



International Network for Family Poultry Development
Réseau International pour le Développement de l'Aviculture Familiale
Red Internacional Para El Desarrollo de la Avicultura Familiar
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Good Practices for Family Poultry Production



Hay Box Brooder: A Milestone to Increase Rural Households Poultry Production

by

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Recommended Citation

Solomon Demeke. 2012. Hay Box Brooder: A Milestone to Increase Rural Households Poultry Production. INFPD Good Practices of Family Poultry Production Note No 01.

Keywords

Hay Box, brooder, rural poultry

Date of publication:

October 2012

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Acknowledgements

The purpose of the International Network for Family Poultry Development (INFPD) is to share information about poultry production among scientists, researchers, policy makers, educationists, students and development workers and to promote the cause of family poultry production.

Good Practices of Family Poultry Production (GPFPP) are "practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products" (FAO COAG 2003 GAP paper). Sharing information about "Good Practices for Family Poultry Production" that are successfully implemented in countries, regions or development projects is an important objective of the INFPD so that these practices can be replicated in different region based on the farmers' demand.

Dr. Md. A. Saleque, the coordinator of the FAO/IFAD/INFPD project "Support for Smallholder Poultry Development" formulated guidelines for the documentation of GPFPP based on experience for the documentation of good practices by other institutions, including the South Asia Pro Poor Livestock Policy Programme (SA PPLPP). Special thanks are due to Dr. Fallou Gueye (FAO), Dr. Olaf Thieme (FAO), Professor Dr. E. B Sonaiya (Obafemi Awolowo University, Nigeria), Dr. Robyn Alders (Kyeema Foundation) and Mr. Antonio Rota (IFAD) for their continuous efforts to finalize the guidelines. The INFPD encourages all members to collect and document GPFPP and to make knowledge of them available to a wide audience.

The GPFPP about "Hay Box Brooder: A Milestone to Increase Rural Households Poultry Production" was prepared by Prof. Solomon Demeke based on his works and experiences in Ethiopia. It was reviewed and edited by Dr. Md. A. Saleque and Auvijit Saha Apu from Bangladesh and Dr. Olaf Thieme (FAO). Their valuable comments helped to finalize this note.

1. Introduction

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. Under natural condition, broody hens lay and brood their eggs until they hatch. After hatching she continues rearing the chicks through provision of the needed warmth and protection against predators. Artificial brooding refers to some type of heated enclosure for raising baby chicks and artificial brooders include a heat lamp, provision of food and water and bedding materials.

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 1000 chick capacity. On the contrary electric brooders are economically feasible, could safely and easily be constructed and maintain the desired constant brooding temperature. Unfortunately however, it is difficult to adopt electric brooders by the African rural household poultry producers owing to the unavailability of electric power, numbers of chicks to be raised and remote locations of the farm sites (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; Ethiopian Statistical Authority, 1985-1996), 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. Moreover, artificial brooding will relieve the hen from the long broody period and the hen would come into lay again within a short period and hence increase rural poultry production in the villages.

Some of the African countries developed their own national poultry extension package based on the above described local conditions. For instance the

initiation of the Ethiopian national poultry extension package goes back to the early 1950s and comprised of the distributions of three months old exotic pullets and cockerels. This aimed at promoting small scale exotic poultry production within the rural farming population and up-grading of the indigenous chickens by crossing with exotic males (Alemu Sida, 1987). The Ministry of Agriculture (MoA), being responsible for the Ethiopian national poultry extension package, established several poultry multiplication and breeding centers in different parts of the country to be used as a source of breeding stock and management information. MoA was also reported to have a plan of establishing about 57 satellite brooder houses that would have received day-old chicks from the breeding and multiplication centers, rear them to 3 months of age and supply pullets and cockerels to farmers in their respective zones (Alemu and Tadelle, 1997).

The supply of improved pullets and cockerels from the government poultry multiplication and breeding centers however was not adequate for the demand. Hence, the 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).

