Minireview Article
Overview of zootechnical technologies in traditional poultry farming in West Africa and Togo

ABSTRACT

Aims: To take stock of zootechnical technologies implemented to improve the productivity of traditional poultry farming in West Africa and Togo, in order to capitalize on bestinnovative practices.
Methodology: Inventory of zootechnical technologies based on a literature review.The synthesis consisted in analyzing knowledge published in scientific journals and the activity reports of agricultural extension structures.
Results: Traditional poultry farming in West Africa and Togo is of multidimensional importance at the same time nutritional, socio-economic, socio-cultural and religious. It is characterized by the use of local poultry breeds for egg and meat production. Birds often live freely around dwellings, feeding on food scraps, insects and agro-industrial by-products, and drinking from water collected in discarded utensils. The main zootechnical technologies available and applicable to improve productivity are: semi-divagation rearing; construction of traditional improved poultry houses (PTA) equipped with feeders and drinkers, regular distribution of feed and water, feed supplementation, use of adapted improved poultry breeds, respect of sex ratio and use of chick houses.
Conclusion: The dissemination of these technologies and their adoption by traditional poultry farmers is a major challenge to be met in order to improve productivity and thus fight poverty and satisfy the animal protein needs of populations.

Keywords: Traditional poultry farming, Constraints, Productivity, Zootechnical technologies.

1. INTRODUCTION

In Togo, traditional poultry farming based on empiricism is often considered as a gathering activity, as opposed to modern poultry farming based on the application of scientific technologies [1]. Traditional poultry farming can therefore be practiced by everyone, as it does not require any prerequisites or major investments [2]. It is the most suitable form of livestock farming for small rural farms, as it presents less constraints in terms of feed, water and other inputs [3].
Traditional poultry farming is of multidimensional importance in nutritional, socio-economic, socio-cultural and religious terms. In nutritional terms, it remains an alternative for reducing protein-calorie deficits, especially in rural areas [4]. In socio-economic terms, it represents one of the few opportunities for savings, investment and protection against risk for low-income rural populations [5, 6].
This type of farming focuses on local hens raised in small numbers, especially in rural areas, in an extensive system where each farming family has a relatively small number of poultry [7,8].

In Togo, traditional poultry farming accounts for 80% of the 26 million poultry [4]. It is characterized by divagation, mixing of ages, species (guinea fowl, ducks, hens, etc.) and the small size of farms (less than 50 subjects in the majority of cases).
In addition, productivity is low due to major constraints such as poultry housing, poultry house equipment, feed and reproduction management. To overcome these constraints and meet the productivity challenge, technologies are deployed. The term “technology” refers to all the endogenous or exogenous tools, techniques, methods, processes and knowledge whose combination makes it possible to produce or transform [9]. Zootechnical technologies such as: (i) husbandry methods, (ii) infrastructure and facilities, (iii) reproductionmanagement (iv) feeding practices adopted by traditional poultry farmers are an effective solution for improving productivity.
This synthesis provides an analysis of the various zootechnical technologies and outlines the prospects for their deployment.

2. ZOOTECHNICAL TECHNOLOGIES IN TRADITIONAL POULTRY FARMING

2.1 Husbandry methods

The rearing method refers to the overall management system the poultry. Poultry rearing systems in Togo fall into three categories: free-range, confinement and semi-liberty or semi-claustration [10].

2.1.1 Free-range

It is widespread in rural areas, and is characterized by the complete freedom of the birds, which roam freely in search of food. There may or may not be a habitat. Birds, mostly insmall number,are released in the morning and locked up in the evening when there is a habitat [11]. They rarely receive a few grains in the morning. This type of farming requires large areas and offers few means of controlling production parameters [12]. This type of rearing does not require major investment, but rearing parameters are poorly controlled and productivity remains low. It is well suited to the conditions and resources of rural breeders. However, it encourages the spread of disease and exposes poultry to predators, bad weather and nutritional deficiencies in both quantity and quality, especially when their immediate environment lacks agricultural or domestic food waste [13].

2.1.2 Claustration

This is a type of poultry management in which the birds are enclosed in a henhouse. This type of management is more widespread in modern and semi-modern poultry farming. In traditional poultry farming, this type of confinement is characterized by the presence of a henhouse surrounded by a fence that limits poultry movements[14]. This type of poultry management allows for better control of some rearing parameters and higher productivity, but requires investment and a minimum level of knowledge of rearing techniques. Hygiene management and prophylaxis programs are improved to limit the spread of disease. This is the mode practiced by the commercial livestock farms (EC) promoted by the Togolese government through the agricultural sector support project (PASA) in its sub-component 2, “relaunching the livestock sub-sector” in 2020 [10].

