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## Evaluation of Adoption Status of Artificial Insemination Technique on Dairy Cattle at Farmers Level

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**Abstract:** In the present study the evaluation of the adoption status of artificial insemination (A.I.) technology in 5 villages of Mymensingh district in Bangladesh. Evidence showed that the proportion of households rearing cattle was 47.17%. Forty four percent of those households have adopted the A.I. technology. The proportion of cross-bred cattle population was about 34%. It varied among farm sizes, herd sizes and categories. The distribution of cattle holdings over the households was less unequal than the distribution of land holdings; but there was very little difference between the distribution of cattle and cross-bred cattle holdings.

**Key words:** Artificial insemination, dairy cattle, adoption status and gini coefficient

### INTRODUCTION

Bangladesh is one of the most densely populated countries of the world with a population of nearly 130.20 million and the current population growth rate is about 1.50% per annum. Agriculture as well as livestock plays a vital role for the development of the people as well as for the economic development of Bangladesh. In 1999/2000, contribution of livestock sub-sector in total GDP is 3.3%<sup>[1]</sup> and in agricultural GDP is 7.7%<sup>[2]</sup>.

Bangladesh has a relative density of livestock population compared to many other countries of the world. The number of cattle population in Bangladesh 2nd among the SAARC countries and 7th among the Asian countries<sup>[3]</sup>. The present livestock population is estimated at 23.40 million cattle, 0.82 million buffaloes, 33.50 million goats, 1.11 million sheep, 138.20 million chicken and 13.0 million ducks<sup>[4]</sup>. In spite of high density of livestock population, the country suffers from an acute shortage of livestock products like milk, meat and eggs due to large number of people. Average annual production of milk is 1.6 million metric ton, meat 0.62 million metric tons and eggs 35,000 million. However, current production of milk, meat and eggs are inadequate to meet us the present requirement of the population and the deficits are 87, 89 and 76%, respectively<sup>[5]</sup>. The shortage of livestock products is attributed mainly to poor quality of livestock species and their low productivity. The low productivity of local breeds of animal is an important constraint to future development of the livestock sector in Bangladesh.

In 1959, the technique of Artificial Insemination (A.I) was first introduced in Bangladesh (erstwhile East Pakistan) in 5 districts. The Savar Dairy Farm (SDF) was taken as the nucleus of activities for promotion of the A.I. program. Currently, the program has been operating under the supervision of the Directorate of Livestock Services (DLS) through 23 A.I. centers, 423 sub-centers and 554 A.I. points covering all the 64 districts of the country<sup>[6]</sup>.

The cross breeding program of the DLS has successfully been implemented in some of the area of the country. A survey conducted in 5 adjoining villages of Savar Dairy Farm showed that the proportion of cross-bred cattle population was very low (9%) in those villages<sup>[7]</sup>. In another study conducted in three villages of Savar upazilla covered by the A.I. program<sup>[8]</sup>. It was observed, however, that the A.I. program of the DLS has created substantial impact in those villages. The proportion of cross-bred cattle population was found 22%. Alam<sup>[9]</sup> conducted a study on a socio economic evaluation of A.I. program in Bangladesh. They revealed that the proportion of households rearing cattle was 54.89% and the proportion of cross-bred cattle population in the study areas was 11.69%. It appears that research on this topic is limited in Bangladesh. So, the present study attempts to evaluate the status of Artificial Insemination technique in Bangladesh. This study present the results of that survey with reference to the proportion of cross-bred cattle by farm size, herd size and category. It also analyzes the pattern of distribution of land and cattle holdings over the study area.

**MATERIALS AND METHODS**

The study was conducted in 5 villages of Sadar thana in Mymensingh district. Three villages were under A.I. points areas and two villages under A.I. sub-center areas. A purposive sampling technique was followed in this study. There were 530 total households in studied 5 villages. The average household per village was 106. At first a list of 106 farmers were prepared from selected 5 villages and then categorized according to their farm and number of cattle size. Fifty farmers were selected from 106 farmers of which 8 were land less, 11 were small, 26 were medium and 5 were large farm categories for collecting necessary information. Out of 50 farmers 22 were adopting and 28 were non-adopting farmers in the study area. Direct interviewing method was followed to collect data from the respondents by using questionnaire. A complete survey was conducted in all the villages under study to collect information on cattle population. The data were arranged in tabular form and were analyzed as per the objectives of the study. Tabular analysis and simple statistical tools such as mean, percentage, correlation test and Gini concentration ratio etc. were applied to examine the validity of findings.

