Investigation on the Strategy and impact of Artificial Insemination Programme and Performance of Crossbred Cattle in Bangladesh

Final Report

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Title of the Study : Investigation on the Strategy and Impact of Artificial Insemination Programme and Performance of Crossbred Cattle in Bangladesh.

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Abstract

This collaborative study was sponsored by BRAC and executed by the Bangladesh Livestock Research Institute (BLRI), Savar with logistic and other support of the Department of Livestock Services (DLS), GOB to investigate the strategy and effectiveness of the artificial insemination (AI) programme of the DLS and BRAC at different AI centres, sub-centres and points and to evaluate the performance of the crossbred cattle in Bangladesh. Four district AI centres, 12 AI sub-centres, 16 AI points under DLS and 7 AI points under BRAC were selected. Three villages with varying distance from AI centres or sub-centres of each district and two villages under each AI point were selected. Twelve households rearing crossbred cattle from each village were selected to study the performance of crossbred cattle while 25 households were selected from each village to determine their socioeconomic status and the impact of AI.

Findings show the AI bulls supplied to district AI centres did not strictly conform to the national breeding policy. The semen evaluation system was satisfactory at the central AI laboratory but were not so at different district AI laboratories. Semen preservation systems and facilities were also not very scientific. Almost 50% of the study areas were supplied with liquid semen in vials and the supply was often irregular. The mode of transportation was also traditional which included bus, rickshaw, bicycle or even walking. Most of the AI sub-centres could not examine semen due to absence of equipment and facilities such as microscope, electricity or due to some social problem. Milk yields of crossbred cattle varied and was found higher during the rainy season in Jessore, Rangpur and Comilla but were lower in flood prone areas in Tangail. The best performance was found among Local x Friesian cows followed by Local x Sindhi and L x J. The reproductive performances of Friesian cross progenies were found better than others.

Data showed that BRAC cattle rearers had smaller cultivated land, higher level of education, higher involvement of women in livestock rearing and greater awareness about AI services than non-BRAC rearers. Almost 100% of BRAC rearers used AI to cross their cattle. They also took better care of their animals and achieved higher conception rate.

FOREWORD

More than two decades have elapsed since the formulation of the national cattle breeding programme in Bangladesh. But no overall review of the performance of the Artificial Insemination (AI) programme and the effectiveness of the cattle breeding policy has so far been conducted. The performance of the AI progenies reared under different local conditions, the impact of AI programme on milk production and economic benefit to farmers and the existing AI infrastructure facilities need to be evaluated to successfully meet the challenges of the future development of the genetic potentiality of our cattle and the growth of the livestock sector. This study attempts to look into some of these aspects.

The study was initiated and sponsored by BRAC and executed by the Bangladesh Livestock Research institute (BLRI) with logistic and other necessary support from the Department of Livestock Services (DLS) to investigate the effectiveness of the AI programme and determine the performance of the crossbred cattle in Bangladesh.

The findings of the study, I believe, will provide new knowledge to the field and significantly help policy makers to formulate appropriate policies and guidelines for future development of the livestock sector. The results would also help development practitioners in evolving more effective methods in their livestock development efforts.

BRAC deserves sincere thanks and appreciation for initiating this nationally important study and for providing all necessary support to this study. Special thanks are due to Prof. Golam Shahi Alam of the Bangladesh Agricultural University, a part time consultant, for his untiring efforts and guidance given during different phases of the study. The scientists and other staff of the BLRI who worked very hard in conducting the study and preparing this report deserve thanks. Dr. Khan Shahidul Huque, CSO (current charge) deserves special thanks for his efforts given to finalize the project work and the report. I am also grateful to the DLS for its cordial co-operation and the valuable help provided through its nationwide AI centres.

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They are very much grateful to Prof. Golam Shahi Alam, without whose valuable suggestions and active participation as a part time BRAC consultant, the study would not have been possible to be completed.

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The Authors

Table 30 shows the time period (hours) required to bring the cows to AI points after onset of heat is detected in different selected areas (both DLS and BRAC). A highest percentage (91.2%) of farmers in Jessore areas replied that the required time period was 12 hours followed by Tangail (53.5%), Rangpur (44.6%) and Comilla (34.9%) in the DLS area. Farmers of the BRAC areas only 13% in Jessore and 6% in Dhaka reported with in 12 hours period. Shamsuddin, *et.al.*, (1988) found 85% farmers breed their cows with in 18 hours after detection of estrus. The conception rate does not vary if the cows are served within 12 or18 hours after estrus detection.

Table 30: Farmers practice (%) in bringing animal to inseminate after onset of heat in different areas

DLS:

Duration	Tangail	Comilla	Jessore	Rangpur	All areas
12	53.5	34.9	91.2	44.6	56.05
18	42.3	58.2	6.5	49.3	39.07
24	3.8	6.9	2.3	6.1	4078
Others	0.4	-	-	-	0.1
Total	100	100	100	100	100

BRAC:

Duration	Dhaka	Jessore	Tangail	All areas
12	6.0	12.5		6.17
18	94.0	79.2	100.00	91.07
24		8.3		2.76
Others				
Total	100	100	100	100

A negligible per cent of farmers (2.3% to 8.3%) in both the DLS and BRAC areas reported that they report within 24 hours after estrus detection. Number of farmers (42.3% to 58.2%) brought their cows with in 18 hours after estrus detection was more or less similar in DLS areas except those in Jessore (6.5%). However, in BRAC operated areas 100%, 94.0% and 79.2% farmers in Tangail, Dhaka and Jessore areas, respectively brought their cows with in 18 hours after estrus detection.

The average number of services per conception in different selected areas under DLS and BRAC is presented in Table 31. In DLS areas, a highest percentage (40%) of the farmers in both Tangail and Jessore districts reported that their cows required a single service per conception. About 60.3% and 43.6% farmers in Comilla and Rangpur

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Summary

A study was conducted to investigate the strategy and activities of Artificial Insemination (AI) program of the Directorate of Livestock Services (DLS) and the Bangladesh Rural Advancement Committee (BRAC) in different AI centers, sub-centers and points of the country and to know the performances of crossbred cattle at farm levels. The background information on livestock breeding and AI available in different organizations of the government and non-government since 1930 is reviewed and reported here.

To investigate the strategy, problems and prospects of the AI programme and performance of crossbred cattle, a total of 4 district AI centres, 12 AI sub-centres, 16 AI points under the DLS and 7 AI points under the BRAC were selected. Three (3) villages each at a distance of 1,3 or 5 Km from an AI centre or sub-centre of each district and two (2) villages each at a distance of 1 or 3 Km from a AI point were selected. Twelve (12) households on the basis of the availability of crossbred cattle from each village were selected to evaluate the performance of crossbred cattle. Moreover, 25 households from each of the selected villages were selected using a random sampling method to determine the socio-economic status of farmers and the impact of AI. To study the activity of AI , data and/or information on the supply of AI bulls, semen evaluation systems, facilities available for semen preservation, bull management systems, semen transportation systems, containers used for semen transportation, methods of semen collection and evaluation, semen distribution systems, training facilities and skill of a AI personnel were collected and analyzed. It was found from the data that the AI bulls supplied to district AI centres did not coform with the National Breeding Policy. The semen evaluation system at the central AI laboratory (Savar) was found satisfactory but it is not followed strictly in different district AI laboratories. Semen preservation systems and facilities were found very traditional and scientific rules and regulations were not followed strictly. Bull management facilities were found to be very limited and bulls were not scientifically managed. Skills of the AI technicians found to be good but private calls instead of office duties made them busy. Most of the cases semen transportation systems were

depended on bicycles, buses, rickhsaws and even on walking. Almost 50% of the study areas were still supplied with liquid semen in vials. Semen supply in some areas was found to be irregular. However, more than 50% of the total interviewed centres used to distribute semen within one hour after processing. Most of the AI sub-centres could not examine semen due to the absence of equipment facilities (good microscopes), electricity and due to other social problems. Propaganda to create awareness on AI was found to be very limited or negligible.

Milk yields of crossbred cows were studied and variation was found in different seasons and locations. Milk production in the rainy season was found higher in Jessore, Rangpur and Comilla but lower in flood prone areas in Tangail. The Local × Friesian cows performed the best among all the crossbred cows studied and the first 100 days average milk yield was 395 litres followed by LocalxSindhi (336.0 litres) and LxJ (323.0 litres). The average birth weight of L × F and L × Sl × F calves was 19.5±0.5 and 22.8±1.16 kg, respectively and was heavier than the others.

The reproductive performances such as age at puberty, gestation length, postpartum estrus period, 1st service conception rate, non return rate and postpartum changes of live weight were studied. Considering all traits Friesian cross progenies showed a better performance. It was noticed that farmers use to be more careful to their Friesian cross cows.

Data found from the survey on socio-economic status of the farmers showed that the total land, homestead area and area of cultivable land were lower in the BRAC than those in the DLS areas. The percentage of farmers having primary education was much higher in BRAC than those in the DLS areas. Contribution of female in livestock rearing was found higher in BRAC than that of the DLS areas. Farmers in the BRAC areas were found to be much more aware on AI services. Almost 100% farmers were using AI to cross their animals. They used to bring their cows at the AI points in proper time and manage their animals properly towards achieving a higher percentage of conception rate.

Introduction

Cattle being an integral component of the farming system of Bangladesh use to supply draft power for cultivation, crop processing and rural transport, milk and meat for human nutrition and manure for producing fuel energy and enriching soil fertility. The number of milking cows is 3.5 millions and represents 16 percent of the total 22 millions cattle in the country. The national annual milk production is estimated as 1.60 million metric tons and meets only 13.6 percent of the total milk requirement (National Survey Report, 1988-89). The minimum requirement of milk as recommended by the UNO is 250 ml per head per day but the availability in the country is 20 to 30 ml (FAO/UNDP Survey, 1977).

