

THE COST OF SEMEN PRODUCTION AND THE RATE OF CONCEPTION FOR ARTIFICIAL INSEMINATION IN CATTLE

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Summary

This study was conducted to determine the cost of production of semen and the rate of conception for artificial insemination in eight randomly selected districts of Bangladesh. A sample of 640 adopting farms were investigated. Results indicate that the cost of liquid semen per dose on full-cost and cash cost basis were Tk. 16.17 and Tk. 14.48, while the cost of locally produced exotic semen and imported semen were Tk. 31.25 and Tk. 110.00 respectively. The cost of liquid semen per insemination, per conception and per progeny on full-cost were Tk. 26.65, Tk. 50.64, and Tk. 56.27 respectively and on cash cost were Tk. 23.88, Tk. 45.37 and Tk. 50.41 respectively. The average cost of semen paid by the farmers was Tk. 14.00 and it was higher in urban areas than in rural areas. Out of the cost of A.I. centres, government had subsidized 92.16 percent and the rest 7.84 percent accrued as returns. About 40 percent of the produced semen was lost in the system which could not be used at all. The conception rate on first insemination was 53.6 percent. The rate increased to 73.2 percent upto the last insemination. The difference in conception rate between liquid semen (69.97%) and frozen semen (70.48%) was not statistically significant.

(Key Words : Cost of Semen, Government Subsidy, Conception Rate)

Introduction

Bangladesh has a high density of cattle population. The relative density of cattle population is well above the averages for many other countries of the world. It ranks twelfth in cattle population and thirteenth in cattle and buffalo population among the world's countries (Alam, 1987). In the SAARC countries and in the Asian countries, her position is 2nd and 3rd, respectively, when cattle population is exclusively considered. Despite such a high density of cattle population, the country has been suffering from an acute shortage of milk, meat and draft power. The shortage of milk, meat and draft power accounted for about 86, 90 and 41 (power unit) percent, respectively (Alam, 1992). The shortage is attributed to poor quality of cattle species and their low productivity. This situation has compelled policy makers to take resort of the artificial insemination (A.I.) technology to produce quality cattle population.

The artificial insemination technique was introduced in Bangladesh in 1958. Currently a programme of artificial insemination has been operating through 23 A.I. centres, 416 sub-centres and 425 points covering all the 64 districts of the country. However, no systematic study was conducted to evaluate the performance of the programme.

The cost of insemination, production and utilization of semen, and the conception rate constitute important components for evaluation of an A.I. programme. This paper presents empirical data on those components collected very recently from randomly selected eight districts of Bangladesh.

Materials and Methods

Sampling technique

A multi-stage stratified random sampling design with district as upper strata, upazila as primary, A. I. points as secondary, village as tertiary and household as the ultimate unit of sampling was followed for the study. Out of 24 A. I. centres (Considering Manikgonj as a centre), 8 centres were selected randomly. From each centre, 2 sub-centres and from each sub-centre two A. I. points were selected on random basis. Finally,

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taking two villages from each A. I. points and 10 adopting households from each village, there were 64 villages and 640 adopting households for detailed investigation.

The study was conducted during 1989-90 and data were collected by survey method with a specially designed questionnaire.

Estimation of cost and returns

The procedure used in estimating the cost and returns is given below:

1. Fixed costs: The depreciation charge on bulls, infrastructure, laboratory equipments and land use values constituted the fixed cost.

a) Depreciation of bull: The depreciation charges were worked out according to straight line method, (Shiyani et al., 1989) based on the value of bull minus its 'debris' value. The useful life of the bulls was considered 10 years.

b) Depreciation of infrastructure and lab. equipments: They were also calculated on the basis of straight line method. The total value of infrastructure and lab. equipments were divided by their respective useful life. The useful life of buildings was considered 20 years and for equipments 2 to 10 years (depending on nature).

c) Land use value: It was the lease value of the land prevailing in the study areas.

2. Variable costs: The variable costs included the payment actually made for salary and allowances, bull maintenance, lab. re-agent, taxes, WASA bills, electricity charge, travelling allowance, oil, fuel and maintenance of vehicle, telephone and postal charges, A. I. tools for one time use and miscellaneous expenses. The interest on variable costs was calculated @ 10 percent per annum.

Returns: The charges on semen, sale of cow-dung, value of fodders etc. were considered as returns to A. I. centres.

Cost of semen: The cost of liquid semen was calculated per dose, per insemination, per conception and per progeny on full-cost and variable cost basis. In full-cost all types of cost were included, while in variable cost only the value of variable inputs were included.

Statistical technique

Simple statistical tools such as mean, percentage, analysis of variance, Duncan's multiple range test (DMRT) and the test of significance of

difference between means were applied.