**RESULTS AND DISCUSSION**

**Proportion of cross-bred cattle:** The results of the field survey on the proportion of cross-bred cattle is presented in Table 1. It appears that only 47.17% household reported to have been rearing cattle. Out of them, 44% households have adopted the artificial insemination technique. In relation to total number of households, the proportion of adopting households was 20.75% only. The proportion of cross-bred cattle was found to be 33.92% in the selected areas. There were, however, differences in the proportion of households having cattle, and the magnitude of adoption of A.I. technology among farm sizes, herd sizes and categories. The possible explanations for observed differences are given in the next few sections.

Characteristics of adopters and non-adopters were examined in Table 2. It was observed that herd size and the density of cattle population are relatively high for non-adopters than those of the adopters. On the contrary, the literacy rate and income is relatively high for adopters than those of non-adopters.

**Distribution of cross-bred cattle by farm size:** The surveyed households were analyzed by farm size and it presented in Table 3. Among those households 14.15% were landless (0.0-0.50 acres), 21.70% were small (0.51-2.00 acres), 51.89% were medium (2.01-5.00 acres) and 12.72%

Table 1: The Proportion of Cross-bred Cattle in the study Areas

Items	Quantity	Present Study	National average
Total Number of households	No	106	1,16,76442
Total number of household having cattle	No	50	74,73,169
Total number of adopting households	No	22	20,983,921
Total number of cattle	No	227	1,93,897
Total number of cross-bred cattle	No	77	NA
Proportion of households having cattle	%	47.17	NA
Proportion of adopting households in relation to total households.	%	20.75	NA
Proportion of adopting households in relation to total households having cattle	%	44	NA
Proportion of cross-bred cattle	%	33.92	0.96 (Total local cattle 2,01,68,538 total cross cattle 1,93,897)

Note: NA-Not available, Source (for national average): Survey on livestock and poultry in Bangladesh (1994)

Table 2: Herd size, density of cattle population, literacy rate and income of adopting and non-adopting households

Adoption status	Herd size (Number)	Density of Cattle per acre	Literacy rate (%)	Income (Taka)	
				Average	Total
Adopters	3.60	1.51	84.93	10299.82	3089945
Non-adopters	5.71	2.04	77.16	4798.42	1439527

Source: Field Survey, 2001

were large (5.01 and above acres) farms. It can be observed from Table 3 that the percentage of households having cattle increased as the farm size increased. It ranges from 13.04% for landless to 63.64% for medium farm size group. The higher proportion of household having cattle in medium farm size group. The higher proportion of household having cattle in medium farm size group was related to availability of feed resources and requirements of draft cattle heads for crop cultivation.

It is interesting to note that the coverage of households by A. I. was significantly higher (53.85%) for medium farms than other farm sizes. The small farms had the lowest coverage (27.27%). As the farm size increased, the coverage of households by A. I. decreased in a certain level that is medium farms group. This can be explained by using Chayanovian analysis<sup>[10]</sup> of consumption need. As the farm size decreased consumption need per family member increased. The farmer therefore, responded to improve breeding practices quickly to earn more income from this limited livestock holding for survival.

In case of cross-bred cattle population the difference in proportions among farm sizes was not statistically significant (F 0.05>0.078). However, the proportion seems higher for medium farms. One can notice from Table 4 that the density of cattle population per acre was higher, but the other relevant variables were lower for landless farms. It also reveals from the table that the adopter farmers had higher literacy rate and income than the non-adopter farmers irrespective of all farm size groups.

Table 3: The Distribution of Cross-bred Cattle by Farm Size in the Studied Sample Households

Farm size (Acres)	Total number of households	Percentage of house hold having cattle	Percentage of adopting households in relation to		Proportion of cross-bred cattle (%)
			Total households	Households having cattle	
Landless (0.0-0.50)	15	13.04	20.00	42.85	13.10
Small (0.51-2.00)	23	13.64	13.04	27.27	11.90
Medium (2.01-5.00)	55	63.64	25.45	53.85	61.90
Large (5.01-above)	13	9.09	15.39	33.33	14.15
Total	106	24.85	18.47	39.33	25.26

Source: Field survey, 2001

Table 4: Herd Size, Density of Cattle Population, Literacy Rate and Income of Adopting and Non-adopting Household by Farm Size

