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Full Length Research

On-farm comparative evaluation of Solomon hay-box brooder and Mekete bamboo brooders at Basketo Special District, Southern Ethiopia

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ABSTRACT: The study was conducted in two peasant associations (ZabaEla and GezaAyima) and in one city administration (laska) at Basketo special district of SNNPR, Ethiopia. The objective of this study was to compare Solomon hay-box brooder with Mekete bamboo brooder for growth and production performances of day-old chickens**.** Ten randomly selected households (5 participants with Solomon hay-box and 5 participants with Mekete Bamboo brooder) were involved and each received 50-dayoldkoikok breed chicks. The brooders were used during the night whereas chick-runs were used to hold and feed the chicks during the day. During the brooding period (up to 8 weeks old), chicks were fed on commercial starter ration. Water was provided to chickens at *ad libitum*. All collected data were analyzed by using statistical package for social science (SPSS) version 20.0. The total cost for building Solomon hay-box with 50 chicken capacities was 4600BIRR and 910BIRR for Mekete bamboo brooder. About 92, 89.2, 87.6 and 86% of chick survivability was recorded at 2nd, 4th, 6th and 8th weeks, respectively at Solomon hay-box and for Mekete bamboo brooder the result was 94.8, 91.6, 90 and 88.8% at 2nd, 4th, 6th and 8th weeks, respectively. The average age at first egg laying at Solomon hay-boxwas 139.6 days and 145.4 days at Mekete bamboo brooder. Average weight of eggs at Solomon hay-boxwas 39.16 g and 38.38 g at Mekete bamboo brooder. The average weight of male and female chicken at 20 weeks of age was 1.63 and 1.18 kg, respectively at Solomon hay-box and 1.61 and 1.18 kg for Mekete bamboo brooder. Both brooders have almost similar capacity in all compared parameters except that of cost of input. So, introducing economical brooder is compulsory to increases profitability of farmers.

Keywords: Basketo, chick, koikok, mortality, weight, Ethiopia.

INTRODUCTION

Chicken population in Ethiopia is estimated to be about 56.06 million including cocks, cockerels, pullets, laying hens, non-laying hens and chicks. Most of the chicken are chicks and followed by laying hens. With regard to breed, 88.19, 6.45 and 5.36% of the total chicken were reported to be indigenous, hybrid and exotic, respectively. Southern Nation Nationalities and Peoples (SNNP) region contributes to 18.8% of the total chicken population in the country. Within the SNNP region majority of the chickens are found in Sidama zone followed by GamoGofa zone (CSA, 2018).

The majority of the national poultry population (41.7%) is baby chicks characterized by extremely high mortality. Due to lack of temperature regulation, about 60% of the chicks hatched in the countryside of Ethiopia die during the first eight weeks of age, as day-old chicks need external heating to regulate own body temperature (Dessie and Ogle, 2001).

Chick brooding refers to the early periods of growth (0-8 weeks), when young chicks are unable to maintain their normal body temperature without the aid of supplementary heat. Unlike most other small animals, baby chicks are

unable to live for any length of time without an additional source of heat other than their own bodies. Different artificial chick brooders exist of every conceivable type and size, heated by oil, coal, wood, water, gas and electricity. With the exception of the electric brooders, all other methods are difficult to operate with local skills in rural areas. They do not maintain constant brooding temperature, require foreign currency for importation and are expensive in size of less than 1,000 chick capacity. On the contrary electric brooders are economically feasible, could safely and easily be constructed and maintain the desired constant brooding temperature (Solomon, 2007).

It is by natural brooding that the indigenous baby chicks are raised all over rural Africa including Ethiopia. The broody hen is rearing and protecting few chicks and ceases laying during the entire incubation and brooding periods of up to 81 days. Yet the success of the brooding process depends on the maternal instinct of the broody hen and the prevalence of predators such as birds of prey, pets and some wild animals, all of which are listed as the major causes of premature death of chicks (Solomon, 1999). Natural brooding as it is practiced in different parts of rural Africa is characterized by high chick mortality. The average survival rate of baby chicks to an age of 3-months reared under natural brooding condition in Ethiopia is about 40 percent (AACMC, 1984; Hoyle, 1992) and the other parts of rural Africa are not exception to this situation.