There are no recognized breeds of cattle in Bangladesh and the native cattle is referred to as "deshi cattle" having estimated average milk yield of 225-250 liters per lactation period. The number of improved variety of cattle is estimated as 0.12 million and represents 0.6 percent of the total cattle population. When compared to milking cows, only 1.09 percent found crossbred (National Servey Report, 1988-89). These cattle are concentrated around the urban and in the traditional milk pocket/bathan areas where winter grazing is available.

The Central Cattle Breeding Station (CCBS), Savar started its major breeding programme and AI services in 1973. Emphasis was given to produce high quality crossbred bulls with Friesian, Jersey and Shahiwal breeds. The proven bulls with excellent performances were sent to the district AI centers for services. The local cows are being crossed since three decades with the improved cattle viz. Shahiwal, Hariana, Friesians, Jersey and Red Sindhi. At the moment Department of Livestock Services (DLS), Non-Government Organizations (NGOs) and private entrepreneurs have been promoting genetic improvement of native cattle through artificial insemination (AI) or natural mating using superior or imported bulls. A survey on Dhaka Metropolitan City areas showed that the milk yield of the crossbred cows varied from 5 to 25 liters per day per cow (BARC/DLS survey, 1993).

The Government, recently, has taken a policy to reduce the amount of imported powder milk gradually in order to encourage dairy entrepreneurs and rural dairying for increasing local milk production and other dairy products. As a result, large number of entrepreneurs are encouraged to rear crossbred cattle commercially. However, the average milk production of different categories of cross-bred cattle in different farms/households at different regions of Bangladesh has not been well documented or quantified. In addition, the reproductive performances (age and weight at puberty/first service, sources of semen/bull, number of services per conception, abortion/reproductive failure, number of calves born, calving interval etc.), heredity, management and nutrition of these animals need to be investigated. Moreover, it is important to document the performances and impact of AI programme and its services at farm levels.

The present research programme was executed by Bangladesh Livestock Research Institute (BLRI) to investigate the strategy and performances of Artificial Insemination (AI) programme at different AI centers, sub-centers and points of the country and to know the performances of crossbred cattle at farm management conditions with logistic and other necessary supports from the DLS.

Objectives of the study :

I) To review the strategy of the Government AI programme.

ii) To study and analyse the performance of AI activities at different centres, sub-centres and points.

iii) To evaluate the performance of crossbred cattle at farmer's level under different management conditions throughout the country.

iv) To study the impact of AI services at farmers level.

Methodology

1. Location and Climate

Survey and investigation were carried out on crossbred animals reared by the selected households of each thana under 4 selected districts (Figure 1). Data were compiled and analysed in the AI laboratory of BLRI, Savar, Dhaka. The average range of ambient temperature (minimum to maximum) in different seasons of a year was 23.2°c to 36.3°c in the summer (March-June), 25.3°c to 32.5°c in the rainy (July-October) and 9°c to 22°c in the winter season (Weather report of the Metrological Dept. of the government).

2. Selection of AI centres, Sub-centres and Points

Four districts namely Tangail, Rangpur, Jessore and Comilla under Dhaka, Rajshahi, Khulna and Chittagong divisions, respectively were selected as study areas. From each district one AI centre, three AI sub-centres and one AI point were selected with the help of District Livestock Officer (DLO), Assistant Director (Animal Production) and Thana Livestock Officer (TLO). In addition, seven BRAC linked AI points were selected with the help of the area managers of the BRAC Rural Development Programme (RDP).

To collect the background information of AI activities, the concerned personnels of the DLS, Bangladesh Agricultural University, Mymensingh, Bangladesh Milk Producers Co-operative Union Limited (Milk Vita) and some NGOs were interviewed. Information on collection, processing, methods of quality control, preservation procedure and distribution of semen through AI extension services were also collected. Data were compiled and analysed using SPSS statistical computer package.

3. Household selection

Three villages each at a distance of 1, 3 or 5 km from the selected AI centre/sub-centre of each district and two villages each at a distance of 1 or 3 km from an AI point were selected. A list of the selected villages under each district AI centre, sub-centre and points is shown in Annexure-A.

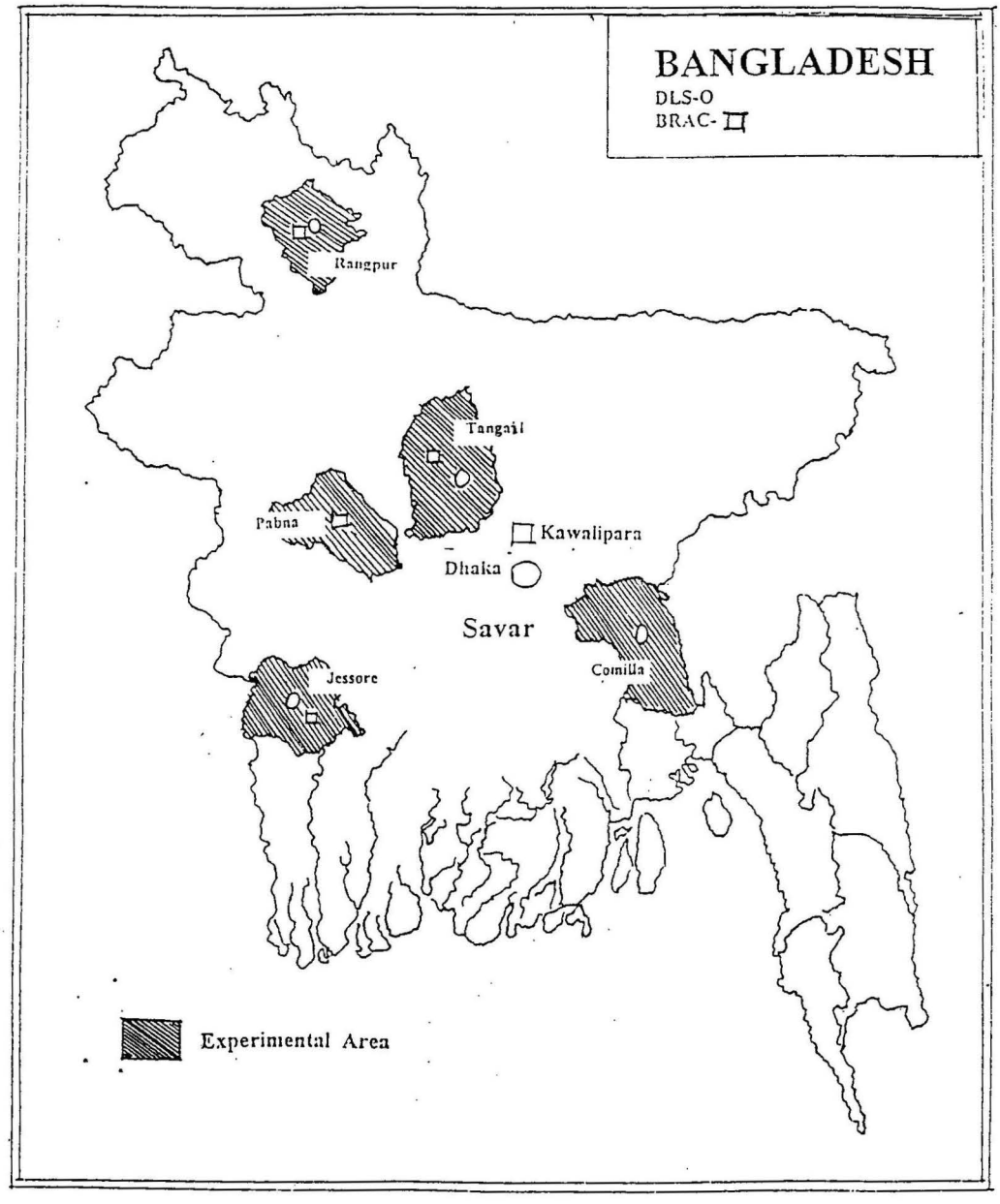

Figure 1 : Map of Bangladesh indicating study area

The total number of selected district AI centres, sub-centres, points, villages and households are shown below :

District AI centres	:	4
AI sub-centres(4x3)	:	12
AI points (4x4)	:	16
BRAC AI points	:	7
Villages under each district AI centre (4x3)	:	12
Villages under each AI sub-centre (12x3)	:	36
Villages under each AI points (16x2)	:	32
Villages under BRAC AI point (7x2)	:	14
Total no. of selected villages	:	94
Total no. of selected households (94 × 12)	:	1128

Eleven hundreds and twenty eight (1128) households were selected on the basis of the availability of crossbred cattle, i.e., the farmers reared crossbred cattle were selected. To know the productive and reproductive performances of crossbred progenies, a total number of 1622 animals were monitored and data were recorded in respect to their birth weight, milk yield, age at puberty, post-partum estrous period, first service conception rate and post-partum live weight changes. They were analysed statistically to determine the difference in their performances in different management conditions.

Twenty five households were selected from each of the selected villages to know the socio-economic conditions of farmers use to rear cattle. Selection was done on the basis of random sampling procedure and a total of 2350 households were selected. The selected households including the households under BRAC cooperated AI points were surveyed with a standard questionnaire. The collected data were compiled and analysed.

4. Methods used for different components of the study

A. *A review of the strategy of The Govt. AI programme*

Under this study, available background information on breeding policy and its implementation strategies, bull production programme of the CCBS, maintenance and use of bulls in the AI Extension programme and so far achievements of the AI programme conducted by DLS was collected from the concerned personnels of the respective

organizations. Information were collected through personal contact, reviewing literatures, reports, documents, policy papers etc. available in the library and in government and non government offices.

