

## A Comparative Study on the Efficiency of Locally Made Low Cost Brooders for Brooding Chicks

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**ABSTRACT :** An experiment was carried out with day-old "Sonali" ( $\delta$ RIR $\times$  $\phi$ Fayoumi) chicks to investigate the efficacy of locally made low cost brooders for brooding chicks in rural areas. Three types of indigenous brooders viz. charcoal, haricane and sawdust brooders were used for brooding chicks throughout the experimental period of 28 days. The efficiency of the brooders was observed in respect of their ability to maintain temperature, fluctuation in temperature during operation and cost effectiveness. Following initial trial of temperature maintenance for 48 h, the chicks were put under the brooder stoves and brooded up to 28 days. The experimental birds were fed on chick starter diet. Maintenance of temperature with sawdust brooders was found satisfactory and optimum for brooding the chicks at different stages of brooding and at the same time involved least cost for brooding in comparison with charcoal and haricane brooders which did not perform well in generating heat necessary for brooding and were not economically feasible for poor farmers. On the other hand, performance of charcoal brooders was better in respect of temperature maintenance during initial stage (when the brooder was started) but the temperature fluctuated rapidly, whereas fluctuation of temperature was gradual in sawdust brooders. Body weight gain and feed conversion were best in sawdust brooders. Survivability was highest in sawdust brooders and lowest in haricane brooders. Sawdust brooders may be appropriate for brooding chicks in rural areas, where electricity is not available. (*Asian-Aust. J. Anim. Sci.* 2004, Vol 17, No. 11 : 1586-1590)

**Key Words :** Brooder, Chick

### INTRODUCTION

In rural areas of Bangladesh, most of the poultry have been raised traditionally. It is estimated that there are approximately 139 millions of poultry in the country, most of which are maintained by the woman of the family and fed on household wastes and crop residues (Rahman, 2003). About 89% of rural livestock households rear poultry and the average number per household is 6.8 (Islam et al., 2003). In this regard poultry keeping is one of the most appropriate income generating activities of the small farmers in Bangladesh (Table 1).

Brooding refers to the early period of growth when young chicks are unable to maintain body temperature without the aid of supplemental heat. A complete brooder is simply a special form of house designed for the purpose of keeping chicks comfortable (Nesheim et al., 1979). Brooding is essential to provide artificial heat to the birds to adjust their body temperature with the environmental temperature during early stage of life. Brooding is done from day-old to 4 or 5 weeks of age in summer and may be 5 or 6 weeks in winter. Brooding also necessitates making the birds ready so that they can show maximum potential

for production of either meat or eggs.

Farmers are facing some problems during rearing of chickens. As regards brooding, most of the modern brooding systems require electricity as the main source of power and heat, but in many parts of a third world country like Bangladesh, electricity is not yet available. Even where it is available there is a high probability of power failure. In those cases the farmers need alternative system of brooding chicks by which the farmers can be benefited if they would have easy access to resources and opportunities to adopt new agro-based low cost rural brooding systems. So technologies need to be generated for the development of rural poultry, so that the small farmers can make quick economic returns with lower investment. The present research work was carried out with the following objectives: 1) To develop a low cost brooder suitable for brooding chicks in the rural areas. 2) To study the performance of chicks under different brooders. 3) To know the cost effectiveness of the technology for the rural small farmers.

### MATERIALS AND METHODS

The experiment was conducted under the project entitled "Smallholder Livestock Development Project in Five Southern Districts" (SLDP-2) in collaboration with the Department of Poultry Science, Bangladesh Agricultural University, Mymensingh, Bangladesh. The research work was carried out with day-old "Sonali" (RIR $\times$ Fayoumi) chicks for a period of 28 days to examine the efficiency of

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**Table 1.** Distribution of households engaged in poultry rearing

Locality	Poultry (%)	
	Engaged domestically	Engaged commercially
Bangladesh	74.0	0.9
Urban	39.0	0.6
Rural	81.0	1.0

Source: Seminar Proceedings of the Bangladesh Animal Husbandry Association, 2003.

locally made low cost brooders. Under this research programme, comparative efficiency of three locally made brooders (sawdust, charcoal, haricane brooders) were compared in terms of maintenance of temperature and at the same time fluctuation of set temperature, cost effectiveness and durability of brooders. The research work was completed in two phases: Phase I: Temperature trial and Phase II: Brooding of chicks.

