitarian and developmental issues so there is a need to coordinate the implementation, monitoring and evaluation of the approach.

Methods of Dissemination

The methods of dissemination that can be utilized in the Community Based Approach are varied and depend entirely on the needs of the community and the resources available on hand.

The Simple Hazard Map

A common visual aid utilized in the Community Based Approach is the Simple Hazard Map. It is basically a map of the local community which points out safe escape routes and safe refuges as a guide to where people can run and where they can gather if there is a hazard event (Disaster! 94). Simple hazard maps generally map out areas of risk and lead to action to reduce risk in those areas. It enables people to take the correct escape routes and gather at safe places when disaster strikes. It helps save many lives, homes and belongings which would otherwise be lost in a disaster.

Posters and Videos

Posters and leaflets on natural, technical and manmade disasters and their impacts can be produced and distributed or put up on community notice boards. The production and viewing of videos on past disasters can also be shown to communities to highlight important issues in preparation for or in response to disaster.

Community Theatre (Drama)

The delight of theatre groups to dramatize disaster management awareness message is a medium that is very powerful. During the awareness meetings a mobile traveling theatre group or a local group can highlight the event. This is also a highly effective means of creating awareness in developing countries as the majority of people often have no access to newspapers and television.

Informal Training

The Community Based Approach to Education and Awareness in Disaster Management also uses informal training as an efficient tool to prepare communities in the event that disaster strikes. The awareness training based in the communities is geared towards supporting them to understand and manage their hazard to reduce and mitigate their risks.

Workshops

A week long workshop facilitated by experts in disaster management for community leaders covering enough information, examples, activities and discussion to adequately prepare them in the event that disaster strikes. This is done by gathering all the members of the community at a communal meeting place (e.g. a community hall, church or other traditional meeting place) and imparting this information to the rest of the community.

Mass Campaigns

The mass campaign is a huge undertaking whereby the entire Islands, countries and international donor agencies will be participating. The governments, the donor funding agencies, the non-government organizations (NGOs), the communities and other possible stakeholders need to cooperate fully by pooling resources. The outcomes must meet the objectives of the process so the planning of the entire operation is crucial.

Mock Exercises

Another kind of informal training given at the community level is the use of mock exercises in reducing disaster risks. Community leaders from high risk communities are encouraged to organize occasional mock exercises so as to familiarize their communities with escape routes, safe areas to gather, etc.

The Community Based Action Plan

Community leaders can also create Community Based Action Plans specific to their needs. This action plan incorporates the hazard map, mock exercises and other important methods, skills and information needed in preparation for a disaster. The implementation of a community based action plan involves a long process. The following describes how a community-based action plan (referred to here as a 'disaster management plan') can be actively implemented.

Implementation Actions

The success of activities of the disaster management plan will depend on the successful operation of Community Disaster Management Organization (CDMO) and will include various tasks and processes e.g. tasking, mobilizing community resources, capacity building, monitoring and review and making necessary adjustments.

Tasking

The CDMO should be responsible for setting up appropriate committees to implement the various necessary risk reduction measures such as risk communication, health, evacuation, early warning, agricultural etc. The CDMO should ensure that committees responsible for risk reduction measure are clear on the roles assigned to them and each has access to individuals and groups with necessary skills and expertise to implement the tasks assigned to them. To ensure that these activities can be carried out, the CDMO should mobilize the broader community and its resources. The CDMO should also assign at least one person to carry out each of the following roles:

- Leadership role – have overall responsibility for activities of the committee
- Management role – ensure implementation of agreed activities
- Administrative role – assist in management
- Technical role – provides inputs
- Financial management role – provides proper accounting
- Social mobilization – to mobilize community resources

Capacity Building

To implement their respective tasks it is imperative that responsible individuals and committee members have the technical capability. Without capacity building, the quality of risk reduction measures will be compromised. The CDMO once formed can get assistance from partner NGOs and government organizations or ministries.

Mobilising Resources

To ensure the availability of resources at all times it should continue through to the implementation phase. Should there be a lack of required technical skills within the community, it is the responsibility of the CDMO to mobilize external partners and stakeholders e.g. relevant government departments and ministries, NGOs and local business organizations to meet the needs. It should also involve mobilization of resources to build capacity of the CDMO members and committees and mobilization of appropriate range of resources e.g. human, physical/material, natural and financial.

Monitoring

It should be a vital role of the CDMO to arrange participatory monitoring activities in order to track progress on implementation of the risk reduction measures. This includes monitoring of progress on activities, time frames, budgets, indicators, outputs and objectives and the impact of risk reduction measures.

Advantages and Disadvantages of the Community-Based Approach

Advantages

Ownership and Sustainability: The Community Based-Approach involves people and gives them a sense of ownership of the materials created or methods incorporated in education and public awareness. Through ownership comes sustainability.

Addresses the Immediate Needs of Communities: The Community-Based Approach is targeted specifically at particular communities and it addresses their immediate needs. This is because at the community based level, immediate needs are better identified.

User Friendly: Information is presented in such a way that people can easily understand or relate to, for example, the use of the language that people in a community are most familiar with.

Provides Knowledge and Skills: Community Based Approach empowers or equips people with the necessary knowledge and skills to help themselves in the first seventy two (72) hours of a disaster. This is the most crucial time at the onset of a disaster when outside help is still on its way.

Disadvantages

Fear: Communities are sometimes reluctant to expose the vulnerabilities of their localities to outsiders. This is because they fear that they will lose potential investors in their communities, e.g. tourists.

Lack of Resources: At the community based level, the lack or unavailability of resources required to effectively carry out awareness is also a disadvantage. Without the necessary resources, people have to improvise with what limited resources they have and this not only makes it very difficult for them but also impacts on the quality of work they have produced.

Misleading Information: When public awareness and education is not carried out properly at the community level, misleading information is disseminated to the rest of the community. This can lead to a chaotic situation and ultimately loss of lives at the onset of a disaster.

Lack of Proper Training: A further problem with this approach is also the fact that those utilizing the tools of communicative approach may not have had proper training in what they are doing. This can also lead to distortion of information, thus misleading the rest of the community.

Gender Bias: Last but not the least, there is a tendency in many developing countries not to involve women and young people in the creation of the tools of the Community Based Approach due to religious and cultural influences. Observation shows that too often those involved in public awareness and education at the community based level are males (middle aged and older).

Physical and Socio-Economic Impacts of Disasters

The impact of a disaster may either be a direct or indirect one, its effect trickling into most homes and families in the community. The more obvious physical impact leads to the socioeconomic and emotional impact felt by the community. The intensity of the impact of any disaster is dependant on the preparedness level of the community or nation. Factors that increase the intensity of the effect of a disaster are poverty, environmental degradation, population growth, and lack of information and awareness about the hazards that exist in the area, and the potential risk they pose to the community at large.

Physical Impacts

The physical impacts of a disaster are the deaths and injuries, and the damage to property and the built environment. The built environment can be classified as infrastructure and service sectors such as electricity, water etc. The amount of deaths can lead to a reduction in the population, and thus the workforce, which will in turn have an impact on the socio economic sector of the community.

Infrastructure

Infrastructure includes the basic facilities, services and installations required for the functioning of a community or a society. Since these facilities, services and installations are spread throughout the community and country, they are normally impacted to some degree when disasters strike. While all infrastructures damaged or destroyed in the disaster it will eventually require rebuilding or repair; critical infrastructural problems must be addressed in the short term as well as long term.

Transport System (land, sea and air)

This system is important because at the time of disasters there needs to be an evacuation route available so as to get people out of the danger zone and or bring relief in. Transport is also important when a team needs to be sent in to the disaster zone to do a Rapid Assessment exercise. Transport mediums also need to be available, so that if one transport system is cut off, another mode of transport can still be used.

Gas and Oil Storage and Transportation

Connected to transportation above, there needs to be a store of the above to enable transportation of people out of the danger zone. Evacuation may take a couple of days to a week, and so extra fuel and oil is needed for the cars, boats, or helicopters etc that will be transporting people out.

Communication

This is a critical because before a disaster and in the event of a disaster communication is needed. It is needed to get information out so that the outside "world" knows what is needed and can respond appropriately.