2.2.3 Semi-claustration

The chickens are in semi-liberty. A henhouse is available to house the poultry. This henhouse can be fenced off. Every morning, the birds are released and fed by distributing feed in feeders and water in drinkers. The birds are then released to roam around the

henhouse in search of insects and other feed supplements. In the rainy season, these birds return to the henhouse in case of danger or to drink [15]. In this system, the poultry are more secure, with control of some rearing parameters and improved productivity, but a minimum investment and some knowledge of rearing techniques are required. However, these birds may be prone to theft or disease contamination, as hygiene and prophylaxis are limited [13].
Semi-claustration seems more suited to the context of traditional poultry farming in Togo, taking into account the breeds of poultry raised, the resources available and the level of knowledge of the techniques by the farmers. In addition, local poultry raised in Togo need space for their exercise. They are hardy and adapt well to the natural environment. Furthermore, the level of technical knowledge of poultry farmers in rural areas does not allow them to manage a fully enclosed operation. Finally, resources are very limited, which explains why semi-claustration combined with the improved traditional poultry house (PTA) is so widely used in Togo [10].

2.2Infrastructure and facilities

In Togo, only 9% of farmers have no specific shelter for their poultry, who take refuge in the evening on trees, on roofs, in attics or in disused buildings [16], in contrast to the results in Gambia and Burkina Faso where respectively, only 10% and 11% of farmer have henhouses[17, 18, 19].
The henhouses used are often makeshift dwellings [15 , 20] notably the lower parts of attics, arrangements of branches in habitat, a superposition of bricks, old tires, canaries, barrels and some old utensils fitted out as henhouses [21], sometimes small huts made of wood or earth are fitted out (Fig.1). These habitats, very common in rural areas, protect poultry from the bad weather, but remain fragile and sometimes expose them to animal and human predators. They are not easy to clean and disinfect.

Fig.1. Some types of traditional poultry house in Togo

Alongside these traditional poultry houses, the improved traditional poultry house (PTA) is developing. This type of housing uses mostly local materials [19]. It can be built of rammed earth, cement or wood (boards, racks, etc.) with a straw or sheet metal roof, depending on the farmer's resources.The floor is made of cement, for easy cleaning and disinfection, and the wall is completely plastered. The PTA (Fig.2), popularized in Togo since the 1990s, comprises at least two rearing compartments: one for hens and their chicks (Chick house) and the other for adults (pullets, cockerels, roosters and hens), with a common fenced yard [22,23]. This second compartment is equipped with nesting boxes for laying and brooding. This type of poultry house makes it possible to: (i) protect poultry from rain, sun and certain

predators (snakes, rodents, birds of prey); (ii) keep a close eye on poultry; and (iii) feed and water them properly. The PTA is built next to the concessions, well-ventilated and well equipped. Unlike the traditional henhouse, which requires almost no expenditure, the PTA, however modest, requires financial resources.

Fig.2. PTA models [10].

The type of housing illustrated in Figure 2 is the one popularized in Togo by those involved in the development of traditional poultry farming [10]. It is continually evolving to adapt to the environment and the farmer's resources, while maintaining the following guiding principles: (i) protection and safety of the animals; (ii) sufficient space for the farmer to enter easily; (iii) aeration; and (iv) age groups and species.

As far as equipment is concerned, whatever the type of farming practiced, suitable equipmentare used. In the free-range system, the farmer rarely provides special equipment to manage the rearing. Poultry are fed on the ground or in old, abandoned containers. They find water in abandoned cans, old utensils or pieces of broken pots. In the semi-free-range or confinement system, with traditional or improved traditional poultry houses, various types of rearing equipment are used, with varying degrees of technical sophistication. The main types of equipment are: (i) feeders to serve feed; (ii) drinkers to serve water; (iii) nesting boxes to serve as egg-laying areas; (iv) perches to allow birds to perch on them (thus increasing the usable space and enabling more birds to be kept in the same area) [24, 25].

Feeders and drinkers are by far the most common equipment used by breeders(Fig.3 and Fig.4). There are several types of feeders, the most common of which are: (i) circular metal feeders; (ii) modern linear wooden feeders; (iii) linear tree trunk feeders (solid wood or bamboo); (iv) gourd feeders (suspended or placed on the ground); and (v) devices for serving greenery to poultry. Feeding troughs are also made of local materials (wood or salvaged materials), protected by a top bar to prevent animals from stepping inside [14]. We recommend around 50 cm per adult bird around a feeder. To avoid wastage, the space accessible to the feed is limited to the size of the chicken's head.