B. Analysis of the performances of AI activities at different centres, sub-centres and points

Location : A survey was conducted through interviewing the concerned officials in the Central Cattle Breeding Station (CCBS), DLS HQ, District Livestock Offices, Thana Livestock Offices, District AI laboratories, Veterinary Hospitals and BRAC RDP offices in the selected districts. A questionnaire entitled "Bull selection for AI and other informations, Form-2" was used for this purpose. Collected data were analysed using SPSS computer statistical program.

Selection of AI centres, Sub-centres and Points : Four districts AI centres namely, Tangail, Rangpur, Jessore and Comilla under which 12 AI sub-centres situated at thana head quarters and 16 AI points under the management of DLS were selected for collecting information on the performance of AI activities. Information collected is shown below.

- Breeds of AI bull used at the AI centres.
- Semen evaluation systems.
- Constituents of diluents.
- Physical facilities for semen preservation.
- Qualification of AI technicians.
- Post storage semen evaluation.
- Housing of bulls.
- Exercise of bulls.
- Vaccination of bulls.
- Feeding of bulls.
- Vehicles used for semen transportation.
- Containers used for semen transportation.
- Semen collection and preparation.
- Semen distribution time/intervals.
- Training facilities for AI personnels.
- Efficiency of Officers and Staffs involved in AI activities.
- Qualitative test of semen at the field level.
- Mode of publicity about AI.

C. *Evaluation of the performance of crossbred cattle at farmers level under different management condition*

Location : This study was carried out at the farmers condition in different districts. Data on productive and reproductive parameters were collected and analysed in the AI laboratory of BLRI.

Household and animal selection : A total of 1128 households who had crossbred cattle were selected in this program.

Data collection : Data on different productive (birth weight of progenies, milk yield etc.) and reproductive performances (age at puberty, gestation length, post partum estrus period, 1st service conception rate and post partum changes of live weight in relation to milk yield) were collected. This study was conducted during the 9 months period of the project.

The same statistical package as stated above was used for analyzing the data.

D. *Determination of the impact of AI services on farmers condition*

Location : A survey was conducted in the selected 25 households of each selected village in the 4 selected districts. Collected data were analysed in the AI laboratory of BLRI.

Survey : A total of 2350 households were surveyed through a standard questionnaire under the study. Questionnaire was prepared to address the socio-economic status of the selected farmers.

Data analysis : Data were collected and analysed using the SPSS statistical computer program.

Results and Discussion

A. A review of the strategy of Govt. AI programme

During the major part of the British rule, almost all cattle population in the then undivided Bengal, particularly in the East Bengal, was non-descriptive type. Over 90% of the cattle was without any definite characteristic and was indigenous in nature. The productivity of these animals was low due to their poor genetic make-up, disease incidence, absence of organized feeding and management systems. The then Viceroy of India Lord Linlithgow, realized the potentiality of cattle development in this part of India and took initiatives and created a new era of cattle development. In 1937, the Lord collected about 1000 pure Hariana bulls from the northern India and distributed them to all districts of the then undivided Bengal except Sylhet and Chittagong regions for the purpose of up-grading local cattle through natural services. The bulls were maintained by the farmers who were paid Tk. 15 per month as an allowance for feeding and management of a bull. Arrangements were made by the Govt. for castration of local bulls and for distribution of seeds or seedlings of leguminous fodder like khesari, matikalai, cowpea etc. at a subsidised rate to farmers. The genetic quality responsible for increasing production of milk or draft power of the local cattle mated with the improved bulls were thought to have improved to some extent. The name of the areas where the bulls were distributed is given below.

a) Rajshahi (Godagari area).
b) Pabna (Shahjadpur, Bera, Pabna Sadar, Sathi and Faridpur).
c) Dhaka (Manikganj, Munshiganj, Narshingdi).
d) Faridpur (Madaripur, Faridpur Sadar, Gopalganj).
e) Comilla (Brahmanbaria)
f) Mymensingh (Bajitpur, Austagram, Kuliarchar).

Before starting the Hariana breeding programme, two dairy farms were established in Dhaka and Sylhet for production and distribution of Hariana bulls for animal breeding research and for milk supply to the cities.

The artificial insemination programme conducted during the later part of the 50th decade with the following objectives:

a) Better utilization of superior proven bulls.

b) Control of reproductive diseases and

c) Faster up gradation of local cattle

In 1960, Savar Dairy Farm was established (Ahmed and Islam, 1987) with the objectives

a) to conduct fundamental research on livestock breeding problems and to evolve cattle breeds suitable for the country.

b) to conduct fundamental research on animal nutrition problems and to select or evolve high yielding varieties of fodder suitable for cultivation.

c) to supply milk and milk products to Dhaka city.

A programme on up gradation of local cattle was undertaken by DLS through importing exotic breeds like Red Sindhi, Sahiwal and Tharparker from the then West Pakistan. But the systematic breeding work could not be done until 1967 due to the lack of adequate infrastructure facilities and trained manpower. At that time the performance of progenies of crossbred bulls (Holstein or Jersey crosses with unknown pedigree) was evaluated and Jersey crosses were found better than Holstein crosses (Islam and Ahmed, 1987). In 1969, a bilateral programme with the then Federal Republic of Germany (FRG) was undertaken to develop the infrastructural facilities at Savar Dairy Farm.

The then Government undertook the AI programme to improve the local cattle and initially established five district AI centres in Dhaka, Rangpur, Rajshahi, Chittagong and Jessore in 1965. Establishment of AI centres in all the old 19 districts was completed in 1970. In 1973, 125 pure bred Friesian and Jersey bulls from Australia were found as gift "for those who have less". A new dimension in the field of animal breeding was created

with those exotic breeding bulls despite of having problems in their adaptation, acclimatization, disease prevention, nutrition and management. Major thrust of the work was given to produce high quality crossbred bulls with Friesian, Jersey and Sahiwal breeds. Intensive study on all important traits, i.e., weight at birth, age at puberty, age at first calving, average milk production, average days of calving interval, average lactational milk yield, daily weight gain, disease resistance and parasitic infestation was conducted. An average performance of pure and crossbreds bulls were reported (Ahmed and Islam, 1987) which indicated that F1 crossbred (Local × Friesian) progenies performed better. On the basis of the previous findings, a breeding policy was formulated in 1976.

The breeding policy included the recommendations

i) to breed females of the urban, semi-urban and milk-pocket areas with the 1/2F - 1/2Sl bulls.

ii) to breed females of the rural areas with 1/2F - 1/2L bulls.

In 1982, the bilateral programme with Federal Republic of Germany was ended and importation of Frozen semen of Friesian bulls from West Germany, New Zealand and Kenya was started in 1983 which were used at the Central Cattle Breeding Station (CCBS), Savar (Bhuyan, 1997). Until 1997, the Breeding Policy was in operation without any fruitful results. The present government has been trying to formulate a new breeding policy for the development of cattle population of the country.

B. Analysis of the performances of AI activities at different centres sub-centres and points

Different type of available breeds, methods of semen evaluation, the composition of diluents, mean percentages of motile spermatozoa and the mode of semen distribution at different AI centres/sub-centres and points are presented in Table 1. It was observed that the pattern of availability of crossbred cattle in different areas of the country was more or less similar except that in Rangpur district where Friesian and Shahiwal crosses were more available than the others. The number of dosages of semen supplied to

Rangpur could be one of the factors for this pattern. Semen evaluation methods were similar in all the study areas except that in Tangail district where morphological evaluation of sperms was not conducted. The morphological test of sperm is essential to conduct and necessary arrangements need to be made to conduct the test before using semen. The composition of semen diluents was similar in all the study areas. The mean percentage of the motile spermatozoa was relatively higher in Tangail and Rangpur areas (>70%) compared to Comilla (>60%) and Jessore (>60%). The overall motility percentage of spermatozoa was at the desired level and arrangements for close supervision to keep the trend continue need to be made. The liquid semen in vials is being distributed in all the study areas.

Table 1: Breeds, semen evaluation method, constituent of diluent, motility and distribution of semen at different areas

Parameters	Areas			
	Jessore	Comilla	Tangail	Rangpur
Crossbred	SL × F SL × F L × F L × F	SL × F × L SL × F L × F S × L× F SL × F LH × F × S	SL × F S × SL× F L × F L × F L × F	S × L× F F SL S × F
Semen evaluation	Morphological & Microscopic test	Morphological & Microscopic test	Morphological test	Morphological & Microscopic test
Constituents of diluent	egg-yolk, sodium citrate, distil. H_2O Penicillin & Streptomycin	egg-yolk, sodium citrate, distil. H_2O Penicillin & Streptomycin	egg-yolk, sodium citrate, distil. H_2O Penicillin & Streptomycin	egg-yolk, sodium citrate, distil. H_2O Penicillin & Streptomycin
Motility	60-75% (75%) 60-70% (25%)	70-80% (50%) 60-75% (50%0	70-80% (100%)	70-80% (100%)
Semen distribution	Liquid	Liquid	Liquid	Liquid

Table 2 shows some physical facilities available for semen preservation and training facilities for AI technicians/field assistants. It was observed that in all the project areas the condition of the refrigerator was good (100%) except that in Comilla areas (80%). The differences in refrigeration facilities among the areas are not high enough to affect the cooling system. However, the refrigeration problems in Comilla area need to be

developed. The condition of liquid nitrogen container was good (100%) in all the areas. However, the laboratory facilities for semen processing were not sufficient at Jessore and Rangpur areas as compared to Comilla and Tangail areas. There were no officers' or technicians' training facilities at Tangail and Rangpur areas. Semen storage facilities were available in all the study area. The storage period of semen was 1 to 3 days in Jessore and Comilla and 1 to 2 days in Tangail and Rangpur areas. However, more storage facilities need to be provided to the project areas.