2. Practice of Hay-Box Brooder

2.1 Construction and Specifications

The hay-box chick brooder which is not using any artificial heat is an ESTC (Ethiopian Science and Technology Commission) award winning technology developed by Prof. Solomon Demeke at Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) (Solomon, 2003). Unlike other brooders, this device does not require coal, oil, or electricity for heating. The brooder comprises of a simple square box made of four outer framing wooden boards, a door, small ventilation holes, a wooden or wire-mesh floor, a central nest, a roof (top cover) and wire mesh enclosing a chick run (Figure 1). The walls of the brooder could be made of 4 outer framing boards, each being 30 cm high and 2 cm thick. Four small ventilation holes of 2.5 cm diameter are drilled at the upper side of each frame board (making it a total of 16 holes). A door of appropriate dimension, depending on the size of the box, is made at the center of one of the four frame boards. The floor of the hay-box brooder should be made durable, smooth and easy to clean and disinfect.

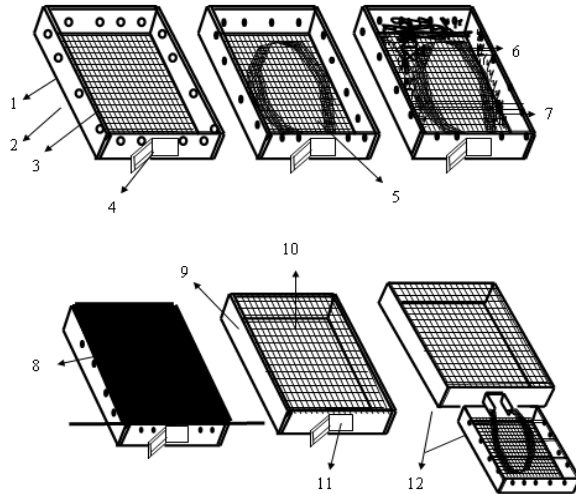


Figure 1 Construction design of the hay-box and run.

1= frame board, 2 = Ventilation hole, 3 = mesh-wire floor, 4 = door, 5 = central nest, 6 = stuffed hay, 7 = stick, 8 = sack filled with hay, 9 = run frame board, 10 = mesh-wire, 11 = run door, 12 = box and run arrangement.

Cheap (soft) wood and/or half inch wire-mesh tightly stretched to prevent sagging could be used for the construction of the floor. The central nest is made up of a central circle of wire-mesh netting with an opening to the door that is arranged to lead directly into the run, leaving no open space between the nest and door. Insulation material (hay or straw) is stuffed very loosely into the space between the central nest and the sides of the box. Depending on climatic conditions the roof or top of the hay-box is made of either a single or double layered sack filled with an insulation material. The run is made of 4-wooden frame boards, each of them 30 cm high and 2 cm thick (similar in height and width to the frame boards of the hay-box brooder) covered by wire mesh.

The suggestions for the minimum and maximum number of chicks that could be conveniently raised with the use of the hay-box chick brooding technology under the rural/village conditions of Africa are based on experiences in Ethiopia with respect to housing and feeding. It has been shown that the fabrication of hay-boxes for less than 10 chicks is expensive and urban dwellers and rural farmers participating in its introduction were reluctant to accept the offer of hay box brooder of that size. On the other side, retarded growth and high chick mortality were observed among chicks raised in hay-box brooders for more than 70 chicks. Most of the observations made and the results of a series of on-station and on-farm trails indicate that for the hay-box chick brooding technology a capacity of 10 to 70 is the most appropriate size under the present Ethiopian small holder conditions (Solomon, 1999). The

specifications for different size hay-box chick brooders in the range for 10-70 chicks of egg type breeds are shown in Table 1 (Solomon, 2001).

Table 1 Specifications of the hay-boxes for 10-70 chicks		
No chicks	Box dimension (cm)	Run dimension (cm)
10	30 x 26 x 26	30 x 56 x 56
20	30 x 37 x 37	30 x 80 x 80
30	30 x 45 x 45	30 x 98 x 98
40	30 x 52 x 52	30 x 113 x 113
60	30 x 63 x 63	30 x 139 x 139
70	30 x 68 x 68	30 x 150 x 150

2.2 Management

Feed and water are always provided in the run and not in the brooder box. Very close attention is required during the first week of brooding and the chicks should be moved out of the box 4 to 5 times/day for feeding and watering in the run. Two to three hours after feeding and watering they should be gently pushed back into the box and the door closed behind them. After the first week of brooding, the chicks will know their way about and will freely run in and out of the box, when the door of the box to the run is left open during daytime. Changing the position of the box and run frequently (for provision of fresh pasture) and closing of the chicks into the box at night are the major managerial practices required after the first week of brooding.