Results and Discussion

Cost and Returns of A. I. Centres

The cost and returns of A. I. centres are presented in table 1. The fixed cost and the variable costs are presented separately. It appears that total cost of A. I. centres for the year 1989-90 was Tk. 10.99 million. The variable cost was 89.58 per cent of the total cost. The return for the year was Tk. 0.86 million which constituted only 7.84 percent of the total cost. The cost over returns was Tk. 10.13 million, which was subsidized by the government.

In recent years, the Government of Bangladesh has given top priority on the improvement of cattle population through a rapid adoption of the artificial insemination technique. However, the rate of adoption of this technique is still very low at the farm level. Therefore, the Government has been heavily subsidizing the artificial insemination centres to keep the cost of insemination very low at the farm level so that the farmers are encouraged to adopt this technique.

Cost of Semen

The cost of liquid semen in 1989-90 is presented in table 2. It appears from the table that the cost of liquid semen per dose was Tk. 16.17 on full-cost and Tk. 14.48 on variable cost basis. This was more than double the amount calculated by Ahmed (1986) in 1985-86. The higher cost of semen in 1989-90 compared to that in 1985-86 was related to inflation and higher prices of inputs.

Table 2 shows further that the cost of semen per insemination was Tk. 26.65 on full-cost and Tk. 23.88 on variable cost basis. The cost of semen per conception and per progeny on full-cost basis was Tk. 50.64 and Tk. 56.27 respectively, while it was Tk. 45.37 and Tk. 50.41 respectively, on variable cost basis. The Government subsidy on account of liquid semen per dose, per insemination, per conception and per progeny were Tk. 14.90, Tk. 24.56, Tk. 46.67 and Tk. 51.86 respectively. The magnitude of subsidy given on artificial insemination is much higher compared to that of other inputs in the agricultural sector.

The utilization of semen for insemination was

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TABLE 1. COST AND RETURNS OF THE A. I. PROGRAMME IN THE STUDY AREAS (1989-90)

(Taka 38.75 = US \$ 1.00)

Item	Total (Taka)	Percentage of total
Fixed cost		
Depreciation of bull	303,368	
Depreciation of infrastructure	196,500	
Depreciation of laboratory equipments	330,039	
Land use value	314,550	
Total fixed cost	1,144,457	10.41
Variable cost		
Pay and allowances	5,604,868	
Wages	251,711	
Bull maintenance	932,683	
Laboratory re-agent	274,174	
Tax, Water and electricity	148,665	
Travelling allowances	739,503	
Fuel, oil and maintenance	494,575	
Telephone & Postal	43,834	
A.I. tools for one time use	29,750	
Others	429,891	
Interest on variable cost @ Taka 10 per annum	894,967	
Total variable cost	9,844,631	89.59
Total cost	10,989,088	100.00
Return		
Charges of semen	824,412	
Cow dung sale	4,500	
Fodder sale	2,545	
Others	30,328	
Total return	861,785	7.84
Cost over return (Government subsidy)	10,127,303	92.16

poor in the study areas. Table 2 shows that the total production of semen was 0.67 million doses and total number of insemination was 0.41 million in 1989-90. It means that only 61 percent of total semen produced in the centres was used for insemination. The rest was abused or unused. The evidence indicates that there was scope to reduce the magnitude of subsidy by reducing misuse of semen.

An important reason for under utilization of semen was that the supply of semen was more than the demand for it in the study areas. This was related to poor extension work among the farmers. In Bangladesh, most of the farmers are illiterate. They are not expected to take the risk of adopting the artificial insemination technique unless they are properly motivated about the benefits of the technique through extension agents.

The cost of deep frozen semen has been calculated by the Directorate of Livestock Services for the year 1990-91. It was found that the cost of locally produced frozen semen was Tk. 31.25, while the cost of imported one was Tk. 110.00 per dose. The cost of imported frozen semen was much higher than the cost of locally produced semen. The higher cost of imported semen was related to the higher cost of labour in those countries and the transportation charges involved in it. In contrast, Bangladesh has the cheapest supply of labour which made the production cost of semen lower compared to other countries of the world.

Cost Paid by Farmers

Information was collected on the cost of insemination paid by the farmers in the study areas. The analysis of information shows that the cost per insemination was Tk. 22.40 at home and Tk. 13.30 at point (table 3). The average cost of insemination paid by the farmers was Tk. 14.00. The inseminators are generally paid higher fees per insemination when they go to farmer's house to inseminate cattle.

The cost of insemination paid by the farmers was little higher in urban areas than in semi-urban and rural areas (table 3). However, the difference in cost per insemination among urban, semi-urban and rural areas was not found statistically significant at 5% level. The cost paid by the farmers for liquid semen and frozen semen was almost the same for all locations. It appeared that the farmers were indifferent in making their choice for the liquid or the frozen semen. They did not have enough knowledge on the effectiveness of different types of semen.