Table 2: Conditions of refrigerator & Liquid N_2 containers, laboratory facility for semen processing and storage, storage period and training facility at different areas

Parameters	Areas			
	Jessore	Comilla	Tangail	Rangpur
Condition of refrigerator	Good-(100%)	Good-(80%) Not good-(20%)	Good-(100%)	Good-(100%)
Condition of Liquid N_2 container	Good-(100%)	Good-(100%)	Good-(100%)	Good-(100%)
Lab. facility for Semen processing	Not sufficient (100%)	Sufficient-(60%) Not sufficient-(40%)	Sufficient-(100%)	Not sufficient-(100%)
Training facility	Yes-(55.6%) No-(44.4%)	Yes-(100%)	No-(100%)	No-(100%)
Semen storage facility	Yes-(100%)	Yes-(100%)	Yes-(100%)	Yes-(100%)
Storage period	1 day-(37.5%) 2 day-(50%) 3 day-(12.5%)	1 day-(60%) 2 day-(20%) 3 day-(20%)	1 day-(100%)	2 days-(100%)

The qualifications, job experiences and performances of AI technicians and distance of AI centres from district head quarters are presented in Table 3. It was found that all the AI technicians working in the study areas had educational qualifications up to higher secondary certificate (HSC) level. The experience of AI technicians varied between the study areas and ranged from 7 to 27 years depending on their joing date of the post. The number of AI performed by an AI technician again varied between the areas. No semen is evaluated for determining sperm viability after storage except Tangail district where the semen is evaluated after storing for a requisite period of time. This practice of Tangail needs to be adopted by the technicians of the other areas. The

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inseminators of Jessore, Comilla and Rangpur areas deposit semen in the uterus and those of Tangail area deposit both in the uterus and the cervix.

Table 4 shows the housing pattern, exercise periods, vaccination facilities and feed intake of breeding bulls at different areas. In all the areas, the bull sheds were semi-paved and the space was within the range of 200 to 300 sq.m in Jessore, Comilla and Rangpur. However, in Tangail, it was 1280 sq.m. The reasons for this difference were not known.

Table 3: Qualification and experience of AI technician, distance of AI center, evaluation of semen after storage and deposition of semen at different areas of reproductive tracts

Parameters	Areas			
	Jessore	Comilla	Tangail	Rangpur
Qualification of AI Technician	SSC-(28.6%) HSC-(71.4%)	SSC-(20%) HSC-(80%)	HSC-(100%)	SSC-(28.6%) HSC-(71.4%)
Experience of AI Technician (years)	7-18	6-29	10-19	14-27
No. of AI performed by persons/month	135-375	200-450	120-200	100-500
Distance of AI sub-center from dist. AI centres	6-125 km	5-125 km	5-60 km	8-100 km
Microscopic exam. of semen after storage	No-(100%)	N0-(100%)	Yes-(70%) No-(20%)	N0-(100%)
Deposition of semen during AI	Uterus-(100%)	Uterus-(100%)	Uterus-(37.5%) Cervix-(62.5%)	Uterus-(100%)

The bull houses of Jessore was south faced while that of Comilla, Rangpur & Tangail were South, West, East faced, respectively. These differences could be due to the lack of coordination or attention of the concerned authority in DLS during the planning and construction of sheds. Cleaning time of sheds at different areas was similar except that of Rangpur where cleaning was done in the noon in additional to morning and evening cleanings. The exercise period of the semen collecting bull was 1, 2 and 4 to 6

hours, respectively in Jessore, Tangail and Rangpur. However, there was no bull exercising facility at Comilla. There might be a fenced circle for walking around. The breeding bulls were vaccinated against Foot and Mouth Disease (FMD), Haemorhegic Septicemia (HS), Black Quarter (BQ) and Anthrax (AN) at different areas except Jessore where vaccines for AN was not used. The reasons were unknown. The average feed intake of the bull was 18, 29, 25 and 25 kg/head/day (concentrate feed + green grasses) in Jessore, Comilla, Tangail and Rangpur areas, respectively. The difference could be due to the size and live weight of the bull and availability of feed.

Table 4: Housing pattern, available exercise, vaccination facility and amount of feed supplied to the breeding bull at different areas

Parameters		Areas			
		Jessore	Comilla	Tangail	Rangpur
Housing	Type	Semi pacca	Semi pacca	Semi pacca	Semi pacca
	Measurement	203.5±0 sq. m	210±0 sq. m	1280±0 sq. m	300±0 sq. m
	Front view	South	West	East	East
	Cleaning time	Morning & Evening	Morning & Evening	Morning & Evening	Morning, Noon & Evening
Exercise		1 hour	No facility	2 hour	4-6 hour
Vaccination		FMD, H.H, BQ	FMD, H.H, BQ, AN	FMD, H.H, BQ, AN	FMD, H.H, BQ, AN
Amount of total feed supplied to the bull (Conc. + Roughage)/ day / animal)		18.00±2.0 kg	29.40±2.69 kg	25.00±0 kg	25.00±0 kg

The types of bull houses, exercise, vaccination and feeding are very important for a breeding bull to produce good quality semen. An ideal bull shed should be south faced. Exercise of bull should be performed regularly in the morning for at least one hour, routine vaccination should be done for sound health of bulls and feed should be supplied as per the requirement of bulls. Result of the present study revealed that bulls at different AI centres were not maintained properly according to their requirement.

Table 5 represents the kinds of vehicles used for semen transportation at different districts. In Comilla areas bus, train, boat, van and rickshaws were the major means of transportation whereas in Rangpur areas train and bus were the major vehicles for semen transportation. Motorcycle, tri-wheeler, bus, train and bi-cycle were the sources of transport for carrying semen at Jessore area. On the otherhand, rickshaw, bus, tri-wheeler and walking were the modes of semen transportation at Tangail area. Absence of official vehicles was the main reason for adopting available private transport facilities. However, faster semen transportation may help keeping semen quality good and insemination at a proper time. Motor vehicles may be suggested for transportation of semen.

Table 5: Kinds of vehicles (%) used for semen transportation at different districts

Kinds of vehicles	Comilla	Rangpur	Jessore	Tangail	Total (all areas)
1. Train	20	50	16.67	-	21.67
2. Boat	16	-	-	-	4
3. Bi-cycle	4	-	11.11	-	3.78
4. Walking	4	-	-	9.09	3.27
5. Rickshaw	8	-	-	45.45	13.36
6. Van	16	-	-	-	4
7. Motor-bike	4	-	27.78	-	7.94
8. Tri-wheeler	-	-	22.22	9.09	7.82
9. Public Bus	28	50	22.22	36.37	34.14
Total	100	100	100	100	100

Different kinds of semen containers used for semen transportation at different districts are shown in Table 6. It was observed that mainly Thermoflasks are being used in all the areas for carrying semen. However, at Comilla and Tangail districts liquid nitrogen containers are also used for carrying semen.

Table 7 shows the methods of semen collection, collection intervals and volume (ml) of semen per ejaculation at different AI centres, sub-centres and points. The collection interval varied from 3 to 7 days in different areas. The Artificial Vagina method is being followed for collection of semen at all the areas and the average volume (ml) of semen

Table 6: Different kinds of semen containers (%) used for semen transportation at different districts

Kinds of container	Comilla	Rangpur	Jessore	Tangail	Total (irrespective of areas)
Flask	57.14	100	100	83.33	85.11
Nitrogen container	42.86	-	-	16.67	14.89
Total	100	100	100	100	100

per ejaculation per bull ranged from 7 to 9 ml. Standard semen collection interval is twice daily and 2 days in a week (Hafez, 1993). On the otherhand, the ejaculated volume and sperm counts can be increased by restraint and sexual stimulation to the bull (Cited by Bhuiyan 1998).

Table 7: Methods used in semen collection, collection intervals and volume (ml) of semen per ejaculation in different district AI center, sub-centers and AI points

	Jessore	Tangail	Comilla	Rangpur	Total (irrespective of areas)
AV Method (%)	100	100	100	-	100
Collection interval (days)	100% (4-5)	100% (7)	100% (3)	100% (7)	100
Volume (ml) (Mean ± S.E)	7.78±0.296	7.5±0.645	7.8 ±0.984	9.0±0	8.02

The conditions of the supplied semen are shown in Table 8. It was observed that 57.14% of the semen was supplied in vials and 42.86% was supplied in straws in Tangail. In Rangpur, 100% semen was supplied in vials whereas in Jessore 75% semen was supplied in vials and the rest 25% as in straws. However, in Comilla 66.67% semen was transported in vials and 33.33% in straws. The differences in the use of materials (vials/straws) for semen transportation may be due to their availability in the AI Centres.

Table 8: Conditions of supplied semen in different districts

Semen condition	Tangail	Rangpur	Jessore	Comilla	All areas
Straw	42.86	-	25	33.33	25.30
Vail	57.14	100	75	66.67	74.70
Total	100	100	100	100	100

However, the preparation of semen in straws instead of vials showed a better conception rate (cited by Bhuiyan, 1998).

Semen distribution time at different districts is shown in Table 9. It appears that in 50 to 89% cases semen was distributed in different areas within 1 hour of processing after collection. At Rangpur semen was distributed within 6 hours after collection in 20% cases.

However, in 50% cases in Tangail and 11.12% cases in Jossore semen distribution after collection and processing found to be occured after 24 hours. It was noted that in Comilla semen supply was very much irregular in 29% cases. The local administration of the respective offices was responsible for the irregular and inconsistent supply of semen.