2.3 Brooding Temperature and Space

One of the critical requirements of successful chick brooding is regulation of brooding temperature and provision of adequate space. As chicks grow and mature, the need for supplemental heat is less important whereas, the need for adequate space becomes critical. Generally there is no agreement among poultry men as to the exact brooding temperature of baby chicks, just transferred from an incubator. The initial brooding temperature below the hover should be 35°C at 5 cm from the floor and this initial brooding temperature should be reduced by approximately 3°C per week until 21°C is reached (Amanda, 2007). A brooding temperature of about 34-39°C is achieved in the hay-box brooders during the first week of brooding if the specified design and the dimension of the technology are maintained. The brooding temperature of the hay-box brooders could be reduced by at least 3°C weekly, to the desired level by reducing the amount of hay stuffed between the sides of the box and the central nest. There is thus gradual increase in the available space with the proportional reduction of the amount of hay stuffed between the sides of the box and the central nest. The central nest will thus have to be enlarged and adjusted each time the insulation material is reduced (Solomon, 2007).

2.4 Ventilation

The ventilation needs of the hay-box brooder depend on the climatic conditions and chick density and are ensured by the 16 small ventilation holes drilled on the top of the outer frame boards of the hay box-brooder. The omission or blockage of these ventilation holes results in high brooding temperature, suffocation and chick death. The floor of the hay-box may also provide considerable additional air circulation depending on the type of constructional materials used. A wire-mesh floor would provide the best ventilation in addition to the continuous supply of fresh air through the sack covering the top.

2.5 Feed and Water

Adequate commercial or homemade feed and clean water need to be available in the run permanently during daytime. Additionally the practice of thinly spreading of household scraps, green leafy materials and by-products of yellow vegetables such as carrots, mango, papaya etc into the chick run is advisable. The consumption of very cold water early in the morning makes baby chicks uncomfortably cold and results in bunching, crowding and smothering in the run accompanied by high mortality. Therefore it is advisable to provide warm water in the run immediately after the chicks are moved out of the box early in the morning.

2.6 Parasitism

The Hay-box brooding technology involves the use of fibrous and bulky dry organic substance (hay and straw) as insulation materials for the conservation of the metabolic heat of the chicks. Unfortunately however, these insulation materials and the top covering sack may harbor external parasites such as lice, mites, and bed bugs. Heavy infestation by these blood sucking parasites could be encountered under rural household conditions resulting in stunted and retarded growth of chicks. It is important therefore to change and renew the insulation materials and to clean the hay-box and the run with boiling water on a regular basis.

2.7 Ant Attack

The technology offer safety against predators such as birds of prey, pets and wild animals. Unfortunately however, it could easily be attacked by ants which could result in total loss of chicks. Close attention (supervision) and fast reaction to sound signals are required in areas where there is high prevalence of ants such as south, west and southwest of Ethiopia.

3. Key Components of the Good Practice

The hay box chick brooding technology utilizes simple and locally available materials. The major principles of this simple technique are brooding chicks by conserving the metabolic heat produced by the chicks and thus keeping them

warm. It was assumed that the use of the hay box brooder could alleviate the burden of the breeding and multiplication centers of the Ethiopian Ministry of Agriculture and develop the capacity and success of the national poultry extension services. Under village conditions using the hay box brooder also has the advantage of providing protection to chicks against predator attack and reducing the risk of exposure to disease through confinement. Another potential benefit of this technique is that it could enable farmers to isolate chicks from their mother at a very early age and raise them separately so that the hens could resume egg laying in short period of time (Nigussie *et al.*, 2003). The hay box brooder is a low-input technology that releases the mother hen from brooding so that it may return to laying early. This would increase small scale poultry production in general and egg productivity in particular. The brooder is easy to construct, use and modify with the use of locally available skills and materials (Photos 1-2).