The general observation is that broody hens cease egg laying for 2.7 months for the purpose of rearing 2.8 chicks to an age of 3 months (Solomon, 2010). Mortality will be reduced if an artificial chick brooding system is adopted. The supply of improved pullets and cockerels from the government poultry multiplication and breeding centers however was not adequate for the demand of improved chicken production. Hence, the Ministry of Agriculture (MoA) cannot claim to have had a sustainable and measurable impact on the rural communities that it was expected to serve in the area of poultry production. It seems difficult to expect rapid and positive change through the supply of 3 months old pullets and cockerels from the government poultry multiplication centers. Although these centers have adequate hatching capacity, they cannot meet the huge demand for brooding facilities. Brooding chicks by using the hay-box chick brooding technology, that was developed at Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) seems promising in bridging this gap (Nigussie et al., 2003).

But at the present condition, hay-box chicken brooding technology is expensive in farmers economic level and this study was conducted to evaluate the effect of modified Mekete bamboo chicken brooding technology and comparing it advantage with that of Solomon hay-box chicken brooding technology. Therefore, the objective of this study was to compare Solomon hay-box brooder with Mekete bamboo brooder for growth and survival performances of day-old chickens and to evaluate social acceptance and economic feasibility of the technologies for day-old chickens' growth.

MATERIAL AND METHODS

Description of the study area

Basketo Special District is one of Special Districts of SNNP Region. It is located at 310 km west of Arbaminch, the existing place of Arbamnich agricultural research center and 626 km south of Addis Ababa and lies between 6°37′ and 6º65´N and 37°51′ and 37º80′E latitude and longitude ranges, respectively. The total land coverage of the Woreda is 105,750.75 ha. From these, the areas covered by annual as well as perennial crops are 19,250 ha, by cultivable lands are 63,188 ha ,by grazing lands are 2,250 ha, by forest land 491.75ha with an altitude ranging from 780 to 2,200 m above sea level and minimum and maximum temperature of 15 and 27°C, respectively; while average annual rainfall is 1,200 mm/year. The major town in this district is Laska. The district is bordered on the east and north by Gezegofa district of Gofa Zone, on the south by Semen Ari district of South Omo Zone and on the west by Salamago districts of South Omo zone. The District had an estimated total 62,184 head of cattle; 12,514 sheep; 20,421 goats; 52 horses; 245 mules; 3,985 donkey; 71,489 poultry of all species and 986 beehives (Basketo special District Agricultural office, 2018). The study was conducted in two peasant associations (ZabaEla and GezaAyima) and in one city administration (laska) at Basketo Special Woreda of SNNPR, Ethiopia. Both peasant associations and the city administration found in the same agro-ecology.

Participant selection

Participants were selected purposively in collaboration with district livestock and fishery office. Ten participants were selected, who fulfilled the required preconditions (willingness to house construction, feeding and watering material preparation and to cover cost to buy chicks). Then training was given on construction of poultry house, health management, feeding and watering management and data recording. Finally, day-old Koekoek chicken was distributed among those farmers at their gate with starter ration and some medication materials.

Disease prevention and control

Disease prevention and control action was undertaken using the district livestock health experts. Those health experts provided vaccination against poultry diseases such as Marex at day one, New castle/HB1 at day three, Newcastle/HB1 and Gumboro at day seven, Gumboro at day fourteen, Newcastle/Lasota at twenty-one day,

Figure 1. Picture of Solomon hay-box brooder (in the left) and Mekete bamboo brooder (in the right).

Gumboro and fowl typhoid at twenty-seven day and Gumboro at thirty-five day-old.

Experimental birds and their management

Solomon hay-box brooder uses 30 cm (height) x 57 cm (width) x 57 cm (Length) [A (area) =L x W, 57 x 57 = 3249 cm^2] for brooder box and Mekete bamboo brooder uses 30 cm height with that of 64.33 cm diameter circular box [($A = \pi r^2 = 3.14 \times 32.166^2 = 3249$ cm^2].