Table 9: Semen distribution time after collection of semen in different districts

Time after collection	Tangail	Rangpur	Jessore	Comilla	All areas
As soon as possible (within 1 hour) (%)	50	80	88.88	71	72.47
½ day (%)	-	20	-	-	5
1 day (%)	50	-	11.12	-	15.28
Irregular (%)	-	-	-	29	7.25
Total	100	100	100	100	100

Table 10 shows semen evaluation status after arrival at sub-centers/points or before insemination in different areas. It was noted that in Tangail semen was evaluated in 91% cases after arrival. This was the highest figures of all the four areas. The lowest found in Jessore (37.5%). In Rangpur semen was not evaluated after arrival. The reasons were not known but it would be worth while to evaluate semen after arrival. It was also observed

that in 40% and 72% cases in Comilla and Tangail, respectively semen was evaluated before insemination. However, the practice was absent in Jessore and Rangpur. Transportation of liquid semen from the district AI centre to the sub-centre and points resulted in a significant deterioration in semen quality and subsequent fertility (Shamsuddin, et.al., 1988). It is obvious that every batch of semen needs to be evaluated by the Scientific Officer (AI) before insemination to ensure viability of spermatozoa and subsequent conception of cows.

Table 11 shows on the training facilities available for the concerned AI personnels i.e., Assistant Directors (AP), Scientific Officer (AI lab.), Field Assistants (AI), Laboratory Technicians of different district AI centres and sub-centres. It was observed that in Comilla area 17% AI personnels were trained on storage and use of semen whereas none of the AI personnels of Jessore, Tangail and Rangpur got this training. In all the areas, over 43% of

Table 10: Evaluation of semen after arrival at different sub-centers/points and before insemination in different districts

Parameters	Comilla	Jessore	Tangail	Rangpur	All areas
At sub-center/points :					
Evaluated (%)	60	37.5	90.90	-	47.1
Not evaluated (%)	40	62.5	9.10	100	52.9
Total	100	100	100	100	100
Before insemination					
Evaluated (%)	40	-	72.72		28.18
Not evaluated (%)	60	100	27.28	100	71.82
Total	100	100	100	100	100

AI personnels got training on livestock related activities. In Tangail no AI personnel got training. On the other hand, about 17% of the total AI personnels of Comilla got training on storage and use of semen, maintenance of liquid nitrogen containers, animal diseases, frozen semen, nutrition and forage production and different AI related courses. However, AI personnels of Rongpur got training on AI related courses only. It is evident from these

information that the AI personnels of different areas are not getting proper training on AI related activities. This inconsistency in training should be solved through proper planning and organizing training programmes.

The efficiency evaluation of officers and staffs involved in AI activities are shown in Table 12. It was found that 10% officers and other staffs in Comilla area could diagnos the pregnancy whereas only 5.26% and 4.91% officers and staffs of Jessore and Rangpur areas could do the same. There was no record at Tangail area in this regard. It was observed that efficiency of officers and staffs were evaluated on the basis of their achievments in reaching their targets, data management, bull maintenance, AI index, annual conception rate, pregnancy, progeny performance, and ability on centre supervision. In Comilla area, only about 20% of the total target was achieved in different AI centres. In Tangail area, only 18.75% of the officers and staffs were accounted to be efficient in annual achieving their targets. In Jessore areas, a similar trend was observed. In Rangpur area, a highest achievement was obtained in pregnancy, maintenance of progeny

Table 11: Training materials available for the concerned AI personnel in different AI centres and sub-centres.nd sub-centres

Training Areas	Jessore	Tangail	Comilla	Rangpur	All areas
Storage and use of semen	-	-	17.65	-	4.91
Maintenance of liquid Nitrogen container (%)	-	-	17.65	-	4.41
Animal diseases (%)	15	15	17.65	-	11.91
Frozen semen (%)	20	-	11.76	-	7.94
Veterinary Training Institute (VTI)	-	20	11.76	-	7.94
Nutrition and forage production (%)	10	25	5.88	-	10.22
Different AI related courses	30	25	17.65	100	43.16
Laboratory use and evaluation of semen	5	-	-	-	1.25
Other Livestock related activities	20	15	-	-	8.75
Total	100	100	100	100	100

performance and supervision of centres, progeny collection and proper communication at the field level. The result indicates that there is no uniform skillness in officers and staffs

regarding their efficiency in AI activities at different areas. A methodical per rectal examination of the genital can identify pregnant cows or heifers with 100% accuracy (Shamsuddin, *et.al.*, 1988). This problem might be solved by posting trained and experienced livestock officers for a maximum of 10 AI centres to monitor the field level AI activities.

Table 13 presents the data on the evaluation of the supplied semen at different AI centres. It was noted that in 12.5% cases sperm was evaluated by motility test in Comilla. In Tangail, Jessore and Rangpur, sperm motility was tested in 38.47%. 12.5% and 12.5% cases, respectively. The supplied semen was maintained by temperature control in 30.76%, 12.5% and 12.5% cases in Tangail, Jessore and Rangpur district but no such control measures are practiced in Comilla areas. Microscopic test of the supplied semen was done at the highest number of cases (75%) in Rangpur area. In Comilla, Tangail and Jessore areas, quality of the supplied semen was evaluated by pregnancy diagnosis within 3 months period of insemination in 25%, 15.38% and 25% cases, respectively. However, these practices are not being carried out at Rangpur area.

Table 12:Efficiency Evaluation criteria of Officers and AI Technicians involved in AI activities

Perameters	Comilla	Tangail	Jessore	Rangpur	All areas
Cows conceived or not (%)	10	-	5.26	4.91	3.81
Semen supply and preservation (%)	-	2.5	5.26	4.41	1.94
Changes on conception rate (%)	-	6.25	-	11.91	1.56
Record keeping & Reporting on time (%)	10	20	5.26	7.94	8.81
Maintenance of breeding bull & AI index (%)	10	15	5.26	7.94	9.46
Office management	-	-	5.26	10.22	1.31
Pregnancy, Progeny performance register maintenance and centre Supervision (%)	20	6.25	52.66	43.16	44.72
AI activities (%)	-	6.25	-	-	1.56
Progeny collection (%)	10	12.5	-	1.25	5.62
Proper communication at field levels (%)	20	6.25	-	8.75	6.56
Quality control of semen before use (%)	-	6.25	5.26	-	2.88
Annual target achievement (%)	20	18.75	15.78	-	13.63
Total	100	100	100	100	100

Table 13: Evaluation of supplied semen at different AI Centers.

Parameters	Comilla	Tangail	Jessore	Rangpur	All areas
By Sperm motility Test (%)	12.5	38.47	12.5	12.5	18.99
By Temperature control (%)	-	30.76	12.5	12.5	13.94
By Microscopic evaluation of Semen (%)	37.5	15.39	33.33	75	40.43
By Pregnancy diagnosis at 3 *months period*	25	15.38	25	-	16.34
Using only frozen semen (%)	25	-	16.67	-	10.41
Total	100	100	100	100	100

Table 14 shows different learning aids used for artificial insemination. It was observed that in Tangail areas, posters, slides, leaflets, bulletins, training, meeting and motivation by Ansar and VDP were used for artificial insemination. On the other hand, in Comilla area, per cent of poster publication was the highest (44.49%) for public motivation towards AI. In Jessore area, 44.41%, 3%, 33%, 15% and 4.56% publicity were done by posters, leaflets, personal contacts, extension works and meeting, respectively. Whereas, in 75%, 20% and 5% cases personal contact, extension works and meeting were used as aids for publicity on AI in Rangpur.

Table 14: Mode of pulicity (%) about artificial insemination

Media	Tangail	Comilla	Jessore	Rangpur	All areas
Radio	4.54	-	-	-	1.13
Television	4.54	-	-	-	1.13
Poster	27.27	44.44	44.44	-	29.03
Slide	4.54	-	-	-	1.13
Leaflet	27.27	11.11	3	-	10.34
Bulletin	4.54	-	-	-	1.13
Personal contact	-	16.67	33	75	31.16
Training	13.63	11.11	-	-	6.18
Motivation by Extension work	-	11.11	15	20	11.52
Meeting	9.09	5.55	4.56	5	6.05
Motivation by Ansar & VDP	4.54	-	-	-	1.13
Total	100	100	100	100	100

C. Evaluation of performance of crossbred cattle at farm management conditions

Different productive traits i.e., daily milk yield, milk yield in 100 days, birth weights and reproductive traits, i.e., age at puberty, gestation length, post partum estrus period, first service conception rate and post partum live weight in crossbred cows at farmers level were studied and presented below.

Milk yield:

The seasonal milk production of different crossbred cows at different areas is shown in Table 15. The results show that the average daily milk yield of L×F crossbred cows was the highest in the rainy season (4.39 ± 0.31) whereas L×J cows produced the highest average daily milk both in the summer (3.19± 541) and in the rainy season (3.15+0.331). The results on the average daily milk yield of different crossbred cows show that the L×F crossbred progenies were found to be the best. This result is in consistent with the findings of Majid, et al, 1997, Ahmed, 1985, Bondoc, et al, 1989 and Bahar, 1996.