The advantages and significance of the hay-box chick brooding technology compared to natural brooding are the better performance in terms of number of chicks raised at a time and their survival rate, earlier start of egg laying by the hen and protection of chicks from predators such as birds of prey, pets and wild animals. It also better fits a market oriented production system, since batches of up to 70 chicks could be reared at a time. Compared to electric brooders the advantages and significance of the hay- box chick brooding technology are that:

- It is as productive as the electric brooder in any size of ≤ 70 chicks.
- No artificial heat is employed in the hay-box and hence brooding costs are saved.
- It is portable and exposes the chicks to natural vegetation.
It is simple and could successfully be operated and managed without high level specialized training.
- It can be modified by local skills to the local situation of climate and available type of construction materials.
- It is applicable to different agro-ecological conditions and a wide range of changing circumstances.

The construction and management of the hay-box brooder have been well conceived, operationalized and monitored. In 2010, the Food and Agriculture Organization of the United Nations (FAO) provided funds to the Jimma University College of Agriculture and Veterinary Medicine (JUCAVM), for field testing of the hay box brooder in Poultry Sector 4 farms in Ethiopia, Kenya and Tanzania. The activities included fabricating different sizes of the hay box brooders and producing an English manual how to manufacture and use the hay box brooder. The English and Amharic (local language) version of the operational manuals are now available from JUCAVM

(solomondemeke2000@gmail.com or solomon.demeke@ju.edu.et) or through the [Ethiopian Agricultural Portal](#) .



Photos 1-2 Construction of the hay-box brooding technology at JUCAVM

4. Effectiveness and Impact of Hay Box Brooder

Hay box brooders maintain a temperature of 34-39°C during the first week of brooding, which can later be adjusted by reducing the amount of hay used for insulation as the chicks grow and depend less on external heat. All the series of on station and on farm trials conducted at different locations all over Ethiopia clearly showed that batches of 10-70 day old chicks could successfully be reared with the use of the hay-box brooder except during the heavy rainy season in the months of June, July and August (Solomon, 2003). With few exception most of the trials conducted in different parts of Ethiopia reported chick survival rates to an age of 3 months in the range of 85 percent to 95 percent. This is very high compared to the results from natural brooding as it is practiced in different parts of Ethiopia.

With the support of an “agricultural sustainability” project funded by CIDA (The Canadian International Development Agency), the hay- box brooder was extended to hundreds of farmers in the Jimma Zone. The project funds were provided from 2005 to 2009 to build and distribute brooder boxes, day old chicks of improved breeds and starters ration formula and to deliver short companion training program. This has proved to be an additional source of food and income for rural and peri-urban people in the region. A number of additional success stories are attributed to the hay box brooder. A large number of female headed families have become self sufficient in the purchase of essential household food items (sugar, salt, cooking oil, kerosene etc) through the sale of poultry product raised with the use of hay box brooder. JUCAVM students get to practice community development skills by assisting in hay box brooder construction (Photos 3-8). This technology is a great example of how small amounts of money can go a long way in helping to improve the livelihood of the needy people (Solomon, 2010). The hay box chick brooding

technology has proved a success in diverse locations across the country and batches of 10-70 baby chicks have been successfully raised in different regions of Ethiopia. With joint work by ESTC and UNHCR, the development of the technology was extended to all the regional states of Ethiopia, including Gambella and Asossa. The demand for the technology expressed from individual farmers to governmental and non-governmental organization is very high. The supply of exotic baby chicks from the government poultry breeding and multiplication center, along with the constructional design of the hay box chick brooding technology attracts regions of Ethiopia where there is no electricity (ESAP, 2003).



Photos 3-8. Training and distributions of hay-box brooders and related deliverables in Jimma

Sponsored by FAO, the hay box brooder is made available in Kenya and Tanzania and it is reported to have effectively helped poultry farmers solve the problem of high chick mortality rates within the first 8 weeks caused by disease, predation, harsh weather and physical injury. The cost for preparation of the brooder is just Ksh100 (€1) spore.cta.int/en/component/content/1150?task=view.