For comparison of Solomon hay-box brooders with that of Mekete bamboo hay-box brooder (Figure 1), a total of 500-day old chicks of "Potchefstroom Koekoek" breed was purchased from DebreZeit Agricultural Research Center. Those chicks were randomly selected, weighed at day old age, divided into batches of 50 and transferred to each of 10 brooders with 50 chick capacity (5 Solomon hay-box brooders and 5 Mekete bamboo brooders), each brooder was replicated 5 times. Data collection formats were prepared and given to each participant to record all the required data. Intensive follow up during the brooding phase and monitoring and evaluation was undertaken by the team of researchers from Arbaminch Agricultural Research Center. Up to eight weeks of age, chicks were provided with commercial starter ration and water *ad libitum*. All farmers were trained on chicken management practices.

Data collection

Data was collected on cost of brooder construction, survivability (Death of chicks that occurred due to either disease, predator, mechanical or others were recorded), age at first egg, body weight at 20th week. To evaluate those technologies, field day and research presentation forum were organized and undertook.

Field day arrangement

Field day was arranged when the chicken was at the age of 12th weeks so as to create awareness as time passes by and benefits realized, all participants got a conviction to consider the technology as a viable agricultural venture. Accordingly, 215 (154 male and 61 female) farmers and 24 (19 male and 5 female) researchers, experts and government officials from regional and district level participated on field day.

Data analysis

Descriptive statistics of questionnaire data were analyzed using descriptive statistics of Statistical Package for Social Sciences (SPSS 20.0).

RESULTS AND DISCUSSION

Survivability of chicks and cost of building materials

Acceptances of both brooders by participant farmers were

Table 1. Survived chicks at two months.

Replication	Solomon hay-box brooder				Mekete bamboo brooder			
	2nd week	4th week	6th week	8th week	2nd week	4th week	6th week	8th week
1	45	45	45	45	47	44	43	43
2	47	47	46	46	48	46	46	45
3	47	45	45	43	50	50	48	47
4	44	42	41	41	50	48	48	48
5	47	44	42	40	42	41	40	39
Total	230	223	219	215	237	229	225	222
Survivability (%)	92	89.2	87.6	86	94.8	91.6	90	88.8

Table 2. Costs of input.

Participants	Solomon hay-box brooder				Mekete bamboo brooder			
	Brooder construction cost	Chick cost	Feed cost	Total cost	Brooder construction cost	Chick cost	Feed cost	Total cost
1	920	300	700	1920	182	300	800	1282
2	920	300	300	1520	182	300	1300	1782
3	920	300	1900	3120	182	300	2040	2522
4	920	300	1550	2770	182	300	1200	1682
5	920	300	1500	2720	182	300	1980	2462
Total	4600	1500	5950	12050	910	1500	7320	9730

due to their usefulness in dramatic change in chick mortality as compared to the broody hen. As shown in Table 1, at two months of age which is for chicks to be freed from brooders, 86% of the chicks survived from Solomon hay-box brooder and 88.8% from Mekete bamboo brooder type. Causes for the death of the majority of chicks were management problem. Using Solomon box brooder, the current study clearly showed that about 92, 89.2 and 86% of the distributed chickens survived to an age of 2, 4 and 8 weeks respectively and using Mekete bamboo brooder, the study clearly showed that about 94.8, 91.6 and 88.8% of the distributed chickens survived to an age of 2, 4 and 8 weeks respectively. This survivability rate was high according to the Ethiopian standards. In another study, the death of the chickens was 12(8%), 1(0.67%) and 4(2.67%) negative control, Pot-charcoal under 500 gm charcoal (positive control) and Cotton –plate as-cage (Mulugeta Brooder) test brooder respectively (Mulugeta, 2013). The findings of this study indicating that both brooder types have almost similar survivability percentage.

Cost preference was influential factor during comparison and showed that due to the difference of building materials of those brooders, Solomon hay-box brooder of 50 chick capacity costs 4,600birr and Mekete bamboo brooder of 50 chick capacity costs 910 birr so Mekete bamboo brooder is of lower cost (Table 2). This indicated that Mekete bamboo brooder has a reduced cost of purchase by one fourth as compared to Solomon hay-box brooder. This showed that farmers could minimize their cost by using Mekete bamboo brooder with a similar result of chicken growth and survival rate as compared to Solomon hay-box brooders (Table 1).