"Sonali" chicks were obtained from Central Poultry Breeding Farm, Mirpur, Dhaka, Bangladesh. Fresh, dry rice husk was spread at a depth of about 7.0 cm as litter material. Newly made brooder stoves were placed randomly in the partitioned pen. After completion of the first phase of the experiment, feeders and drinkers were placed in the house. A thermometer was hung in the experimental room. The total number of chicks (1 day-old) was 360. They were weighed and randomly allocated to 3 treatment groups. Each treatment was replicated 3 times with 40 chicks in each replicate group.

### Construction and design of the brooders

Charcoal and sawdust brooders were made with galvanized iron sheet with no lid. These were drum like structures. The height of the structures was 38.1 cm and diameter was 33.0 cm. In charcoal brooders, thin rods were placed parallel at a spacing of 1.3 cm to hold the coals inside the brooder. In the case of sawdust brooders, at the lower part 7.6 cm from the base an opening of about 10.16 cm diameter was made to pass air which facilitates the burning of sawdust. Medium size ready made haricane was used as haricane brooder. One brooder was used for each replication of 40 chicks.

### First experimental phase (temperature trial)

This phase of the experiment was continued for 48 h. In this phase, hourly recording of the temperature of the heating sources were done from each replicate group. This phase was conducted to examine how these heating sources were working and whether or not these temperature ranges would be sufficient for brooding the chicks.

### Second phase (brooding of chicks)

This phase was started after 48 h of temperature range trial and continued up to 4 weeks of age. In this phase, daily room temperature, maintaining temperature of brooder

stoves and weight gain of birds were recorded. After starting, the charcoal and sawdust brooders were allowed half an hour to exhaust the fumes outside the house.

### Feeding and management

Starter diet as recommended in the Shaver 579 Commercial Management Guide for egg type chickens was supplied to the experimental birds. Feed was supplied *ad libitum* throughout the experiment. The birds were exposed to similar care and management practices in all treatment groups throughout the experimental period. The following management practices were performed during the experimental period. After arrival of 1 day-old chicks, they were provided with glucose solution to minimize dehydration stress. The chicks were provided with 38.7 cm<sup>2</sup> floor space per bird during the experimental period. Fresh, clean and cool drinking water was made available at all times in round water containers. Beak trimming (Glatz, 2000) was performed at 10th day of age for better access to feed and avoidance of cannibalism.

### Feeder and waterer management

In the early life of chicks, for the first 2 days, feed was supplied on paper for feeding, and then, one round feeder and one round waterer were given for each replication. After 7 days one extra feeder was provided to each pen. Required feeding and drinking space were provided according to the number and age of the birds in each replication. The feeders and waterers were fixed in such a way that the birds were able to eat conveniently. Feeders were cleaned at the end of each week, and waterers were washed twice a day.

### Brooding management

The experiment was conducted in the month of April to May, 2003. During the experiment, the environmental temperature satisfied the requirement of brooding temperature and no additional heating was required. Brooders were fixed according to chicks' behaviour and need. Hard board was used as a chick guard and was removed at the end of the 1st week.

### Lighting

The birds were exposed to a continuous lighting of 23 h and then a dark period of 1 h. The dark period provision was practiced to make the birds familiar with darkness. During night, one 60 watt electric bulb was used for necessary lighting in each pen. The light was set up 2.33 m above the floor.