Electricity, Water Supply System, and Public Health

Damage to critical infrastructure which provides the above basic services needed by the community can affect the lives of people in the short term. The great need immediately after any disaster is water and sanitation, as well as the health of the disaster victims. Again, this is assessed in the Rapid Assessment exercise so that it is dealt with immediately.

Security

Most of the resources were used for immediate evacuation of people and saving lives! Today however security has become and important factor that has been mainstreamed into the action plans of many disaster planning offices.

Physical Security

Physical security is necessary requirement that once implemented is designed to prevent, deter, inhibit or mitigate threats that face the safety and security of persons and/or property. Security on the other hand provides for reduction of risk of occurrence of injury, loss or death from the deliberate or intentional actions of man and natural causes.

Welfare

Welfare falls into the socio-economic and socio-political category. The local and national economy can experience low productivity, price slump, high unemployment and inflation. Small island states are more vulnerable compared to the larger developed nations when confronted with disasters of a large magnitude. There are overall financial impacts on the households and individuals that adversely impact on people's welfare for example dwellings, homes, property, and other assets can be damaged, sentimental value of assets can be lost forever which imply investment loss and reduction in the quality of life for the communities affected.

Economic Impacts

Economic costs of disasters vary across space and time. Evidence suggests a strong correlation between a country's level of development and disaster risk. Economic impacts are one of the major areas that need attention from the moment of any disaster. Just like food and shelter, education also needs to be included in the list of areas that contribute to the economic impacts. Hence, this is possible only if the community gets prepared to use the resources available in the community beforehand.

Major Disasters in Bangladesh

Bangladesh, an active delta located at the confluence of three major river systems of the world, and with a funnel shaped coastline, is highly prone to different types of disasters.

Cyclone

Tropical cyclones are frequent in the Bay of Bengal. Bangladesh has the worst record of cyclones and storm surges in the world. They occur so frequently and in such magnitude that they have multiplied the problem of poverty and seriously challenge the efforts of the country towards self reliance.

Flood

Flood is a relatively high stream or tidal flow that overtops the natural or artificial banks in any reach of a stream or coastal plain. The major rivers slowly rise from snowmelt in the Himalayas and the high regions to the north. As the floodwaters arrive from upstream, locally heavy rains help increase the river levels. The rivers can be above flood stage anywhere from a few days up to several months. Heavy rains in the Khasia, Jaintia, Garo and Tripura Hills cause local rivers and small streams to rise to dangerous levels. In addition, heavy and continuous rains can cause flash flooding in local areas.

Droughts

Bangladesh experiences draught conditions at some intervals in time. In the recent past, drought conditions having disastrous crop failure. Droughts of 1957 and 1972 were of severe nature also. Crop failure by drought comes as a significant strain also to the socio-economic structure of Bangladesh.

River Bank Erosions

Along the courses of the mighty rivers, the Jamuna, the Meghna etc erosion every year takes away chunks of land causing displacement of large number of people and losses of properties.

Tornadoes

Tornadoes cause localized devastation and demand an immediate response. Loss of cattle heads and damages to household are also substantial.

Major disasters occurred in Bangladesh are:

Year of disaster	Nature of disaster	Death of people
1985	Cyclone	11069
1987	Flood	1657
1988	Cyclone and Flood	7457
1991	Cyclone	138868
1997	Cyclone	550
1998	Flood	1050
2000	Flood	36
2007	Cyclone	3406
2009	Cyclone	503

Source: Khan (2003, P. 17) and Islam (2009).

Regulatory Framework of Disaster Management in Bangladesh

It is a well-known fact that Bangladesh is a disaster-prone country in which natural disasters occur frequently. Natural disasters do not know any political boundary and cannot be controlled by any means. It is accepted all over the world to go for a coordinated disaster management with all its elements so as to minimize risk factor significantly. Based on this realization, different countries in the world are adopting different regulatory and organizational initiatives for disaster management. Bangladesh is the first country in the world where a full-fledged government ministry, named the Ministry of Food and Disaster Management (MFDM) is dedicated to disaster management. The MFDM is the national focal point for all aspects of disaster management in our country. It manages disasters through its two directorates: the Disaster Management Bureau and the Directorate of Relief and Rehabilitation. Formulation and implementation of policies relating to planning, coordination, monitoring and evaluation of all relief programs, formulation of disaster management guidelines, coordination of all disaster-related activities by different agencies of government and emergency rehabilitation of temporary nature through distribution of relief materials are performed by this Ministry (MFDM) as their major responsibilities. It is assisted by other government agencies, such as Fire Service and Civil Defense and Armed Forces. The 1999 Standing Orders on Disasters articulates the role and responsibilities of the government and other response stakeholders. From the district, upazila to the union levels, a series of local disaster response committees have prepared local disaster action plans to address specific hazard episodes likely to impact upon the resident population. In

addition, specific Local Disaster Action Plans (LDAP have been prepared by over 700 Union Parishads through a participatory process of learning and sharing. The Comprehensive Disaster Management Programme will embark upon a training programme to incorporate disaster risk reduction into the process of developing local disaster action plans as well as into the local development plans.

The detailed composition, structure and responsibilities of the following three national level committees are provided below:

National Council/ Committee	Chairperson	Key ministries/agencies
National Disaster Management Council (NDMC)	Prime Minister	Planning Commission, Ministries of Water Resources, Finance and Planning, Health and Family Welfare, Agriculture, Home Affairs, Defense, Local Government and Cooperatives, Roads and Railways, Shipping, Armed Forces Division and Food and Disaster Management
Inter-Ministerial Disaster Management and Coordination Committee (IMDMCC)	Minister, Ministry of Food and Disaster Management	Principal Secretary to the Prime Minister, Member (Programming), Planning Commission, Secretaries from the Ministry of Foreign Affairs, Agriculture, Defense, Water Resources, Education, Information, Housing and Public Works, Power, Energy and Mineral Resources, Civil Aviation and Tourism, Fisheries and Livestock, Posts and Telecommunication, Environment and Forests, Food and Disaster Management, Finance, Local Government Division, Home Affairs, Roads and Railways, Shipping, Health and Family Welfare, Principal Staff Officer of the Armed Forces Division, Director General, NGO Affairs Bureau, Director General, Disaster Management Bureau, Director General Relief and Rehabilitation and the Secretary General, Bangladesh Red Crescent Society.1
National Disaster Management Advisory Committee (NDMAC)	Prime Minister	Disaster Management Specialist nominated by Members of Parliament elected from disaster prone areas. Experiences person from Government agencies, University, NGOs, donor organizations and other agencies in the field of water resources, meteorology, seismographic engineering, physical infrastructure planning, social anthropology, education,

Source: National Report and Information on Disaster Reduction For the World Conference on Disaster Reduction Kobe-Hyogo, Japan January 18-22, 2005 Prepared by Ministry of Food and Disaster Management In Concert with Disaster Risk Reduction Stakeholders.

Role of Community Workers to the in Disaster Management

Community workers are the most reliable arms of the local government/island council in the implementation stage of the disaster policy and reduction initiatives. Generally disasters have the three phases: pre-disaster, during disaster and post-disaster. Proper disaster management covers all these phases. They have experience in all phases to handle disasters, hazards, emotional problems and coping mechanism and uncertainties. They

assist the local government in establishing a strong cooperation and understanding among diverse stakeholders including the local government, local NGOs, government, regional and international organizations. If this cooperation is effective, every person involved in all community-based disaster programmes is benefited. It is a fact that we have no control over nature; we can reduce the loss on account of disasters by creating public awareness and adequate preparedness. So community workers have a great role in this regard. Community or social work is an enabling profession of community initiative that seeks to help individuals with personal problems and their human relationships. It is evident that the basic functions of social work are restoration, provision of resources and prevention. Restoration of impaired social functioning may be sub-divided into curative and rehabilitative aspects. Its curative aspects are to eliminate factors that have caused breakdown of functioning, and its rehabilitative aspects to reorganize and rebuild interactional patterns. It includes the basic institutions and processes related to facing and solving social problems, those problems that affect large number of people. A disaster situation may be understood as one of the collective stress in which many members of a community fail to receive expected conditions of life from the system. The role of community workers are discussed below:

Building up a professional relationship

The main role of a community worker is to build up a professional relationship with the people of disaster-prone area so that the people can become familiar with the worker and can share or exchange their views to him/her about the disastrous situation. In order to achieve this objectives community worker needs specific training, skill, and scientific knowledge about the human relationship.