Farm size (acre)	Adoption status	Herd size (number)	Density of cattle per acre	Literacy rate (%)	Income (Taka) from livestock	
					Average	Total
Landless (0.0-0.50)	Adopters	4.5	16.98	62.5	9032.86	108394.33
	Non-adopters	5.00	13.44	54.17	3379.59	70971.40
Small (0.51-2.00)	Adopters	2.33	1.27	71.42	7864.31	78643.07
	Non-adopters	5.20	2.73	66.67	3357.72	104089.60
Medium (2.01-5.00)	Adopters	3.85	0.98	84.04	9271.52	472847.31
	Non-adopters	6.92	2.07	97.17	3067.64	267987.86
Large (5.01-above)	Adopters	6.00	1.83	86.36	7309.62	8775.50
	Non-adopters	8.25	1.38	82.35	1651.86	54511.26
Total	Adopters	4.17	5.27	76.08	8369.58	186900.05
	Non-adopters	6.34	4.91	70.59	2864.20	1243390.03

Source: Field survey, 2001

Table 5: Distribution of local and cross-bred cattle by herd size

Number of cattle	Average farm size for local breed (acres)	Percentage of total households	Average farm size for cross-bred cattle (acres)	Proportion of cross-bred cattle
1	0	0	0	0
2	1.60	25.00 <sup>a</sup>	1.63	18.18 <sup>c</sup>
3	1.77	14.29 <sup>c</sup>	2.90	27.27 <sup>a</sup>
4	2.12	17.85 <sup>b</sup>	3.00	22.73 <sup>b</sup>
5	3.33	10.71 <sup>d</sup>	4.75	18.18 <sup>c</sup>
6	4.80	17.86 <sup>b</sup>	6.50	9.09 <sup>d</sup>
7	6.75	14.29	10.00	4.55

Note: a, b, c, d, means dissimilar superscripts in each column (P<0.05) significant at 1% level, Source: Field survey, 2001

Table 6: Distribution of cattle type in the study areas

Breed type	Milking cow	Dry cow	Bull	Heifer	Calf	Sub total	Total %
Local breed %	28.19	3.08	9.69	1.32	23.89	66.08	100.00
Cross-bred %	15.86	3.08	0.88	1.76	12.33	33.92	100.00

Source: Field Survey, 2001

**Distribution of local and cross-bred cattle by herd size:**

Distribution of local and cross-bred cattle by herd size is presented in Table 5. It reveals that the number of local and cross-bred cattle increased with the increase in herd size. The proportion of local and cross-bred cattle remained almost the same for all the herd size. However, the herd sizes 1 and 7+ had significant difference (at 5% level) with other herd sizes. It reveals further that farm size increased but the proportion of household of decreased with the increase in herd size. It was observed that the farm size and herd size was most positively correlated (r=0.96) and the herd size and the proportion of total household were poorly correlated (r=0.29) in the study areas.

Table 7: Distribution of Local Breed and Cross-bred Cattle Holding in the Households of the Study Areas

Quartile	Adoption status	Cumulative percentage of household	Cumulative percentage of land holding	Cumulative percentage of cattle holding
First	Adopters	25.00 (25.00)	13.43 (13.43)	17.14 (17.14)
	Non-adopters	25.00 (25.00)	6.88 (6.88)	16.00 (16.00)
Second	Adopters	50.00 (25.00)	34.33 (20.90)	37.00 (20.00)
	Non-adopters	50.00 (25.00)	24.14 (17.27)	30.00 (14.40)
Third	Adopters	75.00 (25.00)	62.69 (28.36)	65.71 (28.57)
	Non-adopters	75.00 (25.00)	53.73 (29.57)	61.60 (31.20)
Fourth	Adopters	100.00 (25.00)	100.00 (38.31)	100.00 (34.29)
	Non-adopters	100.00 (25.00)	100.00 (46.27)	100.00 (38.40)
Gini coefficient	Adopters	-	0.06	0.04
	Non-adopters	-	0.10	0.06

Note: Figure in the parenthesis indicate the percentage of respective quartile, Source: Calculated from surveyed data, 2001

**Distribution of cattle by category:** An attempt was made to analyze the distribution of cattle population by category of cattle viz, milking cow, dry cow, bull, heifer and calf. It was observed earlier that the proportion of local and cross-bred cattle were 66.08 and 33.92%, respectively. Table 6 shows that proportion of local milking cow, dry cow, bull, heifer and calf were 28.19, 3.08, 9.69, 1.32 and 23.89%, respectively and that the cross-bred milking cow, dry cow, bull, heifer and calf were 15.86, 3.08, 0.88, 1.76 and 12.33%, respectively.