### Management of temperature and humidity

In order to maintain good ventilation and required temperature and humidity inside the house, all windows

**Table 2.** Minimum and maximum temperatures (°C) recorded from different types of brooders and fluctuation of temperature during the first week of the experimental period

Age (weeks)	Treatment	Temperature (°C)					
		Day time			At night		
		Min	Max	Average	Min	Max	Average
1	T1	31.32	36.58	36.94	30.93	36.32	33.53
	T2	31.29	31.74	31.43	31.05	31.50	27.314
	T3	34.61	35.93	35.21	34.38	35.72	35.02
	LSD	0.338	0.456	0.428	0.114	0.561	0.276
	Level of significance	**	**	**	**	**	**
2	T1	29.74	35.38	32.48	29.54	35.11	32.22
	T2	28.93	31.01	29.63	30.47	30.83	30.58
	T3	32.42	32.93	31.86	30.95	32.62	31.53
	LSD (SED)	2.575	1.072	1.516	(0.843)	1.028	(0.576)
	Level of significance	*	**	**	NS	**	NS
3	T1	29.11	35.21	32.03	28.82	34.94	31.80
	T2	29.61	29.97	29.68	29.40	29.78	29.51
	T3	28.61	31.81	30.11	28.54	29.46	30.02
	LSD	0.490	0.290	0.257	0.506	0.922	0.556
	Level of significance	**	**	**	*	**	**
4	T1	-	-	-	27.97	33.97	30.33
	T2	-	-	-	27.00	28.11	27.69
	T3	-	-	-	26.51	29.92	28.14
	LSD	-	-	-	0.652	0.548	1.711
	Level of significance	-	-	-	**	**	*

T1, T2 and T3: Charcoal, Haricane and Sawdust brooders respectively. \*\* p<0.01.

were kept open during day time. The housing temperature and relative humidity were recorded 3 times in a day (6:00, 14:00 and 22:00) using a thermometer.

### Record keeping

One day-old weight of birds was recorded at the beginning of the experiment, and the final body weight was taken at the end of the experiment. The birds were weighed just prior to morning feeding and the average live weight and daily weight gain of birds were calculated for each replication. Daily feed intake of birds throughout the experimental period was recorded. Brooder temperatures were recorded hourly for 48 h in the first phase. In the second phase of the experiment, brooder temperatures were recorded at two hours interval from the point of starting to the end of heat produced by the brooders. The per cent viability of the birds was calculated for each replication at the end of the experiment, by dividing the number of birds surviving by the total number of birds housed at the beginning and multiplying by 100.

### Brooding cost was calculated using the following formula

$$\text{Brooder cost (Tk/chick)} = (\text{total cost of brooder (Tk)} / (\text{longevity of brooder (years)} \times \text{No. of chicks brooded per batch} \times \text{No. of batches to brood each year}))$$

$$\text{Fuel cost (Tk/chick)} = (\text{cost of fuel in each day (Tk)} \times \text{duration of the brooding period (days)}) / (\text{No. of chicks brooded})$$

$$\text{Total brooding cost (Tk/chick)} = \text{brooder} + \text{fuel cost}$$

### Statistical analysis

All the recorded and calculated data were analyzed for ANOVA using a Completely Randomized Design (CRD) with the help of a computer package, MSTAT-C. Significant differences for comparison of mean values of all recorded and calculated parameters among the treatments were calculated by using Least Significant Differences (LSD).

## RESULTS AND DISCUSSION

### Maintenance of temperature in different brooder stoves

The temperature record of different brooders throughout the experimental period is shown in Table 2. During the first week, in both daytime and at night, average temperatures of T1 (Charcoal brooder), T2 (Haricane brooder) and T3 (Sawdust brooder) differed significantly. Average temperature of T3 (Sawdust brooder) was optimum for efficient brooding during that period. At that time, highly significant (p<0.01) variation was observed between T2 (Haricane brooder) and T3 (Sawdust brooder). Temperature of T1 (Charcoal brooder) was closely related to the standard temperature for brooding (Shaver 579 Commercial

**Table 3.** Cost of brooding (Tk/chick) of different brooders

Parameter	Treatments			LSD	Level of significance
	T1	T2	T3		
Brooding cost	14.43	9.65	6.52	6.151	**

T1, T2 and T3: Charcoal, Haricane and Sawdust brooders respectively.