To create awareness among the people

The community level worker can play a role to create awareness of the community people in the probable disaster prone areas. Most of the people in the coastal area of our country are unconscious, illiterate, and ignorant and believe in their fate. They are not aware about the time, situation and consequences of disasters.

To arrange publicity for disaster-prone areas

Proper information needed to save the huge loss of lives and property from the disaster. A disaster can cause havoc damage of a particular community partially or fully lacking information. Community worker can play a role to transmit information related to disaster.

To advise people to listen broadcasting news

Advise people to listen to special weather bulletins broadcast by Bangladesh Betar after formation of a disastrous situation. Even after hoisting warning signals, advise all boats and trawlers to anchor near the coasts and to take shelter in safer places.

To advising people to pack the necessary goods

Community workers can advise the community people to pack flattened rice, treacle and drinking water, green coconut, utensils, safety matches, and so forth, in their polyethylene bag and keep them under the earth three feet deep so that these could be used in times of need.

Ti participate in rescuing operations

They can arrange for evacuation of population and livestock from dangerous areas to safer places such as a cyclone/flood shelter, fortified earthen mounds, community centers and other government buildings, and also arrange for supply of food, clothing, and so forth.

To conduct a survey to identifying the impact of disaster

To realize the actual problem and identify the real losses and impact of disaster, social workers explore the nature and scope of the need, identify other relevant information and examine requirements for services and resources.

To arrange for burial of dead bodies

After a disaster, there are to be found dead bodies of human beings and domestic animals in disaster-hit areas which create environmental pollution. Community workers can arrange for burial of dead bodies with the help of volunteers, Village Development Police (VDP) and if necessary with the police, Banglagesh Rifle (BDR) and army, and disposal of carcasses.

To ensure proper relief operations

Disaster-affected people require relief materials from the several government and non-government organizations for their survival. Community workers have a great role to ensure proper, fair and quick distribution of relief materials, houses, cash, house building grants, and so forth, and also proper operation of emergency hospitals, relief centers, gruel kitchens, and so on.

Community-Based Disaster Management

With the emergence of changing role of the Government and with the increasing participation of public in socio-political activities of the Government, the increasing unusual trend of various natural disasters are posing a fundamental question as to the role of government and how it would manage the disaster and what would be the more rationale and effective way of management. A common consensus is emerging amongst the policy makers, experts and professionals that the Government alone can not and will not properly manage and handle all types of disasters with its machinery which require active participation by the people in any region of a country. In line with this philosophy, involving local level people, leaders and community to provide necessary services and logistics to their victims during

and after disaster has been encouraged both in the developed and developing countries. And in recognition to this philosophy a new approach of managing disasters has been evolved known as Community-Based Approach (CBA) which emphasises total participation of all people facing any hazard or disaster and makes sure to render all possible services to the community. This approach in Bangladesh is being popularized gradually.

Community-Based Disaster Management Practices in Bangladesh

The existing system for disaster management in the country covers activities at normal times for important disaster management aspects like mitigation /prevention, preparedness, response and recovery. Disaster management has become an event rather than process of development. Linkage in ongoing development program and participation from the community in planning and executing the programs will improve the local capacity and preparedness measures.

Community Programme by the Government

The Government of Bangladesh under the project "Support to Comprehensive Disaster Management" took a number of initiatives for community based disaster management. The program includes development of Local Disaster Action Plan (LDAP), organize quite good number of training and awareness campaign at local level to sensitize and mobilize community people in the overall risk management system. A good number of training programs were organized by the Disaster Management Bureau (DMB) at local level for different disaster management committees. However, sustainable mechanism is being developed for continuation of the training and examining the impact.

Community coping system

Many individual communities have their own coping system to face the disasters. Disaster Management Bureau (DMB) conducted a research on the issue. This is the first milestone in this regard. In the year 2003, DMB organized 06 (six) workshops for Community Leaders on disaster preparedness and indigenous knowledge on coping mechanism.

Programmes and activities for disaster preparedness

Government of Bangladesh has initiated a good number of programmes and activities for disaster preparedness. Under the project "The Rights-based Planning and Monitoring: Disaster Preparedness" 112 training programmes have been completed in 2002 and 119 training programmes have been completed in 2003 covering the disaster-prone districts and sub-districts. The main components of the project are awareness raising, capacity building, community mobilization, etc.

DMB's Activities Relating to Earthquake

Very recently there has been noticeable attitudinal change amongst the policy makers and disaster managers to prepare inventory of available rescue equipment in the municipal cities and towns to be used in the event of possible earthquake and promote earthquake awareness programmes as part of public motivation. In fact, DMB because of its inner quest to prepare people against earthquake threats initiated some awareness programmes earlier in the form of workshop/seminar and publication of booklets. As such, DMB has so far carried out the following activities particularly relating to earthquake hazard:

- To arranged a meeting of the representatives of City Corporations and Pauroshavas of high vulnerable areas.
- Prepared a voluminous inventory of equipment and machineries available in different organizations/agencies, which could be used for disaster response and rescue operations in the event of an earthquake emergency.
- Prepared a comprehensive training module on earthquake.
- Prepared and published a Handbook on Earthquake for public awareness with UNICEF assistance.

Disaster Management Strategy

- After the floods of late 1980s and the devastating cyclone of 1991, the concept of acting only after the occurrence of disaster has been replaced by the concept of total disaster management involving prevention / mitigation, preparedness, response, recovery and development.
- The GOB has, therefore, total commitment towards reduction of human, economic and environmental costs of disasters by enhancing overall disaster management capacity.
- Efforts have been continuing for optimum coordination and best utilization of resources along-with ensuring community involvement so that they are aware of what they can do for protecting their lives and properties against disasters.
- The plan and conduct of disaster management by GOB involves preparedness, response, recovery and mitigation as key notes for building up self-reliance of the community people.

Disaster Mitigation

GOB gives equal importance to both structural as well as non-structural mitigation measures. As part of structural mitigation measures various cyclone shelters, flood shelters,

coastal embankment to protect coastal land from inundation by tidal waves and storm-surges, and drainage channels have so far been constructed. For non-structural mitigation GOB has given emphasis on Legislation and Policy, Training and Public Awareness.

Disaster Management Legislation has been drafted with the purpose of providing for the formulation of disaster management policy relating to preparedness and emergency measures, and rehabilitation program to deal with disaster.

As part of public awareness activities, booklets containing information about cyclone, flood etc. and calendar, posters depicting disaster points have been regularly printed and distributed up to the grass-roots levels.

To raise awareness among the students on various hazards/disaster management, a chapter on disaster management has been included in the educational curricula from classes V to XII.

GOB has decided to make compulsory a session of at least 02 hours on disaster management in the training curricula of all types of Training Institutes to train officials and non-officials.

Emergency preparedness

During the last few years, GOB has taken a number of significant steps to build up institutional arrangement from national to the union levels for effective and systematic disaster preparedness in Bangladesh. These are:

i. Establishment of a disaster management organization named Disaster Management Bureau (DMB) in 1993.

ii. Naming of the Ministry of Relief and Rehabilitation as the Ministry of Disaster Management and Relief (MDMR).

iii. Establishment of Council and Committees at the national, district, upazila and union levels for overall disaster management.

Disaster Management Mechanism

- GOB has formulated a set of mechanisms to maintain proper co-ordination amongst the concerned Ministries, organizations and line agencies and also to ensure their effective functioning during emergency.
- For the mechanisms to be operative, a guidebook named `Standing Orders on Disaster" has been published as a basic tool.