Age at first laying and average weight of eggs

Recorded average age at first laying was 139.6 days for chickens at Solomon hay-box brooder and 145.4 days for those which are at Mekete Bamboo brooder (Table 3). The average weight of eggs at first laying was 39.16 g for those at Solomon hay-box and 38.38 g for Mekete Bamboo brooder. The result of chickens at Solomon hay-box brooders was comparable with Nithimo (2004), Addis et al. (2012), DZARC Annual Report (2012), Getiso et al. (2016), Kassa et al. (2016), Atsbaha et al. (2018) who reported that the average age of first laying recorded and average weight of eggs at first laying was 149 days and 40.2 g, 153.3 days and 48.8 g, 130 days and 55.7 g, 194.4 days and 39.01 g, 219 days and 38.7 g and 150 days and 44.2 g at Areka area of SNNP region, Ada"a and Lume districts, South Africa, Mehoni areas of Southern Tigray Zone, Jimma Zone of South Western Ethiopia and Debrezeit Agricultural Research center, respectively. The above discussed results were obtained by using Solomon hay-box.

Weight of chicken

The average weight of chicken recorded at 20 weeks of age under farmers management condition was 1.63 kg

Table 3. Age at first laying and average weight of eggs.

Participants	No. of female chicken at first egg laying	Average age at first egg laying (days)	Average wt. of egg at first laying (gm)
Solomon hay-box			
1	18	141	38.0
2	21	139	43.1
3	19	135	35.0
4	14	137	38.5
5	26	146	41.2
Average		139.6	39.16
Mekete bamboo brooder			
1	16	151	40.5
2	23	149	42.0
3	18	143	35.4
4	20	144	38.0
5	15	140	36.0
Average		145.4	38.38

Table 4. Body weight record (at 20 weeks of age).

Participants	No. of sample taken		Average body weight (kg)	
	Male	Female	Male	Female
Solomon hay-box brooder				
1	5	5	1.59	1.06
2	5	5	1.49	1.15
3	5	5	1.67	1.38
4	5	5	1.71	1.29
5	5	5	1.69	1.03
Mekete bamboo brooder				
1	5	5	1.72	1.20
2	5	5	1.59	1.18
3	5	5	1.71	1.24
4	5	5	1.50	1.12
5	5	5	1.52	1.15

and 1.18 kg for male and females' chickens which are raised under Solomon hay-box and 1.61 kg and 1.18 kg for Mekete Bamboo brooder, respectively (Table 4). Other researches on koikok chicken breed with Solomon hay-box brooder at Areka town, SNNPR, Getiso et al. (2016) reported that a body weight of 1.5 kg and 1.1 kg for male and female at 20th week of age. Similarly, Aregaw and Mengistu (2011) also reported average body weight of 1.39 kg at 19th weeks of age for Koekoek breeds at on station feeding trial at Haramaya University. In another study, Banerjee et al. (2013) reported that male and female chickens weighted 1.04 kg and 1.01 kg of body weight at 15 weeks of age, respectively at Hawassa University in intensive feeding system. In general, the body weight of koekoek breed achieved in this study showed that there is good potential in the area.

Conclusion and recommendations

The results obtained from this study show that both brooders (Solomon hay-box brooder and Mekete bamboo brooder) have almost similar capacity in all compared parameters except for the cost of the brooders production which is four times higher in Solomon hay-box brooder as compared to Mekete bamboo brooder. This showed that farmers could minimize their cost by using Mekete bamboo brooder with a similar result of chicken growth and survival rate as compared to Solomon hay-box brooders. Based on the above conclusion the following points are forwarded as

recommendation.

1. Awareness creation in society about the importance of chicken brooding should be performed.
2. Adoption and scale-up of both brooders, improved chickens, small scale housing, feeds, vaccination and training package should be given to the extension and development programs in the study area.
3. Rural dweller should be encouraged to use brooders by providing them with economical brooder like Mekete bamboo brooder I order to increases their profitability.

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CONFLICT OF INTEREST

The authors declared that they have no conflict of interest.

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