5. Acceptability, Repeatability and Sustainability

Natural brooding does not fit market oriented poultry production system. It is also difficult to adopt electric chick brooders by rural household poultry producers in Africa owing to the unavailability of electricity, the number of chicks to be raised and the remote location of the household farm sites. The hay box chick brooding technology is environment friendly because there is no toxic discharge and emission from the technology.

The information about the hay box brooder was published as news article of the International Ag-sieve Newsletter, Rodale Institute, USA in 1991, and in the Spore Bulletin of CTA in 1988 and 2010, as a result of which the constructional design and the other information's requested were communicated to a wide range of beneficiaries. The technology can be modified by local skills to the local situation with respect to climate and type of construction materials available (Photos 9-10) and is applicable (acceptable) to different agro-ecological conditions and a wide range of changing circumstances.



Photo 9-10. Modified hay box-brooder and run, Machenko, Kenya

5.1 Seasonal Variability

A significantly higher rate of mortality (as high as 40%) compared to electric brooding was recorded from the hay-box groups during the main rainy season which lasts in the Ethiopian high lands, from June to August. The use of hay-box chick brooding technology may be severely affected by heavy rains as the chicks will seldom move outside into the run for feeding, watering and foraging. During the heavy rains, the chicks get wet and are chilled causing them to crowd and huddle together leading to smothering and death.

5.2 Rate of Chick Growth

The growth performance of chicks reared in the hay-box brooders is slower during the first 4-6 weeks of brooding than of those chicks reared by electric brooders. This could be attributed to the fact that the chicks in the hay-box brooders are only fed during daytime since they are closed in the box at night. Contrary chicks in the electric brooders are fed to appetite both day and night. However, comparatively faster growth rate is obtained from the chicks reared in hay-box brooders after the first four weeks of brooding during which time they double their body weight and compensate the slow growth they experienced at the early phase of brooding. They also acclimatize faster than the chicks from electric brooder groups when they are transferred to the growers' houses.

6. Conclusion and lessons learnt

It is by natural incubation and brooding that chicks are hatched and raised all over rural Ethiopia. Almost all the rural household poultry producers are not aware of the existence of artificial brooding methods applicable to indigenous baby chicks. The available experiences indicate that locally constructed portable hay-box brooders in which no artificial heat is employed can be the brooder of choice for the promotion of household poultry in rural Africa but the drawbacks (2.5, 2.6, 2.7 & 5.1) of the technology need to be considered. The conventional Ethiopian poultry extension package envisaged the distribution of exotic pullets and cockerels to the farming population at 3 months of age to maximize survival rate under rural household conditions. However, there were no such cases in which exotic chickens of even 60-89 days of age were distributed from the government poultry breeding and multiplication centers. Fortunately it has been learnt that distribution of day old exotic chicks could be done successfully if they were reared with the use of the good practice of the hay box brooder. Moreover the use of this good practice alleviated the burden of government poultry breeding and multiplication centers in raising the chicks to an age of 3-months. While normally chick brooding refers to raising of chicks for the first eight weeks of life the chicks raised in the hay box brooder could be transferred to their rearing places at an age of 5-6 weeks. This can be attributed to better acclimatization capacity. After introduction of the good practice farmers started incubating eggs with the use of many broody hens at the same time and by raising the resulting indigenous chicks with the help of hay box brooder. Thus the farmer learnt to isolate indigenous chicks from their mothers at a very early age and to raise them separately so that the hens could resume laying.

Traditionally the productivity of scavenging hens was considered to be low because of their low egg production potential and poor management. This was also due to their long reproductive cycle (attributed to natural incubation and brooding) and high chick mortality caused by disease condition and predations. Mean survival rate to an age of 3-months of baby chicks reared under natural brooding condition in Ethiopia is said to be about 40%. On the contrary, with few exception most of the trials conducted in different parts of Ethiopia, Kenya and Tanzania with the use of hay box brooders reported chick survival rates to an age of 3 months in the range of 85 to 95 percent.

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