- The Standing Orders outline the activities of each Ministry, major Agencies / Departments so as to handle emergency situations efficiently.
- In the efforts of making the mechanisms clear and comprehensive, National Policy on Disaster Management has been designed in draft form for consideration of GoB.
- The Disaster Action Plans for DDMCs, UzDMCs and UDMCs are aimed at preparing and protecting people at grass roots levels and increasing their capacities to cope with and recover from disasters

Bangladesh is one of the disaster-prone countries of the world. Development is not possible without the integration of community with disaster mitigation programs. Bangladesh is striving hard to establish an effective and experienced disaster management system from national down to community level to mitigate the effects of disasters. Being aware of the limitations and the vulnerability of the country to natural disaster, the GOB has been making continuous efforts to make Bangladesh a part of safer world in the 21st century and seek help of development partners.

References:

Ali, M. M. (1998). *Bangladesh Floods*, Dhaka: The University Press Limited.

Bishnu, P. and Kenji, O. (1999). *Community Based Disaster Management: Empowering Communities to Cope with Disaster Risks*, (Nagoya) United Nations Centre for Regional Development.

Country Report. (2003). *Disaster Management in Bangladesh.*

Islam, M.R. (2009). "Social Impact and Lessons Learned from Major Disasters: An enquiry into the super cyclone 'Sidr" – 2007. *Social Science Journal,* 15.

Khan, T.I. (2003). *Disaster Management Handbook*, Dhaka: World Vision Bangladesh.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

Evaluation of Training on Capacity Development of Union Parishad Functionaries

Abdullah Al Mamun[1]
Md. Tanbirul Islam[2]

Abstract

A series of four day long training course on capacity development of Union Parishad functionaries for the Union Parishad (UP) Chairmen, Members and Secretaries were organized by the Rural Development Academy (RDA), Bogra with the aim of upgrading their knowledge, skills and awareness. The participants were from Char Livelihoods Programme (CLP) working areas. Training courses were funded by CLP. The courses were organized in 55 batches from October, 2011 to June, 2012 with duration of four days for each of the batch. In all, 1498 participants joined the course out of a targeted total of 1652 (nearly 91%). This evaluation was based on the views and opinion of the participants attended in 21 batches organized from March, 2012 to June, 2012. Kirkpatrick's four levels evaluation model was applied to evaluate the effectiveness of training. The evaluation was focused on different levels; i) *Course level: course content, course structure, methods of delivery, course materials and course organization ii) Satisfaction: Participants opinion about different aspects of training and iii) Opinion: Participants attitudes towards utilization of training and their perception of relevance of the training. The evaluation findings show highly satisfactory performance in said levels of training.*

Introduction

Local Government Division is implementing various development and service-oriented activities for poverty alleviation and to make the rural people's life more comfortable, sound and meaningful. The Char Livelihoods Programme (CLP-2) was taken up with financial assistance from the Department of International Development (DFID) UK, and sponsored by the Ministry of Local Government, Rural Development and Cooperatives of the Government of Bangladesh. It is one of the big projects funded by DFID in Bangladesh which is actually working for vulnerable people living in the Char areas. The programme aimed to lift 1 million people in the project areas out of under poverty by 2016. It was initiated to improve the livelihoods, incomes and food security of extremely poor and vulnerable women, children and men living on remote isolated riverine char of North

[1] Joint Director, RDA, Bogra.
[2] Assistant Director, RDA, Bogra.

Western Bangladesh covering chars located in 114 Char Union Parishads within 31 Upazilas of seven districts, namely, Nilphamari, Rangpur, Lalmonirhat, Kurigram, Gaibandha, Tangail and Pabna (DPP CLP-2, 2010).The activities of the project were organized into four distinct thematic areas or outputs: i) reducing vulnerability through the provision of infrastructure and services; ii) livelihood strengthening and enterprise development; iii) social mobilization, voice and participation, and iv) innovation, monitoring and learning.

Local government i.e. Upazila Parishad and Union Parishad are also working with CLP jointly for livelihood improvement of char people. Union Parishad is the lowest tier of rural local government structure in Bangladesh and the nearest local government organization to the villagers (Rashid, 2009). It's Chairmen and Members are being elected by their own society. So they understand problems of the people of that particular area and can interact with people easily. In any activity to be led, they are able to use their institutional power. Chairman along with members and secretaries play vital role in socio-economic development of the char dwellers. But their capacities were needed to be upgraded through training. RDA-CLP jointly arranged fifty five training Programmes for the UP functionaries to enhance their knowledge and skills towards nature, scope, purpose, problems and issues of development and to achieve the objectives of CLP in their respective char areas.

Evaluation is the process of finding out whether the facilitators have functioned effectively and the Programme has achieved its objectives (Knowls, 2009). If no evaluation of training has taken place, decision will be based upon the decision makers' impression of training. Other factors that influence the need to evaluate training are the quality movement, a focus on continuous improvement and cost cutting (Blanchard and Thacker, 2011). This is where Kirkpatrick's four-level training evaluation model can help objectively analyze the effectiveness and impact of training to improve it in the future (Kirkpatrick and Kirkpatrick, 1996). The four levels of learning evaluation are: i) Reaction of trainees; ii) Learning- that results in increasing the knowledge or capability; iii) Behavior- extent of behavior and capability improvement; and iv) Results- the effects on the environment resulting from the trainee's performance. An attempt has been taken to find out the judgement of overall management of training programme which is jointly implemented by RDA and CLP.

Aims and Objectives

The aim of the evaluation was to assess the extent to which the course objectives were achieved and effectiveness of course through the learning process and identify the key areas for changing and further improvement in future. The specific objectives of the evaluation were to evaluate at course level, satisfaction level and opinion level:

I. To evaluate course level: course content, methods of course delivery, course materials and course management

II. To evaluate satisfaction: participants assessments on facilities of the training and overall management

III. To evaluate opinion: Trainees' perception about relevance of the training and suggestions made by them.

Methodology

About 55 training programme was conducted during October, 2011 to June, 2012 at the Rural Development Academy (RDA), Bogra. In this study, participants evaluation sheet of batches from 35 to 55 were analyzed. Total 574 participated in those training programmes during March, 2012 to June, 2012. The post evaluation was based on participant's registration form and an end-of-course evaluation forms.

Data collection

Data collected at those levels were used to determine what the participants thought the training with a formatted questionnaire. Data were collected in the following ways:

I. Data were collected from participants through the registration form helped the authors to understand their profiles. Participants were also asked to evaluate every aspects of the training course.

II. The end-of-course evaluation forms consisted of 16 questions, is mainly a level of participant's reaction evaluation in terms of Kirkpatrick's Four Levels of Evaluation. There are quantitative questions where participants were asked to respond by circulating in five- point Likert scale respond sheet ranging from highly dissatisfied to highly satisfied where 1 Score 01-50 (highly dissatisfied), 2 Score 51-60 (dissatisfied), 3 Score 61-70 (average), 4 Score 71-80 (satisfied) and 5 Score 81-100 (highly satisfied). There were also open ended questions where participants were asked to give their opinion in their own words. For analysis of collected data, according to Best & Kahn (1981), three steps followed in analyzing qualitative data: i) organizing the data ii) description and iii) interpretation. Quantitative data (score 1-100) are shown as bar graph and pie charts. The average percentage of scores was reported. For qualitative data in open ended questions, the evaluators first coded and classified participants' responses in categories, and then counted the frequency of each category.

Findings and Discussion

Course level: According to the registration form most of the participants (86%) were Union Parishad (UP) Members and the following 7% were UP Chairmen and the rest 7% were UP Secretaries (figure-1). Among the participants 24% were female (figure-2) where no chairman or secretary was female.