\*\*  $p < 0.01$ .

Management Guide) during that period. Temperature of T2 (Haricane brooder) was too low for brooding at that period. During the 2nd week, daytime minimum temperature differed significantly ( $p < 0.05$ ) and highly significant differences ( $p < 0.01$ ) were found between maximum and average temperatures (Table 2) among different treatment groups. At night, minimum and average temperatures did not differ significantly and highly significant variation ( $p < 0.01$ ) was only observed in maximum temperature. Average temperature of T1 (Charcoal brooder) was found optimum for brooding at that period, and the result was consistent with the Shaver 579 Commercial Management Guide. T3 (Sawdust brooder) was closer to optimum, and suitable for brooding but T2 (Haricane brooder) was cooler than T1 (Charcoal brooder) and T3 (Sawdust brooder). During the 3rd week daytime, highly significant variations ( $p < 0.01$ ) were found in temperature maintenance among different treatment groups. At night, minimum temperatures differed significantly ( $p < 0.05$ ) but highly significant ( $p < 0.01$ ) differences were found between maximum and average temperatures among treatment groups. Though average temperatures of T2 (Haricane brooder) were suitable for brooding at that period, it did not perform in generating heat at different weeks throughout the experimental period whereas T3 (Sawdust brooder) performed well and was more or less consistent with the optimum temperature. The T1 (Charcoal brooder) was warmer than the T2 (Haricane brooder) and T3 (Sawdust brooder). During the 4th week daytime, environmental temperature was sufficient for brooding, so brooder stoves were not used at that time. At night, highly significant ( $p < 0.01$ ) differences were found between minimum and maximum temperatures but average temperatures differed significantly ( $p < 0.05$ ) among different treatment groups. Average temperature of T3 (Sawdust brooder) was suitable for brooding at that time and temperature of T2 (Haricane

brooder) was also sufficient at that period but it did not perform well throughout the experimental period. Temperature of T1 (Charcoal brooder) was higher than T2 (Haricane brooder) and T3 (Sawdust brooder). Hence T3 (Sawdust brooder) was found efficient and satisfactory in respect of maintenance of proper temperature.

### Fluctuation of temperature

Significant differences ( $p < 0.01$ ) were found between minimum and maximum temperatures among different brooders and greater fluctuations of temperature (Table 2) were observed in T1 (Charcoal brooder) than that of T2 (Haricane brooder) and T3 (Sawdust brooder). During the 2nd week at night, no significant difference was found in minimum temperature but maximum temperature differed significantly ( $p < 0.01$ ) among different treatment groups. In the case of T1 (Charcoal brooder) initial temperature (when brooder started) was high but it fluctuated rapidly and finally the temperature was not sufficient for brooding as per requirement. It was also difficult to maintain optimum temperature needed at different stages of brooding. In the case of T2 (Haricane brooder) rate of increase in temperature was very low and was not sufficient for brooding during the 1st and 2nd week of age. It was suitable for the 3rd and 4th week brooding. The T3 (Sawdust brooder) was efficient in generating heat and maintaining temperature required at different stages of brooding. It was also easier to maintain temperature in this type of brooder.

### Cost effectiveness

Cost of brooding differed significantly ( $p < 0.01$ ) among different treatment groups. Brooding cost per chick was Tk 14.43 in T1 (Charcoal brooder), Tk 9.65 in T2 (Haricane brooder) and Tk 6.52 in T3 (Sawdust brooder). Sawdust brooder gave lower cost of brooding as compared to Haricane and charcoal brooder (Table 3).