Table 15: Mean±SE of seasonal milk yield of crossbred progenies in different selected areas

Breeds	Per day milk yield (litre)			
	Seasons			
	Winter	Summer	Rainy	All seasons
L×F	3.49±0.34 (190)	3.30±0.31 (141)	4.39±0.31 (148)	3.72±32 (479)
L×SL	2.99±0.41 (73)	2.27±0.40 (33)	3.60±0.48 (41)	2.95±.43 (147)
L×J	2.41±0.24 (23)	3.19±54 (18)	3.15±33 (16)	2.91±0.37 (57)

Figures in parenthesis indicate the total no. of observations, Note : L= local, F = Friesian, J = Jersey, Sl = Sahiwal

Daily and 100 days milk yield :

Average milk yield in the first 100 days of lactation and daily milk yield of crossbred progenies of different genetic groups in the selected project areas are presented in Table 16. The highest milk yield in 100 days (480±15.23 kg) was given by the L×F crossbred

Table 16: Mean±SE of 100 days and Av. per day milk yield of different genetic groups at different areas

Dist	Periods	Breeds				
		L×F	L×S	L×SL	L×J	L
Comilla	100 days	392.81±11.4(66)	380.5±20.83(23)	-	370.8±30.8(16)	-
	Daily	3.11±0.11(66)	3.2±0.22(24)	-	3.08±0.3(18)	-
Jessore	100 days	374.9±26.7(80)	308.28±46.09(7)	259.9±31.8(15)	336.38±46.9(7)	261.6±19.2(16)
	Daily	3.85±0.224(85)	2.67±0.48(7)	2.42±0.33(18)	2.71±0.43(11)	2.15±0.15(24)
Tangail	100 days	332.06±49.2(14)	318.4±34.41(22)	-	2.63±0(1)	275.8±17.4(24)
	Daily	3.12±0.29(18)	3.19±0.33(24)	-	2.39±0(1)	2.35±0.105(31)
Rangpur	100 days	480.4±15.2(58)	-	411.64±21.27(14)	-	-
	Daily	4.60±0.12(19)	-	3.95±0.2(19)	-	-
All areas	100 days	395.03±025.6(218)	335.74±33.8(52)	335.78±26.5(29)	323.34±25(24)	268.68±18.3(40)
	Daily	3.67±0.46(180)	3.02±0.34(55)	3.186±0.53	2.72±0.36(30)	2.25±0.13(55)

cows of Rangpur district followed by that of the Comilla area. The results also revealed that L×F crossbred cows yielded the highest milk among all the crossbreds. This result is in close agreement with the observation of Majid *et al,* 1995, Bondoc, *et al* 1989 and Tibbo *et al,* 1994.

Birth weight :

Birth weight of calves is an important trait to be considered while choosing exotic breeds for breeding purpose. In the present study, birth weight of crossbred calves was recorded. It was observed that L×F crossbred calves of Rangpur district had the highest birth weight (23.92±0.2 kg) and LxSl of Jessore district had the lowest (13.25±0.8 kg). In addition, to breed differences, variations in environmental factors in different districts may have affected birth weights of calves.

Table 17: Mean±SE of birth weight of calves of different crossbred cows at different areas

Breeds	Birth Weight				
	Rangpur	Jessore	Comilla	Tangail	All areas
L×F	23.92±0.2(56)	14.78±0.43(37)	18.91±0.0(80)	20.4±.75(16)	19.5±0.5 (189)
L×SL	21.15±1.4(10)	13.25±0.8(8)	-	-	17.2±1.16(18)
L×S	-	-	18.88±0.2(30)	17.83±0.9(12)	18.33±6.60(42)
L×SL×F	22.8±1.16(5)	-	-	-	22.8±1.16(5)

Figures in parenthesis indicate the total no. of observations.

Reproductive performances of cross-bred progenies

Age at puberty :

The average age at puberty of different breeds in different areas are presented in Table 18. The age at puberty of L×F crossbred cows was found the lowest in Rangpur district (725 days) and the highest in Tangail district (1150 days). In case of L×SL crossbred cows age at puberty was the lowest in Rangpur district (770 days) and the highest in Jessore district (1152 days). Again, the puberty age of L×S crossbred cows was found to be 1286 days and 966 days in Tangail and Comilla districts, respectively. Age at puberty of L×J cows was the lowest in Comilla district (970 days) and the highest in Jessore (1233 days). The average age at puberty of L×F, L×SL, L×S, L×J and Local non-descriptive cows irrespective of areas were 1089, 1117, 1125, 1056 and 1230 days, respectively. It was observed that Local cows required more time to reach their puberty as compared to other crossbred cows. Finally, it may be stated that among the crossbred cows L×S required the lowest time (1056 days) to reach the puberty. Nevertheless, variations in environmental are major factors found to affect puberty.

Table 18: Mean±SE Age at puberty (days) of different breeds in different regions of Bangladesh.

	Age at Puberty				
Breeds	Tangail	Rangpur	Jessore	Comilla	All areas
L×F	1150.07±34.24 (39)	725.34±46.42 (12)	1149.74±17.23 (59)	1063.31±27.36 (45)	1022±31.31 (155)
L×SL	1124.43±25.166 (32)	770.0±125.29 (3)	1152.22±15.59 (35)	982.83±72.56 (10)	1007.37±31.76 (80)
L×S	1286.40±59.54 (25)	-	-	966.91±39.50 (32)	1126.6±49.45 (57)
L×J	-	-	1233.0±40.91 (3)	970.0±61.67 (14)	1101.5±51.29 (17)
L	1229.36±46.81 (41)	-	-	-	1224.36±46.81 (41)

Figures in parenthesis indicate the total number of observations

Gestation length

The average gestation length of different crossbred cows in different areas is shown in Table 19. It was observed that the average gestation length of LxF, LxSL, LxS and the local was 276, 279, 273 and 280 days, respectively. The results indicated that the average gestation period of all crossbred and local cows were found within the normal range.

Table 19 : Mean±SE of gestation length (days) of different breeds at different regions of Bangladesh

	Gestation length				
Breeds	Tangail	Rangpur	Jessore	Comilla	All areas
L X F	275.8±1.6(37)	274±6.9(55)	280.8±0.99(60)	271.9±0.71(40)	275.6±2.55(192)
L X SL	278.7±1.74(18)	274.7±1.02(32)	277.9±0.74(34)	272.8±1.95(6)	276.0±1.36(90)
L X S	280.1±1.05(24)	-	-	274.2±0.56(19)	277.1±0.775(43)
L X J	-	275.5±5.0(2)	280±6.33 (5)	272.2±0.25(12)	275.9±3.86(19)
100% L	279.7±1.03(40)	-	-	-	279.7±1.03(40)

Figures in parenthesis indicate the total number of observations

Post-partum estrus period :

The average post-partum estrus period of LxF, LxSL, LxS, LxJ and local nondescriptive was 170, 117, 185, 179 and 203 days, respectively. The results so far indicated that the lowest average post-partum estrus period was in L×SL and the highest in local cows.

Table 20: Mean±SE of post-partum estrus period (days) of different breeds at different regions of Bangladesh.

Breeds	Post-partum estrous period			
	Tangail	Rangpur	Jessore	Comilla
L × F	127.5±18.06 (6)	137.68±21.3 (17)	119.33±12.58(6)	239±32.44 (18)
L × SL	87.44±14.15 (8)	95.6±15.35 (5)	104±11.80 (8)	180.5±24.5 (2)
L × S	128.5±1.41 (2)	-	-	197.07±21.89(12)
L × J	-	-	280±6.33 (5)	197.57±27.68(7)
L	202.77±13.01 (10)	-	-	-

Figures in parenthesis indicate the total number of observations

First service conception rate

Conception rate (CR) refers to the percent of cows diagnosed pregnant out of the total number of cows inseminated. This is very important for achieving a healthy calf crop on a regular basis and its an economic factor to dairy entrepreneurs. In the present study, conception rate computed through diagnosing 100 cows by rectal palpation and the result is presented in Table 21. The highest first service conception rate was obtained in local (44.28%) followed by L×F (41.60%) and the lowest in L×Sl cows (33.33%). These values were lower than those reported by Shamsuddin, 1988; Alam, 1991. The reasons behind this variation in CRs may be attributed to the pregnancy diagnosis procedure, personal errors such as proper heat detection, insemination technique and time, quality of semen or other reproductive problems.

Table 21 : Fist service conception rate in different genetic groups of cows in Tangail district

Genotype of Cow	Conception rate (%)
L	44.28 (70)
L×F	41.66 (24)
L×SL	33.33 (6)

Figures in parenthesis indicate the total number of observations

Non return rate :

Non return rate is defined as the number of cows which are not returned for a subsequent insemination within a specified number of days, such as 60 to 90 days (Will ett and Salisbury, 1942). Efficiency of breeding bulls used in different AI centers were studied in the present study. According to Table 22 Sahiwal×Friesian bulls showed the best performance on the basis of the non return rate (50.0%) which was followed by the pure Friesian (48.28%). The non return rate found in this was much lower than those reported by Shamsuddin, 1991.

Table 22 : Non return rate with first service

Genotype of Bull	Non Return Rate
100% F	48.28 (29)
100% SL	45 (20)
L×F	38.23 (34)
SL×F	50 (8)
S×SL×F	40 (5)

Figures in parenthesis indicate the total number of observations

Note : F = Friesian, Sl = Sahiwal, L = Local, S = Sindhi

Post-partum changes of live weight

Post-partum live weight changes in crossbred cows were studied and presented in Table 23. In all the cases live weight was decreased after parturition. In addition to physiological changes, nutrition could be one of the responsible factor. Among the genetic group, rate of live weight loss was the lowest in LxF (-4.55±1.60 kg) and the highest in LxHa (9.67 ± 1.2 kg) after 3 months of parturition. The result also indicated that farmers gave much attention to their L×F cows. More milk production from these cows may be one of the factors for it.