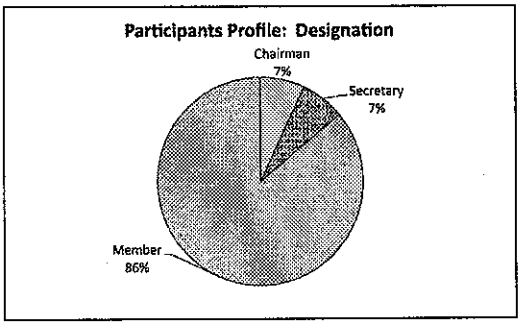


Figure-1

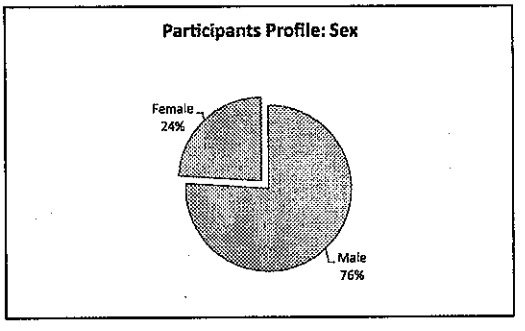


Figure-2

The imparted course was a structured blended learning package combining with group work and lecture centred methods. Participant's response regarding course content, methods of course delivery different

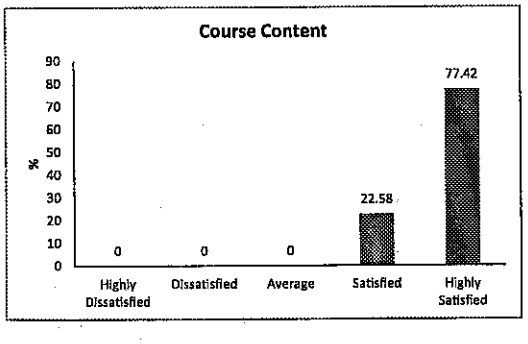


Figure-3

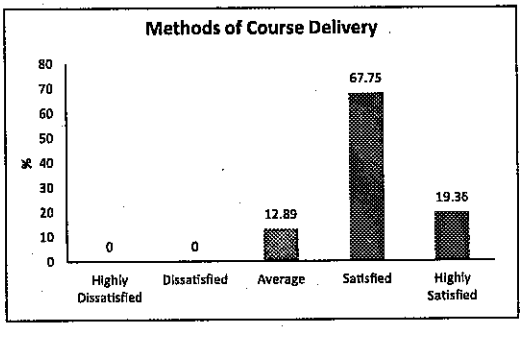


Figure-4

training methods and training materials are shown in figures (3-5). About 77.4% trainees graded contents of the training as highly satisfied while about 22.58% were satisfied about the course content (figure-3). The contents were designed to deliver different ideas regarding CLP implementing and how participants would integrate them in the CLP implementation process.

Apart from lecture method courses were delivered following different techniques such as group work, participation, presentation, brainstorming etc. Participant's assessments on methods of course delivery were also taken (figure-4). Majority of them (65.57%) were

highly satisfied followed by 19.36% satisfied and 12.89% trainees felt about method of delivery at average level.

In the questionnaire, the participants were asked about the training materials. Majority of them were highly satisfied (54.89%) and about 41.94% were satisfied about the materials (figure-5). Trainees were provided lecture notes, case study and some more similar documents for further references.

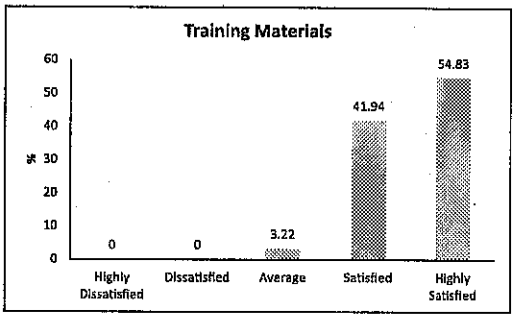


Figure-5

Participant's responses on usefulness of different topics presented during the training Programme were also recorded (figure-6). The percentage of the participants who graded importance of communication as most useful was higher (52%), about 27% of them graded village court and about 21% considered information on Char Livelihood Programme to be useful.

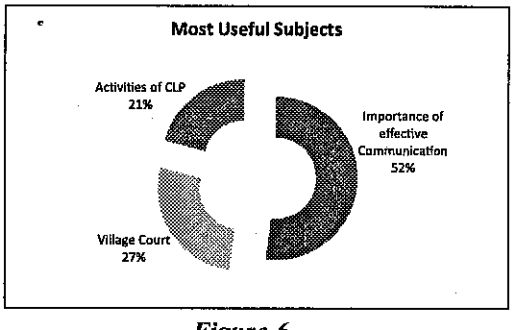


Figure-6

Satisfaction: RDA always tries to ensure the quality of delivery not only learning aspects but also provide other essential components in training such as accommodation, food and logistic supports.

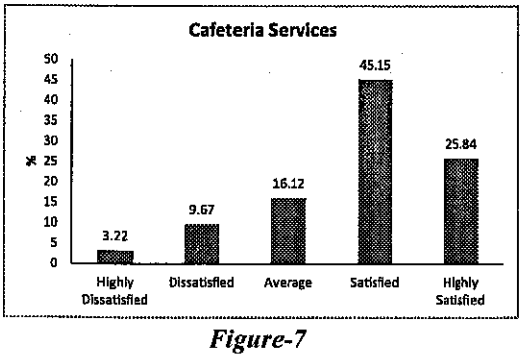


Figure-7

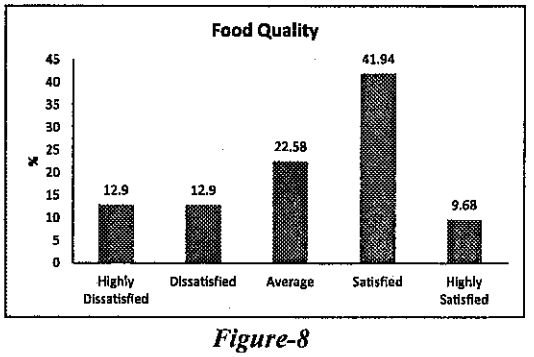


Figure-8

It serves high quality food at reasonable price. Hygienic condition and timely service are at the top priority. Cafeteria maintains high quality service for its clienteles. According to Figure 7 and 8, majority of participants were satisfied about the cafeteria service while 3.22% of them highly dissatisfied about its service. Food is provided as per budget allocation of sponsoring organization and due to price hike it has created some unwanted problems.

Figure-9 illustrates participants satisfied about hostel management. All the participants were provided residential facilities. About 42% participants were highly satisfied and 58% were satisfied (figure-9).

Participants also gave their opinion on the overall course management of the training Programmes. Almost everyone was satisfied and only 3.22% of them rated as average about the overall course management (figure-10). It means that overall management and facilities were satisfactory to enable them to enjoy training Programme.

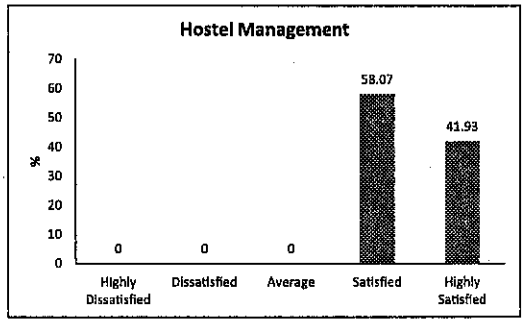


Figure-9

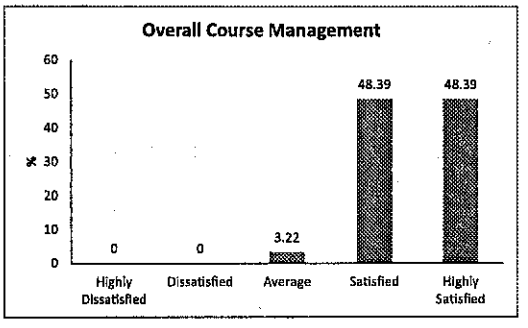


Figure-10

Opinion: Suggestions and Recommendations made by the participants for further improvement of the course in future also incorporated here.

There were open ended questions in the questionnaire to collect subjective qualitative data. Statistics used the frequency of major categories identified by the authors.

Course Duration: As effectiveness of any training Programme correlates a lot with its duration (Sarker and Alam, 2007). The participants of the training were asked about the duration of the training. Participants highly recommended to extend the course duration even up to 10 days has been reflected in figure-11. A total of 87.59% suggested extending the course duration in future, while 5.79% of them wanted to reduce it to three days. Here the reason behind the demand of extending time is the newly elected chairmen and members. Yet if the duration of the programme can be increased in future, it would be helpful for the newly elected representatives to acquire maximum benefit.