One can notice that the proportion of local bull was relatively high but the proportion of cross-bred bull was comparatively low in the study areas. This indicates that the farmers have been depending more on liquid semen for cross-breeding and are less interested to keep cross-bred bull. On the other hand, they need to rear local bull for both breeding and draft purposes.

It also reveals the proportion of cross-breed calves were relatively high in the study areas than that bulls, milking cows and heifers. As the age of cross-bred cattle increased the proportion of different categories of cattle decreased (Table 6). The result indicates that artificial insemination program has gained momentum only in recent years. This result also indicates that a portion of cross-bred heifers and bulls were sent to the slaughter house for slaughtering. The farmers particularly mentioned that these categories of cattle are less useful for draft purpose.

**Distribution of land and cattle holdings:** We compared the agreed pattern of land and cattle holding distribution among the household of the study areas. Four groups of households are categorized on the basis of the average farm size and number of cattle holdings. The data on the share of land and cattle holdings for each group is presented in Table 7.

It can be noticed that the bottom 50% of household own only 24.14% of total land while they own 30.40% of total (Local) cattle heads. In contrast the top 25% of household own 46.27% of total land but they own 38.40% of total cattle heads. The share of total cattle heads and cross-bred cattle heads (except first quartile) to each quartile were nearly equal. The result shows low degree of inequality for land and cattle holdings except first quartile.

Relative inequalities observed by working out quartiles and calculating Gini concentration ratios. The calculation shows a low concentration of cattle and cross-bred cattle holding with Gini coefficients 0.04 and 0.06, respectively and land holding with Gini coefficient 0.06 and 0.10, respectively.

The analysis suggests that the distribution of cattle holding is less unequal than the distribution of land holdings. However, there is very little difference between the distribution of cattle and cross-bred cattle.

## **CONCLUSION AND POLICY IMPLICATIONS**

The study was conducted in 5 villages under Mymensingh district of Bangladesh showed that only 47.17% of households have been rearing cattle. Out of them 44% household adopted the artificial insemination technique. In relation to total number of households, the

proportion of adopting households was 20.75% only. The proportion of cross-bred cattle population in the study area was near about 34%. The study indicated that the high proportion of household having cattle in medium farm size group than other farm size. As the farm size increased, the coverage of households by artificial insemination decreased in a certain level that is medium farm size group. The farmer therefore, responded to improve breeding practices quickly to earn more income from this limited livestock holding for survival. In case of cross-bred cattle population, the proportion for medium farms was higher than other. It also revealed that the adopter farmers had higher literacy rate and income than the non-adopter farmers in respect to all farm size groups. The study observed that the number of local and cross-bred cattle increased with the increase in herd size. The proportion of local and cross-bred cattle remained almost the same for all the herd size. The study also indicated that as the age of cross-bred cattle increased the proportion of different categories of cattle decreased. It appears that a number of cross-bred cattle are slaughtered for meat at their early ages. As a result, the number of cross-bred cattle decreased at their productive age. Empirical evidence of the study showed that the distribution of cattle holding is less unequal than the distribution of land holdings.

## **Implication for policy**

1. The benefits of artificial insemination program have been distributed equal to all farm sizes of the rural community. Therefore, an expansion of the program is recommended to increase employment and income in rural areas. This will help to alleviate rural poverty without having any worsening effect on the rural income distribution.
2. Cross-bred cattle have higher productivity potentials than the local ones. The advantages of cross-bred cattle should be publicized, through mass media, posturing and cattle exhibitions so that the farmers are encouraged to rear cross-bred cattle.
3. Rural points play the key role in adoption process. More number of A. I. points should be established for expansion and intensification of A. I. program. There should be new A.I point in each agricultural Block.
4. Literacy rate of farmers should be increased to increase adoption of A.I. technique.
5. Extension work should expand to increase awareness of farmer to A.I. technique.
6. Investment should be increased for cattle development, which will help to improve the quality of cattle population on one hand and the equal distribution of income in rural areas on the other.

7. Frozen semen should be imported for expansion of A.I. program through breed development.
8. There are indications that a number of cross-bred cattle are slaughtered for meat at their early age. Laws should be framed to refrain people from slaughtering and sacrificing of cross-bred cattle at their growing stage.

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