Table 23 : Post partum change of live weight of different crossbred cows in the project areas

Breed	Cows wt. at calving (X±SE)	Cows wt. at 1st heat after calving (X±SE)	Cows wt. after 3 months of calving (X±SE)	Live wt. changes of cows (X±SE)
L×F	281.43±7.51 (131)	281.65±10.79 (76)	277.89±8.16 (120)	-4.55±1.60 (119)
L×Sl	232.0±6.47 (66)	218.76±9.77 (17)	225.09±7.47 (53)	-6.03±2.07 (51)
L×Ha	227.25±11.45 (4)	200.0±54.99 (2)	221.57±18.95 (7)	-9.67±1.20 (3)
L×J	246.33±25.61 (6)	258.6±30.12 (5)	245.52±26.74 (6)	-6.0±2.36 (5)
L	228.55±9.0 (29)	235.0±18.22 (6)	218.68±10.45 (22)	-6.7±3.61 (21)

D. Determination of the impact of AI services at farmers condition

The average area of total land, homestead and cultivable land of farmers interviewed presented in Table 24. The results presented in the Table show that the average total land area of each farmer was the highest in Jessore (202.8 decimals) followed by Tangail (196.7 decimals), Rangpur (187.0 decimals) and Comilla (130.0 decimals). However, the average area of homestead area was found the highest in Jessore (49.2 decimals) followed by Rangpur (27.7 decimals), Tangail (22.9) and Comilla (16.8). Farmers of Tangail area had the highest average area of cultivable land (173.7 decimals) followed by those of Rangpur (160.2), Jessore (149.6) and Comilla (112.9).

Table 24: Average total land, homestead and cultivable areas of the selected farmer in different areas

Land Size (decimals)	Tangail	Rangpur	Comilla	Jessore	Total (irrespective of areas)
Total land	196.73±15.62	187.09±12.01	130.01±6.33	202.83±16.82	179.93±12.69
Homestead	22.85±1.01	27.70±2.57	16.78±0.92	49.16±4.35	29.11±2.21
Cultivable land	173.71±12.37	160.21±25.1	112.85±6.02	149.60±17.35	149.86±15.21

The educational status of the literate farmers in different DLS and BRAC areas is shown in Table 25. It was observed that in the DLS areas, the number of farmers who had primary education was the highest as compared to those with other education. In the BRAC areas, the number of farmers having primary education was higher in Jessore

(62.5%) and Tangail (83.9%) than those of Dhaka (48.6%) where secondary education was found the highest (51.4%). The average percent of farmers having primary education was much higher in the BRAC area (65.0%) than those were in the DLS area (51.2%).

Table 25: Education status of the literate farmers(%) in different areas

DLS:

Level of education	Tangail	Rangpur	Comilla	Jessore
Primary	51.1	58.7	51.1	44
Secondary	32.0	29.5	35.2	45.9
Higher secondary	8.2	6.9	7.8	6.3
Above higher secondary	8.7	4.9	5.9	3.9
Total	100%	100%	100%	100%

BRAC :

Level of education	Dhaka	Jessore	Tangail
Primary	48.6	62.5	83.9
Secondary	51.4	33.4	9.7
Higher secondary	-	4.2	6.4
Above higher secondary	-	-	-
Total	100%	100%	100%

Types of occupations of the selected farmers (both DLS and BRAC) are presented in Table 26. Farmers involved themselves in various types of occupations. The percentage of farmers having agriculture as occupation in Rangpur was found the highest (72%) followed by those in Comilla (30.6%), Jessore (31.0%) and Tangail (27.3%). In Tangail area, 9.4% of the farmers was depended on business, 18% on business + crop production and 23% on service + business. In Jessore area, 29.6% of the farmers was depended on business, 12.7% on service, 6.8% on business + crop production and 10% on crop production + livestock. In Rangpur 6.3% of the farmers was depended on service, 8.2% on business, 6.8% on business + crop production and 1.2% on service + business. In Comilla district, 3.65% of the farmers was depended on service, 8.3% on business, 4.3% on service + crop production, 4% on service + livestock, 15.3% on business + crop production, 9.65% on business + livestock and 24.0% on crop production + business + livestock.

Table 26: Occupations (%) of the selected farmers in different areas

DLS :

Occupations	Tangail	Jessore	Rangpur	Comilla
Service	6.9	12.7	6.3	3.6
Business	9.4	29.6	8.2	8.3
Crop production	27.3	30.0	72.1	30.6
Livestock	0.4	1.4	-	0.2
Service + Crop production	4.8	5.2	1.9	4.3
Service + Livestock	2.1	-	0.9	4.0
Business + Crop production	17.84	6.8	6.8	15.3
Business + Livestock	6.3	2.0	0.9	9.6
Crop production + Livestock	0.6	10		
Service + Crop production + Livestock	-	-	-	-
Business + Crop production + Livestock	1.7	-	-	-
Crop production + Business + Livestock	-	-	0.2	24.0
Service + Business	23.0	2.3	1.2	-
Total	100%	100%	100%	100%

BRAC :

Occupations	Dhaka	Jessore	Tangail
Service	-	12.5	9.4
Business	16.3	37.5	84.4
Crop production	43.7	50.0	6.2

On the contrary, the selected farmers in BRAC areas were engaged either in service, business or crop production. The percentage of farmers engaged in business was 16.3%, 37.5% and 84.4% in Dhaka, Jessore and Tangail district, respectively. The average percentage of farmers on crop production in Dhaka, Jessore and Tangail areas was 43.7%, 50% and 6.2%, respectively. Farmers of Jessore and Tangail engaged in business were found to be 12.55% and 9.4%, respectively (Table 27).

The average annual income of farmers from different sources in different areas is shown in Table 27. The results indicated that the average annual income from agriculture ranges from Tk. 21,333 in Comilla to Tk. 56,097 in Tangail. The total average annual income of farmers irrespective of income sources was found the highest in Tangail area (Tk. 1,07,029) followed by those in Jessore (Tk. 70,142), Rangpur (Tk. 54,882) and Comilla (Tk. 50,179). The selected farmers under different BRAC areas found to have an average annual income of Tk. 5,523 to Tk. 40,734 from crop production and Tk. 3,048 to

Tk. 12,000 from livestock. The total average annual income of farmers irrespective of sources was found the highest in Jessore (Tk. 60,542) followed by Tangail (Tk. 43,103) and Dhaka (Tk. 11,970).

Table 27: Sources of annual income (Tk) of the selected farmers in different areas (Mean ± SE)

DLS:

Sources	Tangail	Comilla	Jessore	Rangpur	All areas
Crop production	56097.5 ± 19274.9	21333.1 ±426.5	26812.2± 12982.7	29250.1±1725.5	33647.5±5870.1
Livestock	16253.6 ± 1463.3	10167.0±426.5	4789.9±485.1	8911.3±1096.3	9803.6±469.7
Others	37197.1 ± 3859.2	18160.2±797.0	31472.1±4351.5	9840.3±906.1	24305.8±1547.9
Total Annual Income	107029.2±20827.1	50178.9±1826.7	70141.9±17221.2	54881.7±2565.5	71362.4±7172.2

BRAC:

Sources	Dhaka	Jessore	Tangail	All areas
Crop production	5522.92 ± 601.92	40733.33 ±7763.74	28333.33±3859.92	15933.33±1792.24
Livestock	4308.16 ± 473.44	3047.83 ±362.13	12000.0 ±1493.58	3865.33±427.22
Others	4756.52 ± 969.33	29995.65 ±6780.87	25586.25 ± 2863.27	20391.33±2151.96
Total Annual Income	11969.39 ±1265.5	60541.67±7214.61	43103.25 ±4605.19	41130.00±2680.48

Participation of male and female members in livestock rearing in the selected households of different areas (DLS and BRAC) are presented in Table 28. The results show that the participation of both male and female was almost similar in DLS areas. On the other hand, participation of female in different BRAC areas was 70.3%, 58.3%, 56.9%, respectively in Tangail, Jessore and Dhaka districts. The results reveal that the participation of female to livestock rearing was found higher in BRAC areas than the areas under DLS. Types of breeding methods followed by farmers in different areas are shown in Table 29. The highest number (66%) of farmers in Comilla district used AI technique to breed their cows followed by those in Jessore (49%), Tangail (41%) and Rangpur (29%).

Table 28: Average contribution of male and female members in rearing livestock of the selected households in different areas

DLS:

Sex	Tangail	Comilla	Jessore	Rangpur	Total (irrespective of areas)
Male	55.5 ± 1.14	44.73 ± 1.12	44.78 ± 1	59.18 ± .78	50.70±1.01
Female	45.17 ± 1.14	55.41 ± 1.12	55.91 ± 1.03	40.73 ± .78	49.30±1.01

BRAC:

Sex	Dhaka	Jessore	Tangail	Total (irrespective of areas)
Male	44.0 ± 2.6	43.48 ± 2.34	29.69 ± 0.31	39.05±1.75
Female	56.9 ± 2.7	58.30 ± 2.88	70.31 ± 0.31	61.05±1.96

Results indicate that a few farmers (<21.9%) used natural breeding technique except the farmers of Jessore district where 34.0% of the farmers still use natural mating. On an average 32.5% of farmers have been using both the natural and AI techniques.

Table 29: Breeding methods (%) practised by the randomly selected farmers in different areas

DLS:

Methods	Tangail	Rangpur	Comilla	Jessore	Total (irrespective of areas)
Natural	12.1	21.9	17.4	33.6	21.25
Artificial	41.4	29.4	66.3	48.5	46.4
Natural+Artificial	46.5	48.7	16.3	18.0	32.35
Total	100	100	100	100	100

BRAC:

Methods	Dhaka	Jessore	Tangail	All areas
Natural	2.2	-	-	0.76
Artificial	44.4	100.00	100.0	81.46
Natural Artificial	53.3			17.78
Total	100	100	100	100

On the contrary, in BRAC areas 100% farmers used AI to breed their cows. The result revealed that farmers in BRAC areas are more conscious for improving their cows through AI.

reported that their cows required double services per conception. On the other hand, in BRAC areas 71% farmers in Dhaka and 83% in Jessore reported that a single service was required per conception and 90% of the farmers in Tangail reported that their cows required double services per conception.