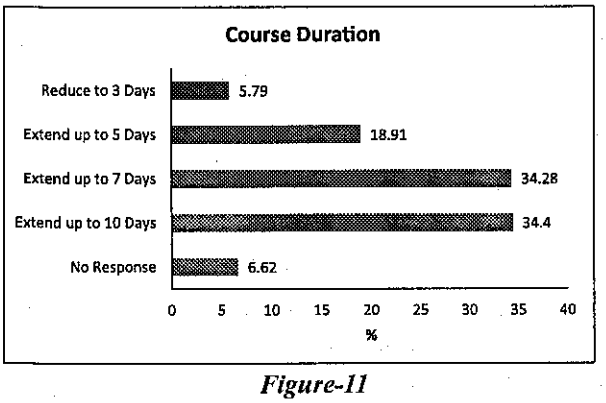


Figure-11

Suggestions: Participants suggested including the following topics in the training programme:

i. Taxation and repayment procedure
ii. Computer skills
iii. Information service
iv. Climate change and disaster management
v. River erosion and preventive measures
vi. Flood control

Besides, participants also suggested bringing more changes in the food menu, including recreation facilities and enhancing their travelling allowance.

Conclusion

The training courses aim to develop the capacity of UP chairmen, members and secretaries for their capacity development, to make them aware about their responsibilities and to inform about various aspects of CLP works. Thereby, training courses provided the skills, knowledge and awareness on different topics in various subject areas related to development. There was significant evidence in the training course evaluation forms that participants appreciated the value of the training course and it was achieved significant success.

References

Andrew, K. (2009). "*Importance of training evaluation*": Suit I01,Vancouver, Canada

Best, J. W. and Kahn, J. V. (2006). Research in Education (10th ed.). New Jersey: Prentice-Hall Inc.

Blanchard, N. and Thacker, W.J. (2011). Effective Training- Systems Strategies and Practices, Third Edition, Pearson, India

Development Project Proforma (DPP). Char Livelihoods Programme Phase-2 (2011). Ministry of Local Government, Rural Development and Cooperatives, Government of Bangladesh

Kirkpatrick. L. D and Kirkpatrick. D.J (1996). Third Edition (http://www.nwlink.com/~donclark/hrd/isd/kirkpatrick.html)

Rashid, S. M. (2009). Chairman-Member Relationship in functioning Union Parishad Activities, Rural Development Academy, Bogra, Bangladesh.

Sarker, M. S. and Alam, M. S. (2007). Effectiveness of tutors training workshop of DYDW programme at BOU, Journal of Agriculture and Rural Development 5 (1&2), page 7-12.

ISSN 1019-9624
Bangladesh Rural Development Studies Vol. XV No.1 (2012)

The Socio-economic Profile of Street and Working Children in Bangladesh

Tabassum Zaman[1]
Fahmida Sultana[2]

Abstract

Human capital is the most important factor of production for a labor intensive country. Child population consists of a large portion of the population of Bangladesh. Improving the standard of living of the street and working children is one of the goals of the millennium development agenda. The standard of living of the street and working children of Bangladesh is bleak and confirms our position far away from achieving the millennium development goal. So, considering their vulnerable condition immediate investment in this segment of population could be a fruitful attempt, otherwise they could pose definite threat to the way of our long-term progress .The finding of the research suggests that their needs should be addressed in the priority basis. It also advocates the distribution of resources properly, via eradication of poverty, accessible education, improved health services and security conditions of this class. Child right should be vastly introduced in every level of the economy and reduction of exploitation of the children by the haves should be ensured. Finally, increased coordination between civil society, NGOs, Government and the foreign partners should be assured and this will establish their respective responsibilities to the deprived children.

Introduction

The pyramid size population of Bangladesh signifies that the major portion of the population consists of the young population. The young population can be proved indeed to be potential human capital for economic progress, if they can be properly utilized. But in our context they are deprived from the basic needs and far away from their potential level of productivity. Among them the most vulnerable group is the area of my concern -the street and working children. Estimated number of street children in Bangladesh is 445,2269 of which 75% are in Dhaka city, 53% boys, 47% girls . According to Baseline Survey (BBS, 2002) it is estimated that 7.4 million children are economically active between the ages of 5-17 years and out of them 400,000 are child domestic workers (CDW) who are between the ages of 6-17 years in Bangladesh. 445, 2269 street based child workers are engaged in

[1] Assistant Professor, Department of Economics, Jagannath University, Dhaka
[2] Assistant Professor, Department of Development Studies, Dhaka University, Dhaka.

different kind of jobs in Bangladesh. M.A Momen in 1993 conucted a study reveals that the children usually work for 16 to 17 long hours a day without having sufficient rest or break, gets TK 50-150 per month. It has been mentioned in the study that four child domestics out of ten do not receive any wage at all, but work only in exchange for free meals .It also found that, the family members of the employer very often abuse domestics verbally and do not hesitate to assault them physically. The employees are also frequently threatened to be dismissed for very mere faults.

Child labor situation in Bangladesh – An assessment by Md. Mahfuzur Rahman in 1999 shows that child labor is caused by a number of 'push', 'pull' and 'interactive' factors[5]. Mass poverty, deprivation created by natural calamities, lack of access to useful education for the poor, prevalence of traditional social norms and values regarding children's work, lack of awareness about the negative consequences of child labor , unrestricted access of children to the job market because of poor implementation of the labor laws, motive of the employers to maximize profit by employing cheap labor and strong desire of the children and their families for immediate income – have been held responsible for rampant child labor. However, in this article an attempt has been made to explore the socio economic status of our street and working children and thereby focus the ignorant concept of child right in our citizens.

Objective

The prime objective of the research is to explore the socio-economic profile of the street and working children and to identify the intolerable condition they are going through. The goal of the research is to inform the citizens about the active participation of the NGOs who are following the CRC principle (Convention on the right of the child) and working with their foreign counterpart and having strident effort to have a positive impact on the socio economic life of the ill-fated children. The study also have some recommendations for the government, civil society and the NGOs to work as watch dogs and mitigate the sufferings of the working and the street children.

Methodology

The research work is a fusion of qualitative and quantitative data analysis about the street and working children in the Dhaka city. Interview and case study was used in this study. About 64 street and working children were interviewed in this research. The first stage of the research consists of participatory learning approach (PLA) to develop the primary notion of street and working children. The second stage identified the facilitator and impeding factors to the children's socio economic life. In the third stage the case of an NGO like Aparajeo Bangla (AB) was taken to identify the availability of services to the deprived street children. The final phase introduces one of the successful NGOs working in this field.

Results and Discussions

Socio-economic Condition of Bangladesh Street and Working Children

The quality achieved in the childhood remains as the main driving force for the rest of the life. But major segment of Bangladeshi children are deprived from their basic entitlements. Let us focus on them through the following view point:

Family background

Family background is researched and found that there are two types of child labor. The first type is children who are involved with some type of income generating activities stay with their families and have a strong tie with their original families. Another type consists of the street children earning livelihood by engaging themselves with some kind of work but do not stay with their family members and have very loose or no connection with their original family, have no permanent place to live in and therefore usually pass night on the street itself.

Parents of the working children have very less or do not have exposure to formal education; especially the mothers hardly have been to any formal type of school. Polygamy and remarriage may be described widespread among the parents, leaving the young children in a vulnerable situation results severe impact on their normal process of socialization.

Table- 1: Occupations of the Family Members of the Participants

Major occupations	Numbers
Housewife	22
Maid servant	09
Rickshaw puller and pusher	06
Shop and hotel attendant	06
Day laborer	16
Begging	05

Source: Survey Data

The professions and the trend of the monthly family income clarifies what would be their standard of living. It is explained in the Table-2.