The Government rate for each insemination was Tk. 5.00 in the reference year. Out of this amount, the Government received only Tk. 2.00 as insemination charges and the rest was paid to the Field Assistant of A. I. as incentive bonus.

TABLE 2. COST OF LIQUID SEMEN PER DOSE, PER INSEMINATION, PER CONCEPTION AND PER PROGENY IN THE STUDY AREAS (1989-90)

Item	Full cost basis (Taka)	Variable cost basis (Taka)	Government subsidies (Taka)
Cost of semen per dose (Total number of doses 679,732)	16.17	14.48	14.90
Cost of semen per insemination (Total number of insemination 402,308)	26.65	23.88	24.56
Cost of semen per conception (52.63 percent of total insemination 216,998)	50.64	45.37	46.67
Cost of semen per progeny (90 percent of total conception 195,298)	56.27	50.41	51.86

TABLE 3. COST OF INSEMINATION PAID BY THE FARMERS IN THE STUDY AREAS (1989-90)

Location	Number of farms	Paid at home (Taka)	Paid at point (Taka)	Average (Taka)	Government rate (Taka)	Cost of semen received by Govt. (Taka)
Urban	120	24.00	15.00	16.50	5.00	2.00
Semi-urban	200	23.00	12.00	13.00	5.00	2.00
Rural	320	20.00	13.50	14.50	5.00	2.00
Total	640	22.40	13.30	14.00	5.00	2.00

The amount to Government subsidy per insemination was worked out as Tk. 24.56. When the average cost of insemination paid by the farmers was Tk. 14.00, there was substantial scope to increase the Government rate per insemination upto Tk. 14.00 for reducing the amount of subsidies. This would cover at least the variable cost of producing per dose of semen.

Conception Rate

The results on conception rate with liquid semen and frozen semen are presented in table 4. The conception rate is the percentage of conceived cows to the total number of cows inseminated in a particular period of time. It appears from the table that the average conception rate with liquid semen on first insemination was 53.63 percent which varied from 52.16 percent in 1984-85 to 64.24 percent in 1989-90. The average conception rate upto the last insemination was 69.97 percent, varying from 64.65 percent in 1984-85 to 73.17 percent in 1989-90. The test

of proportions indicated that the differences in rate of conception over the years were significant at 1% level.

The conception rate with deep frozen semen (table 4) was 70.48 percent upto the last insemination. The difference with that of liquid semen was not statistically significant. The non-return rate for liquid semen was 80.70 percent and it varied from 78.30 to 84.14 percent in different years. The non-return rate for females with deep frozen semen was 68.90 percent which was lower than that of liquid semen. The number of services required per conception for liquid and frozen semen were 1.89 and 1.96 respectively in the year 1989-90. The conception rate and services required for each conception remained almost static over the years.

The results of this study show that the conception rate at first insemination was low and that the number of services required for an average conception was high. About 30 percent of cows was not conceived at all with A. I. at

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any level of insemination. As a result the cost of conception became relatively high.

The problems of conception with artificial insemination were identified. These were genital diseases, poor quality of semen, wrong heat

detection, lack of technical knowledge and mal-nutrition. These problems need to be solved on a priority basis to make the A. I. programme a success in Bangladesh.

TABLE 4. CONCEPTION RATE OF INSEMINATED CATTLE (1984-85 to 1989-90)

Year	Non-return rate (%)	Conception rate		Service per conception
		First insemination	Upto last insemination	
1984-85	84.14	52.16	64.65 ^f	1.95
1985-86	79.89	53.02	69.19 ^c	1.92
1986-87	82.41	53.20	66.95 ^e	1.91
1987-88	78.30	53.21	70.65 ^b	1.91
1988-89	83.21	54.58	68.82 ^d	1.87
1989-90	78.40	54.24	78.19 ^a	1.89
	(68.90)		(70.48)	(1.96)
Total	80.70	53.63	69.57	1.90

^{a,b,c,d,e,f} Means dissimilar superscripts in each column ($p < 0.05$).

Figures in the parentheses indicate non-return rate, conception rate and service per conception using deep frozen semen.

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Literature Cited

- Ahmed, Z. 1986. Cattle Breeding and Artificial Insemination in Bangladesh. Central Cattle Breeding Station (CCBS), Savar, Dhaka, Bangladesh.
- Alam, J. 1977. The draft power shortage in Bangladesh. Asian Profile, Vol. 15, No. 6.
- Alam, J. 1992. The Status of Livestock Sector in Bangladesh: Implications for Research. A Key-Note paper presented at the Inaugural Session of the workshop on Livestock Research in Bangladesh held on February 2, 1992 at Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh.
- Shiyani, R. L., R. D. Patel and D. B. Kuchhadiya. 1989. Economics of buffalo milk production in Kheda district of Gujrat state. The Indian Journal of Dairy Science, Vol. XLII, No. 1.