### Live weight

Initial weight of chicks on different treatments was similar ( $p > 0.05$ ). The result (Table 4) shows that highly significant ( $p < 0.01$ ) variation was observed in final live weight at 4 weeks of bird among different treatments. The

**Table 4.** Performance of chicks under different brooders

Parameters	Treatment			LSD (SED)	Level of significance
	T1	T2	T3		
Initial weight (g/bird)	25.12	25.10	25.08	(0.078)	NS
Final weight (g/bird) at 4-week-old	235.17	226.83	254.17	6.151	**
Weight gain (g/bird)	210.05	201.73	229.08	6.019	**
Feed intake (g/bird)	579.53	591.09	592.87	(8.53)	NS
FCR	2.76	2.93	2.58	0.1014	**
Livability (%)	91.67	85.00	96.67	8.234	*
Performance index (%)	8.53	7.74	9.85	0.3725	**

T1, T2 and T3: Charcoal, Haricane and Sawdust brooders respectively. \*  $p < 0.05$  and  $p < 0.01$  respectively.

highest live weight gain was found in T3 (Sawdust brooder). Poorest live weight gain was found in T2 (Haricane brooder).

#### Feed intake

Similar feed intake ( $p < 0.05$ ) was observed on different treatments (Table 4).

#### Feed conversion

Feed conversion differed significantly ( $p < 0.01$ ) in different treatment groups (Table 4). Superior feed conversion (2.58) occurred in T3 (Sawdust brooder) and inferior feed conversion (2.93) was observed in T2 (Haricane brooder). Feed conversion was medium (2.76) in T1 (Charcoal brooder).

#### Viability

The viability of experimental birds was 91.67% in T1 (Charcoal brooder), 85% in T2 (Haricane brooder) and 96.67% in T3 (Sawdust brooder) as shown in Table 4. Birds were not affected by pathogenic organisms and deaths were mainly due to low brooding temperatures.

#### Performance index

Performance index ( $p < 0.05$ ) was higher in T3 (Sawdust brooder) and lower in T2 (Haricane brooder). The result shows that the performance of birds was best under sawdust brooder and poorest in Haricane brooder.

#### Chick behaviour

It was found during the course of experiment that when brooder temperature was too high the birds were away from the brooder stoves and when the temperature was too low the birds gathered under the brooder stoves. The behaviour

and movement of chicks was found to be more satisfactory in T3 (Sawdust brooder) than in T1 (Charcoal brooder) and T2 (Haricane brooder). This behaviour of chicks was consistent with the results of Pieper et al. (1995). In T2 (Haricane brooder) the birds were often found gathered under the brooder stove. Satisfactory brooding temperatures were not achieved from this type of brooder. In T1 (Charcoal brooder) initially the birds were found with satisfactory movement because the birds got optimum temperature but in later stages when temperature fluctuated rapidly, the birds were gathered under the brooder stoves.

## REFERENCES

- Glatz, P. C. 2000. Beak Trimming Methods-Review. *Asian-Aust. J. Anim. Sci.* 13:1619-1637.
- Hossain, S. A. 2003. Poverty Alleviation through Livestock and Poultry Development. In: Seminar Proceeding of Bangladesh Animal Husbandry Association, pp. 13-17.
- Islam, M. N., Q. M. E. Haque and D. C. Paul. 2003. A Strategy for Small Holder Poultry Production in Bangladesh. In: Proceedings of 3rd International Poultry Show and Seminar, Organized by World's Poultry Science Association-Bangladesh Branch pp. 216-224.
- Nesheim, M. C., R. E. Austic and L. E. Card. 1979. Brooding and Rearing. In: *Poultry Production*. 13th eds, Lea and Febiger Ltd., K. M. Varghese Co., Bombay, India.
- Pieper, U. M., I. Nir and J. Kashti. 1995. A new technique for the behavioural analysis of chicks during the brooding period. *Poult. Abstr.* 21:14.
- Rahman, M. 2003. Growth of Poultry Industry in Bangladesh Poverty Alleviation and Employment Opportunity. In: Proceedings of 3rd International Poultry Show and Seminar, Organized by World's Poultry Science Association-Bangladesh Branch, pp. 1-7.
- Shaver 579. 1979. Commercial Management Guide.