Table 31: Farmers opinion (%) regarding the no. of services/conception per cow in different areas

DLS:

Number of services	Tangail	Comilla	Jessore	Rangpur	All areas
One	40.0	30.8	40.45	20.3	32.83
Two	21.6	60.3	31.45	43.6	39.23
Three	20.5	5.2	17.4	24.2	16.82
Four	18.1	3.7	10.7	11.9	11.1
Total	100	100	100	100	100

BRAC:

Number of services	Dhaka	Jessore	Tangail	All areas
One	71.4	83.3	-	51.57
Two	28.6	16.7	90.00	45.1
Three			10.00	3.33
Four				
Total	100	100	100	100

Farmer opinions on the improvement of livestock through AI collected from different areas are presented in Table 32. A majority of farmers (68.1%) in DLS areas expressed their views in positive. On the other hand, 99.3% of the farmers in BRAC areas expressed the same opinions. A very few farmers had no response on this question. It was observed that a higher percentage of farmers in BRAC areas used AI for the improvement of their cattle than those in DLS areas. It may be due to the presence or close supervision of BRAC Field Assistants in the project areas.

Table 32: Opinion of the selected farmers (%) regarding the improvement of livestock through artificial insemination programme at different areas

DLS:

Response Category	Tangail	Jessore	Comilla	Rangpur	All areas
Yes	76.8	46.8	73.9	75	68.12
No	0.0	1.1	0.6	0.7	3.1
No response	13.2	52.1	25.4	24.3	28.75
Total	100	100	100	100	100

BRAC:

Response Category	Dhaka	Jessore	Tangail	All areas
Yes	97.9	100.00	100.00	99.3
No	2.1	-	-	0.7
No response	-	-	-	
Total	100	100	100	100

Correlation co-efficients of the acceptance of AI with land, education, occupation and sex are presented in Table 33. Land, education, occupation and sex show negative correlation with the acceptance of AI. Thus, the acceptance of AI does not depend on the occupation, sex, education or total land area of farmers.

Table 33: Correlation of acceptance of AI with education, sex, total land and occupation

	AI	EDU	M/W	TLAND	OCCU
AI	1.0000	-.2855	-.9384	-.9647	.1214
EDU	-.2855	1.0000	.7539	.230	-.3276
M/W	-.9384	.7539	1.0000	.8143	.347
TLAND	-.9647	.230	.8146	1.0000	.1443
OCCU	.1214	-.3276	.347	.1443	1.0000

Key Words :

AI - Artificial Insemination
EDU - Education
M/W - Men/Women
TLAND - Total land
OCCU - Occupation

Conclusion

- The Government AI programme shows a trend that introduction of temperate dairy breeds in the country enhanced the genetic quality of the local cattle.
- AI activities in the centres, sub-centres or points were found satisfactory except the absence some lackings in physical and management facilities such as availability of proven breeding bulls, modern semen evaluation and preservation systems at the field level and placement of trained manpower on AI activities and management of laboratory.
- Achievement was not satisfactory with the Government AI programme due to indiscriminate breeding throughout the country ignoring National Breeding Policy.
- Among the crossbred cows, production and reproduction performance of Local × Friesian crossbred cows found the best.
- Jersey cross progenies, found at a very low number, showed a better milk yield and reproductive performances.
- Study on the socio-economic status of farmers indicated that for achieving a higher acceptance of AI by farmers, propaganda or close association of the AI personnel with farmers irrespective of their wealth, education or occupation categories is more important.
- The landless farmers in BRAC areas were much aware to maintain their crossbred progenies rather the rich in the DLS areas.

Recommendation

- For the genetic improvement of local cattle, Friesian breed could be recommended to include in the breeding programme. In addition, Jersey breed could also be considered but further investigation on the evaluation of performance of more Jersey cross progenies is required.
- Genetically superior and proven Local x Friesian or Sahiwal x Friesian bulls should be used in the urban and milk pocket areas where crossbred cows are managed intensively.
- Selection and culling of bulls should be based on their breeding soundness and predicted breeding value.
- Close veterinary inspection on semen production, preservation and transportation, and regular maintenance of the equipment and machinaries used in the AI laboratory should be ensured.
- Considering the prevailing situation in transporting liquid semen, the use of frozen semen could be preferred.
- Examinations of semen by the authorized persons before AI should be a routine practice.
- The hygienic measures practiced in the AI centers require more attention to achieve a better result.
- Preserved chilled semen stored in thermoflasks could be used upto 2 days provided that the sufficient amount of ice remains in the flask.
- More private AI centres could be established besides the Government AI centres for better and competitive results.
- At least 1 (one) livestock officer should be employed for a maximum of 10 AI centres to control AI and the post AI fertility.
- Inter institutional and international linkages must be established for getting unrelated germ plasm and technological cooperation in order to up-hold the quality of AI services and the post- AI fertility.

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Annexure - 'A'

Dhaka Division

Table 1: Selected villages under each district AI center, sub-center and points at Tangail District.

Thana/Points	Name of the villages	Distance from center (km)
1. Tangail Sadar	i) Paurosova	1
	ii) Mirer Betka	3
	iii) Basakhanpur	5
Point-Karatia	i) Karatia	1
	ii) Namder Kumulli	3
2. Mirzapur Thana	i) Nazirpara	1
	ii) Nawapara	3
	iii) Rajbari	5
Point-Dawhatta	i) Mir Dawhatta	1
	ii) Bahuria	3
3. Ghatail Thana	i) Ghatal	1
	ii) Karna	3
	ii) Sadhur Galganda	5
Point-Pakutia	i) Pakutia	1
	ii) Jhunkail	3
4. Madhupur Thana	i) Madhupur	1
	ii) Maori	3
	iii) Jalsatra	5
Point-Narilla	i) Narilla	1
	ii) Bighat	3

Khulna Division

Table 2: Selected villages under each district AI center, sub-center and AI points at Jessore district.

Thana/Points	Name of villages	Distance from the center (km)
1. Jessore Sadar	i) Baspara	1
	ii) Bahadurpur	3
	iii) Mahidia	5
AI Point-Basundia	i) Basundia	1
	ii) Sadullahpur	3
2. Manirampur Thana	i) Hakoba	1
	ii) Debidashpur	3
	iii) Etta	5
Point-Nehapur	i) Nehalpur	1
	ii) Balida	3
3. Jhikargasa Thana	I) Lakhipur	1
	ii) Magura	3
	iii) Bahirumpur	5
Point-Nil		
4. Avoinagar-Thana (Nowapara)	i) Vuikra	1
	ii) Akdiarpur	3
	iii) Mahakal	5
Point-Ghatpara	i) Avoinagar	1
	ii) Bivagathi	3

Chittagong Division

Table 3: Selected village under each district AI center, sub-center and AI points at Comilla district.

Thana/Points	Name of the villages	Distance from the center (km)
1. Comilla Sadar	i) Gobindapur	1
	ii) Kaliajuri	3
	iii) Durgapur	5
Point-Chuara	i) Chuara	1
	ii) Kanastala	3
2. Daudkandi Thana (Gauripur)	i) Ziarkandi	1
	ii) Haripur	3
	iii) Mahammadpur	5
Point-Atipara	i) Atipara	1
	ii) Etakhola	3
3. Chandina Thana	i) Harong	1
	ii) Chrimantapur	3
	iii) Barra	5
Point-Madhaia	I) Nawtala	1
	ii) Kashimpur	3
4. Burichang Thana	i) Burichang	1
	ii) Kharadia Gazipur	3
	iii) Arag	5
Point-Varasar	i) Varasar	1
	ii) Esapur	3

Rajshahi Division

Table 4: Selected villages under each district AI center, sub-center and AI points at Rangpur district.

Tlhana/Points	Name of the villages	Distance from the center (km)
1. Kawnia Thana	i) Ragib	1
	ii) Harisar	3
	iii) Talu Sahabaz	5
Point-Haragasa	i) Minhaz Bazar	1
	ii) Haragasa	3
2. Mithapukur Thana	i) Kashipur	1
	ii) Shothibari	3
	iii) Alipur	5
Point-Bairatihat	i) Bairatihat	1
	ii)	
3. Pirgonj Thana	i) Osmanpur,	1
	Prazapara,	3
	Pirgonj	5
	ii) Dhanshala, Mawkimpur, Gongrampur	
	iii) Rawshanpur, Abdullapur, Majidpur	
Point-Shanerhat	i) Shanerhat	1
	ii) Mesta	3
4. Rangpur Sadar	I) Lalbag	
	ii) Asratpur	
	iii) Tajhat	
Point-Mahigonj	i) Mahigonj	1
	ii) Haragachha	

BRAC-AI Points

Table 5: Selected villages under each BRAC AI points.

Point	Name of the villages	Distance from the point (km)
1. Kawalipara Manikgonj, Dhaka	i) Kathalia ii) Bajda	1 3
2. Ghadkhali Bazar Zhikargasa, Jessore, Khulna	i) Nabib Nagar ii) Haria	1 3
3. Palisara Ranger, Rajshahi	i) Palisara ii) Sutrapur	1 3
4. Khatkhatia Ranger, Rajshahi	i) Khatkhatia ii) Kukurul	1 3
5. Ramandrapur Maligasa, Pabna, Rajshahi	i) Maligasa ii) Kumargari	1 3
6. Chatmohar Pabna, Rajshahi	i) Chatmohar ii) Katakhali	1 3
7. Andarghut Mirzapur, Tangail, Dhaka	i) Andarghat ii) Postkamuri	