Linear wooden feeder with turnstile bar

Plastic chick feeder

Adult feeder in galvanized sheet metal

Fig.1. Poultry feeder models[10].

Modern plastic waterer | Terracotta drinking trough | Bottled waterer

Fig.4. Drinking trough models for poultry[10].

As with feeders, semi-modern plastic and clay troughs are also being introduced. Soviadan et al [25] reported that 69% of farmers benefiting from the PASA project in Togo used semi-modern feeders and drinkers. They also showed that the non-use of semi-modern equipment by farmers benefiting from the project had a negative impact on productivity.
Increasingly, in the PTAs, farmers are using laying boxes, which are nests prepared to enable hens to lay and incubate eggs(Fig.5). There are several types of nesting box, mainly made of canary, wood or basket. There should be one nest for every three hens. The shape and layout of nesting boxes vary, but they should be around 30 cm square and 40 cm deep, in otherto facilitate the isolation of the broody hen. AVSF recommends a nest opening of around 25 cm. In all cases, nests are lined with straw bedding [26]. PTAs are also equipped with perches that reproduce the natural life of free-ranging poultry. For the farmer, these perches make it possible to increase the density in a poultry house. It is recommended to provide a perch of about one meter for every 10 birds. The perch should be 50 cm from the ground [14].

Fig.2. Nesting models[10].

2.3Reproduction management

Poultry reproduction management techniques popularized in traditional breeding units are based on a number of good practices such as: (1) choice of breeders, (2) observance of the sex ratio, (3) selection of eggs for hatching, (4) specialization of hens for brooding or chick management, (5) synchronization of laying and hatching, (6) use of incubators, (7) chick management without mother hens, and (8) renewal of male and female broodstock [27]. The profitability of the unit depends to a large extent on the management of reproduction and numbers. Among the good practices listed above, the most widely used are: sex ratio, renewal of male and female broodstock, use ofimproved broodstock, chick separation and use of the chick nursery.

2.3.1Sex ratio

This is the optimum number of females to one male in a breeding operation for adequate reproduction. This number varies from one species to another. The variation of the sex ratio within a species depends on the breeder's objective. The sex ratio is 1 cock for every 10 hens in the case of chick production via egg brooding by the mother hens. This sex ratio is more like 1 cock for 8 hens when chicks are produced using an artificial incubator (electric, solar, gas or oil-fired), as the cock is more required to produce fertile eggs at all times. Respecting the sex ratio ensures good egg fertilization and, in turn, good hatching of vigorous chicks, as Nickolova [28] has shown with Muscovy ducks. It also avoids fights between adult roosters (when the number of roosters is very high) and the laying of unfertilized eggs by hens (when the number of roosters is too low).

2.3.2Renewal of male and female broodstock

Once male and female broodstock have been selected and used for breeding, they become exhausted over time and are renewed after a period of two years, usually from other well-monitored poultry farms ([14,29]. This operation also helps to avoid inbreeding, as males risk crossing with females from their own offspring, and conversely, breeding females risk crossing with cocks from their own offspring. Compliance with this provision helps maintain the genetic vigor and efficiency of the breeding nucleus, and the viability of the products.

2.3.3Use of breeder stock

Local breeds are known to be small and slow-growing [11]. Consequently, some poultry breeding support projects have conducted programs to introduce exotic breeds to improve the format of the local hen [11,20]. For example, in the Kolda region of Senegal, farmers are trying to improve the performance of their poultry by pairing specific roosters with carefully selected hens, based mainly on certain criteria such as robustness, muscle development and size. This process involves introducing females from different farms to a male of an improved breed. In some cases, to reward the owner of the rooster, the cross breeder offers him cereals, while no compensation is given when exchanges are made between relatives or friends [20]. Similar practices have been observed in Burkina Faso, where the aim is to improve the size of local hens by integrating exotic breeds [11].

2.3.4 Chick separation and use of the chick house

High chick mortality has always been identified as one of the major constraints of traditional poultry farming. To remedy this problem, chicks are separated from their mothers and kept in a brooder [20,30,31]. This involves isolating the chicks in a particular compartment, generally without the mother hen, and keeping them there for around two months. The PTA, which comprises two compartments, one of which is dedicated to the chicks, is indispensable for implementing this practice. This technology is suitable for increasing chick survival rates and accelerating the rate of egg production by local hens. . [32] showed that chick separation could increase the survival rate of six-month-old chicks from 23.9% to 65.1%, an improvement of 41.24%. They also found that the number of breeding cycles could be increased from 3.4 to 5.6 per year and annual egg production from 35.3 to 57.6.