Table- 2: Monthly Family Income (Approximate)

Income (Tk.)	Number of families
0- 850	3
851-1600	4
1601-2400	03
2401-3200	09
3201-4000	11
4001-4800	09
4801-5600	12
5601-6400	05
6401+	4
Without any regular income	02
Unable to figure out	02
Total	64

Source: Survey Data

As the study shows that about 10 % of the respondent's family receive monthly TK 850-TK1600 and 68% receives an amount of TK 1600-TK 5600 per month and only 6 % of respondent's family receive an amount TK 6400 per month which is the highest among all. So the family monthly incomes in relation to the number of family members (4-5 members on an average) are focusing the poverty level of the respondents. The relationship among children, parents and other members of the family is always stressful because of mostly poverty and poverty related causes.

Economic activity

Urban child workers are engaged in around 311 types of economic activities Children are mostly found working as carpenter or helper of carpenter, electronic/mechanic worker welding worker, hotel/restaurant attendant, tempo helper, automobile worker, domestic aid, cleaner, salesperson, sales assistant, rickshaw puller or pusher, shoe-shiner, construction worker, etc. Those who work in electric and welding shop, automobile workshop and factory setting should be described engaged in extremely hazardous job, exposing themselves to life threatening instruments like electric tools and materials , heavy metal, fire etc.Most of the work performed by the children are not suitable for them because of working environment, nature of work and longer working hour.

This study shows that about half of the children (45 percent) work from 11-15 hours a day, requiring substantial physical labor to accomplish their assigned job. It needs to be noted that child domestics, on an average, work 12 hours a day, but in reality they start working

before the sun rise and go on till mid night and have to remain ready to respond on call anytime coming from any member of the family and the average family members and child domestic ratio 5:1 further clarifies their workload per day, which is 15 to 16 hours a day. Around 41 percent of children engaged in a particular work within 8-11 hours a day. On top of their regular job some children are found to be engaged in various unpaid activities, doing the domestic chores such as looking after younger and assist their mothers. It takes 1-4 hours a day, ever sometimes more than that.

Among the street children two group have been researched separately. They are in the age group of 5- 13years and 13- 18 years. The earlier group work per day in the average 5-8 hours and earn TK 30-70 and the later group work on average 7-12 hours and earn per day TK 60-110.Many street child workers engage themselves in illicit activities such as crime, and prostitution mostly organized by criminal and antisocial elements .The monthly income of the participants is shown to identify their standard of living:

Table -3: Monthly Income of the Participant

Income group (Tk.)	Percentage
Up to Tk. 450	30
450-900	37
900-1350	09
1350-1800	05
1800-2250	01
2250-2700	-
2700-3150	04
3150-3500	05
Only food	06
Don't know	03
Total	100

Source: Survey Data

Children workers do not have much control over their income and are bound to make economic contribution to the family. Therefore it becomes difficult for them to save an amount of their income for a brighter future. They don't have any reliable place to save even. So they consider consuming all and saving none. Those who manage to save something from there meager income mostly prefers to invest in shaping their future by kicking off a business.

Shelter

A major portion of street children (81 percent) does not have any specific place to stay overnight. An insignificant number of them lives in filthy environment suffer from lack of toilet and water facilities and above all they often face seasonal catastrophes. The children who cannot afford to rent a place usually find places like island of the street, an open place with shed on top, empty office and market corridor, train and bus station, and room under major bridges. Though these places are supposed to be free, that is not always the case. Girls that sleep on the street are sexually abused regularly.

The study found that among the street children around 30 percent receive half day shelter provided by the NGOs and 22 percent receive full day shelter from the NGOs.It is also found that 35 percent go to the NGOs for shelter intermittently.

About 70 % of the workshop children sleep with their parents at night, and about 15 % of them sleep with their employers' residence. All of the household workers sleep in their employer's house a place much secures compared with the rest.

Food

Around 52 % of the street children are in a position to take three meals a day .30% of the street children take two meals a day mainly launch and dinner, and 7 percent can only manage one meal a day. The rest of them suffer from uncertainty, depending on mostly food donations and therefore sometimes are left with no food. The health related information as per UNICEF Bangladesh 2010, the infant mortality rate is 51 per thousand per year and percentage of malnourished children (below 5 years) is 67 % in our country, explains what health facility the country provides to its child population. Smoking and the use of other drugs are also found to be prevalent among the street children. The daily food menu of the majority consists of rice with lentil, mashed potato or mashed vegetable and also fish, especially small fish, found to be dominant in their daily food menu.

According to the study, most of the working children take three meals a day. More than 80 % can have two meals for lunch and supper, and 20 % take three times meal per day properly and 5 percent of them have only one time meal properly. Their per day calorie intake in the average is ranging from (855 to 1880) Kilo Calorie which is much less than the standard measure of poverty indicator that is 2122 kilo Calorie per day.

Security

Street children are fed up with the kind of humiliation, abuse and violent behavior they face everyday. The nature of violence they regularly go through is threat, intimidation, shouting, pushing, grabbing, slapping, kicking, hitting with object, beaten up indiscriminately,

choking being stabbed with knife, pulling hair and ear, etc.Most of the children who spent night on the street have at least one experience of being beaten up and sometimes mugged/ robbed away and therefore the darkness of the night is the most fearsome for the children since the muggers and night gangs always remain ready to entrap them. The perpetrators are employers, family members of the employers, trainer of the work place, fellow senior workers, gang criminal, bystanders, police etc.

To inform about their health security it is observed that the street children are very much indifferent about their health. They do not go to the doctor when ever they fall sick. They have limited options in front of them as well. When ever they are in a stage which is beyond their control they rely on the NGOs who give them possible medical treatment with medicine.35 % of the street children receive treatment from the NGO's provision.

The study shows that 87 % of the working children receive medical treatment when they fall sick. Among 87 % of the working children, about 47% go to doctor only when they are seriously ill. Around 12 % of them are dependent on their relatives or the public hospitals for their treatment .Allopathic, homeopathic and indigenous forms of treatments are usually received.

Education

Education is still an inculcated dream for the children engaged in some work. One quarter of them has never been to any kind of school and 63 percent had a bit of education ranging from unfinished primary level to Secondary School Certificate (SSC).Of course poverty is the root cause for not being able to continue education, but other factors are also identified like the following:

Table- 4: Major Causes of School Dropout

Major causes
Parents are reluctant to send children to school
Education is not enjoyable to the participant
Education is not considered to be profitable to the parents
Work is more attractive than education
Education is considered to be a hard task
Family relies on the participants income
Ignorance and lack of awareness from the parents part

Source: Survey Data

It is shown that healthy environment within the family is a major factor which helps a child to continue education successfully. One surprising finding of the study is that 15 percent of the working children keep their effort intact to have part time education despite the fact of being involved in tiring work for long hours. However, the education they achieve does not have any positive effect on their income and social status, rather they face insults for dissatisfactory performance at the workplace and whenever a mistake is made. Apart from that, it is the employers who have the final say whether their child employees should be allowed to attend school or not, depending on the attitude of the employers towards the children. The estimation reveals that among the child worker,48 % never attended some kind of school earlier,9 % of them still continue to attend school or some kind of education program offered mainly by the NGOs.Most of the Child workers left the school because of economic hardship. It is surprising that 74 % of the child workers express their interest in attending school if they are given opportunities.

In compliance with the institutional obligation the Government of Bangladesh has declared universal primary education copulsary.Numerous strides have been taken to address the children of all classes. However, the effort pose question, as over one third of the population are still uncovered.

Finally, the investigation further attracts the other aspects of the working and street children's lives like amusement; future plan etc.Amusement is a part and parcel of our life to have both physical and mental balance. In this regard the street children are to a great extent deprived of all kind of recreational facilities other than watching T.V, chatting with each other, going to cinema in a regular interval etc.Some of them are addicted to watching x-rated movies, which opens the window of obnoxious amusement for children.

The above scenarios can be used as a looking glass through which the socioeconomic condition of the street and working children of Bangladesh can be harnessed. Considering the poor condition of our children couples of NGOs with collaboration of foreign partners have been introduced in Bangladesh decades ago and their performances are day by day improving. They follow the CRC principle in this regard. Let us now focus the child right perception.

Rights- Based Approach for Supporting Children

The approach says that each has a right to education, the right to health and proper health care, the right to a name and a nationality. Each has the right to participate in matters that affect them, and the right to be treated equally. Even child has the right to be protected from harm.