2.4 Feeding practices

Proper feeding is necessary to fully exploit the genetic potential for growth or egg production, and is important for the health and well-being of the animals.
In Togo's villages, chickens are rarely fed [8]. They are often left to roam and receive little feed supplementation. In this case, the supplementation is based on millet bran or kitchen waste [15, 19, 25]. Watering is rare and is done in old utensils. Water quality is not a concern

for farmers. Two (02) main poultry feeding systems can be distinguished: foraging in the wild and occasional distribution of supplementary feed.

2.4.1 Feeding in the wild

Feeding in the wild is an inexpensive and almost effortless process for the breeder, who leaves the birds to their own devices. Indeed, living in complete freedom, birds roam around all day in search of food. According to [11], most traditional poultry farmers in Burkina Faso rely essentially on foraging. Poultry feed on meal scraps, insects, earthworms and agricultural residues found in fields, grain threshing areas and granaries. As [8] points out, it is rare for farmers to agree to feed their birds, with the exception of chicks, hens in the brooding period and adults ready for sale.

2.4.2. Occasional feed distribution

This poultry-rearing technique is the most widespread in Togo and is characterized by supplementary feeding. Poultry receive a handful of millet, sorghum or bran thrown in the morning and rarely in the evening [10]. Guinea fowl and ducks, depending on their age, are given the same diet as chickens. Often all avian species of different ages are mixed and fed in the same way. In some cases, two types of rations are fed, one for chicks and the other for adults. In this case, the chicks are fed cereal bran, cereals (millet, sorghum, corn), termites, maggots, etc. [11, 20]. The quantities distributed vary according to the farmer's means, the season and the size of the flock. Farmers can use agro-industrial by-products (wheat bran, beer dregs, tuber husks, etc.) to feed their poultry. This food supplementation is available daily and served in feed troughs to the birds, which are usually semi-free-range [15, 33, 34]. A study by AVSF [14] shows that traditional poultry farmers in Mali, Senegal and Togo who have set up improved traditional poultry houses (PTAs) favor the use of products such as corn, millet, termites, fish heads, legume leaves (such as pigeon pea and Leucaena), spent grains from local beverages, eggshells and oyster shells, as well as various meal scraps and peelings (tomatoes, papaya, yams, beans, etc.) to improve poultry productivity. Similarly, the “Volailles de Boussé” project in Burkina Faso highlighted innovative initiatives by farmers to increase the productivity of their local hens. These innovations include the collection of termites to feed chicks, the recovery of oyster shells to improve calcium intake, the use of fish meal and spent grain, the germination of cereals to increase their protein content, and the establishment of a collective field dedicated to growing cereals [14].

2.4.3. Watering

Poultry need more water than feed. Two to four times as much water is needed as dry feed, depending on the season and climate. In the dry season, the need for water is greater, even though water is scarce. Conversely, in the rainy season, the need for water is limited, as water is more readily available. We must therefore ensure that there is never a shortage of water around the poultry houses in the dry season. Water must be available to the birds at all times, and distributed in clean troughs that are washed daily [34]. It is recommended that water be changed daily, or even twice a day [14].

3. CONCLUSION

This literature review has provided an overview of zootechnical technologies used in traditional poultry farming in West Africa and Togo. It shows that traditional poultry farming is practiced in a variety of ways, notably in free-range, confinement and semi-divagation or semi-claustration. It is characterized by a tendency to adopt innovative practices with the

associated equipment and rearing techniques. Free-range system uses little or no appropriate equipment and techniques, and therefore requires no particular investment. It adapts to the conditions and resources of rural farmers, but it encourages the spread of disease and exposes poultry to predators and bad weather. In addition, this system makes it difficult to control rearing parameters.The confinement system, on the other hand, uses improved equipment (feeders and drinkers), provides all the necessary feed and care, and requires knowledge of rearing techniques. The poultry are safer, with better control of rearing parameters and improved productivity. Compared with free-range system, this requires investment and knowledge of rearing techniques.Furthermore, semi-claustration is another method of rearing with an improved henhouse, a minimum of equipment and feed supplementation. It also makes it easier to apply innovations such as vaccination and feeding, to control rearing parameters and, consequently, to improve productivity. Nevertheless, it also requires investment, but at a lower level than confinement.In the context of traditional livestock farming in Togo, regarding the limited resources of farmers and the fact that local breeds are reared mostly, semi-divagation is the most appropriate management method. This method is the most popularized in Togo, along with the improved traditional poultry house (PTA), feed supplementation and stock management. These technologies are within the reach of low-income households and they allow to valorize available local resources. Thus, by combining tradition and innovation, poultry farming can become an essential lever for improving the living conditions of rural populations while preserving local poultry biodiversity.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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