Depending on these principles the following organizations are successfully involved in Bangladesh:

- Bangladesh Shishu Adhikar Forum (BSAF)
- Aparajeo-Bangladesh
- Appropriate resources for improving street children's Environment (ARISE)
- Ain O Salish Kendro (ASK)
- Street Children Development Program-Plan Bangladesh
- Chinnamul Shishu Kishore Sangshta (CSKS)
- SOS Children
- Shishu Tori Sangshta- STS

The above organizations are actively performing with the membership of different international organizations like Child Hope, Newham Bengali Community Trust, Plan UK, Railway Children, Save the Children Fund UK, World Vision UK etc.The vision , mission and guiding principles and operations of the most successful organization are stated below:

Case Study: Activities of Aparajeo-Bangladesh

AB operates 63 centers at commercial residential, and slum areas of the cities and 26 outreach spots at public places such as railway, bus, boat terminals, markets, perks etc., where the availability of the street and working children is high (Aparajeo-Bangladesh, Annual Report, 2006).Children at the outreach and center-based programs are cared for and protected by the staff team from abandonment, abuse and exploitation[11]. Their specific important services can be broadly categorized as the following:

Education: The non-formal education from a pre school level to class III is offered to the children, aged between 8 to 16 years who are out of school and or never attended school. Aparajeo sponsors potential children to attend from class VII up to the Higher Secondary Certificate (HSC) level.

Recreation: Each center and outreach spot equipped with indoor games. Children are also encouraged to participate in cultural shows and musical teams.

Vocational/ Skill development training: Aparajeo Bangladesh provides various skill development training courses for girls and boys such as, (i) Tailoring and embroidery, (ii) Bi-cycle and rickshaw repairing, (iii) Dying and printing, (iv) Sign board and banner writing, (v) paper bag and paper box making, (vi) Handicrafts and Souvenirs, (vii) candle Making (viii) Cell Phone maintenance & repairing (ix) Operating business machines (Photocopier, Fax, Laminating, Phone, Spiral binding etc.), (x) Flower bouquet designing.

Legal Aid and support: The children who are in contact/conflict with the law as offenders as well as victims are provided with legal aid and support by AB.

Health care and health education: First aid support is provided to all children across their programmes.Preventive, curative and promotive health care services are provided through indoor and outdoor facilities and mobile medical team. Considering high- risk and vulnerability, training on STI/ HIV/ AIDS prevention is provided to all disadvantaged children on regular basis.

Family Re- integration: It is their mandate to re-integrate children to their families after softening their immediate hardship.

Job placement, and/ or self employment: Aparajeo's Social workers team negotiated with employers for apprenticeships and or jobs for the children who graduate from skills/ vocational training on specific trades. During the tenure, the team ensures that the employers understand the situation of disadvantaged children, the job, working environment and duration are non hazardous and the children are paid fair wages.

There is a provision of follow-up for a period of six months to ensure that children who received the AB services are stable and adjusted to their families, workplace and in the society.

Finally analyzing the study from three individual phases we can bring the conclusion and recommendations in the following manner.

Conclusion and Recommendation

Eternal vigilance is the price of our liberty. If it is not ensured it is not far away that we lose our liberty. So, it is our duty to protect the innocent, ill fated children who could be converted into potential human capital and contribute to the future economic liberty and who could also be converted into burden to the country if not properly protected and trained. Observation and findings of this study convinces us that children belong to the community and therefore, it is the responsibility of the community to create a conducive environment to protect the rights of the child. Institution can not only assist the children for a certain period but also disseminate information and knowledge to the wider community so that they become aware about child right and become proactive and can help to reduce their sufferings.

Recommendation of better mobilization of resources, supervision of service providing organizations, and dissemination of CRC through local government levels can be made. NGOs should have the mainstream principle of CRC in their planning. There is a need

to strengthen interministerial coordination in government in case of policy development and implementation. Income generation projects/ micro credit schemes are needed to accompany family reunification and to address rural-urban migration of the children. Social mobilization and community awareness programme should be adopted. Initiation of the successful policies taken by the neighbouring countries should also be practiced through the pilot project and implement thereby.

References

Annual report. (2006). Aparajeo-Bangladesh, Web: www.aparajeo.org

Bangladesh Bureau of Statistics. (1996). Report on Labor Force survey in Bangladesh (1995-1996), p: 4-10, Dhaka :(GOB) Government of the people's Republic of Bangladesh

Hoque, M. (1995), Child domestic work in Dhaka- A study of the exploitative situation. Dhaka

: Save the Children Fund Australia.

Momen, M. A. (1993).Case Studies on Abuse and Exploitation of Children in Domestic Service in Bangladesh, Dhaka Bangladesh Shishu Adhikar Forum.

Rahman, M.(1999). Child Labor in Bangladesh, Journal of Economic Issue,vol: XXXIII,no:4. p:980-985, Dhaka: ILO.

Bangladesh Rural Development Studies: Journal of the Rural Development Academy, Bogra, Bangladesh.

GUIDELINES FOR CONTRIBUTORS

The Academy welcomes original articles based on the field experience/data in the field of Rural Development and Agriculture. The Article sent to this journal should not be under consideration for publication elsewhere at the same time.

1. Four copies of manuscripts typed clearly and double spaced with margin in four sides of the A-4 size paper should be submitted for consideration of the Editorial Board. Articles may contain tabulated material/ information. Diagrams and figures should be used when absolutely necessary and done on black ink.

2. The Journal will not usually publish articles exceeding 8000 words.

3. The article should be preceded by a summary which should be of a maximum length of 200 words.

4. The article can be either in English or in Bangla. However, mixture of the both Bangla and English in the same paper will not normally be acceptable except on special grounds. Again, in English language articles, the author(s) should adhere to either British or American English. No admixture of the two languages in the same article is permitted.

5. The views expressed in the published articles are those of the authors and the Rural Development Academy will not carry any responsibility in this regard.

6. Published materials are regards as intellectual property of both RDA, Bogra, Bangladesh and of the authors.

7. The copyright of all the articles published in the journal is vested in the Rural Development Academy, Bogra, Bangladesh.

8. Numbers from zero to nine should be spelled written. For all other numbers numericals should be used.

9. The name(s) of the author(s) and his/her/their institutional adherence including position should be mentioned in the footnote below the first page of the article using alphabets (a, b, c, etc) or numerical (1, 2, 3, etc).

10. References made in the article text should appear in the proper place with author's surname and date of publication of the work under reference, e.g. (Hossain, 1996; Kundu and Ladha, 1999, Orr et. al., 2002-in case of more than two author's).

11. A list of references should appear at the end of the article containing author's surname, first name, initials; year of publication in bracket, title of publication, place of publication and publisher following alphabetic order.

Example

1 Greenland, D.J. (1997). The Sustainability of Rice Farming, New York: CAB International in association with International Rice Research Institute (IRRI) pp.76-89 (in case of book/monograph article reference).

2 Jabbar, M.A. and Orr, A.W. (2005). Interaction between Weed and Water Management in Boro Rice: A Case of Comilla District in Bangladesh. The Bangladesh Rural Development Studies, XI: 35-53 (in case of Journal article reference).

3. Savithri, P.; Parimal, R. and Nagarajan, R. (1999). Soil and Crop Management Technologies for Enhancing Rice Production under Micronutrient Constraints: V. Balasubramanian, J.K. Ladha and G.L. Denning (Eds.) Resource Management in Rice Systems: Nutrients. Kluwer Academic Publishers, London, UK, pp.121-135 (in case of compendium/proceedings/report article reference).

The published articles may be used as reference materials in other original writings with due acknowledgement and no permission is required in this regard.
Each contributor to the journal will be provided with two copies of the concerned issue free of charge.

The number of authors for one article would not be more than two. Manuscripts- hard copy, soft copy (electronic copy in diskette/CD) along with E-mail and mobile number should be submitted to :

The Executive Editor
The Bangladesh Rural Development Studies
Rural Development Academy (RDA)
Bogra-5842, Bangladesh.
Phone: 88-051-51001, 78602, Extension 117 (O)
Mobile:01715 805462
E-mail: <directorresearch09@gmail.com> or < ranajit_rda@yahoo.com>