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Comparative Analysis of Village Chicken Production in Two Farming Systems in Burkina Faso

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ABSTRACT

This study aimed to describe and compare village chicken production in two farming systems in Burkina Faso. The systems were those in which crops and livestock production were, respectively, the most important. A rapid rural appraisal preceded a monitoring study in which data were collected fortnightly for 2 months. The study revealed that village chickens are used as sacrifices, gifts and objects of exchange for traditional medicine, or are sold for a little money under both systems. Chicken production is a free-range procedure in both farming systems, but there are differences in management. On average, the flock size was 33.5 ± 3 birds, of which 57% were chicks. During the period of 2 months in the rainy season, the overall mortality was relatively low ($8.8\% \pm 1.5$) but mortality in chicks was high (31.7%). The main cause of financial loss in the village chickens was mortality, which represented up to 84% of the total exits. The hatching rate and mortality in young chicks differed significantly ($p < 0.05$) between the two farming systems.

Keywords: chickens, farming system, free range, hatching rate, management, mortality, rapid rural appraisal

INTRODUCTION

In developing countries, such as Burkina Faso in West Africa, village chickens are maintained with very low levels of inputs (land, labour and capital) and are kept by those in the poorest social strata of rural populations (Guèye, 1988). Many authors have indicated that family poultry in general, and village chickens in particular, represent a significant part of the rural economy and of the national economy as a whole. They also play a significant role in the cultural life of rural people as gifts, starting capital for young people and sacrifices (Gunaratne *et al.*, 1993; Panda and Mohapatra, 1993; Guèye, 1998; Sonaiya *et al.*, 1999). Despite these facts, village chicken production has been neglected in the development and research policies of many developing countries, including Burkina Faso. To correct this situation, the

strategic plan for research in Burkina Faso (CNRST, 1995) recommended that research should be undertaken with the aim of improving village chicken productivity.

The current study was conducted in response to that recommendation and aimed to contribute to a better understanding of the village chicken production schemes adopted in two farming systems: the crop/livestock system and the livestock farming system in the Central Region of Burkina Faso.

MATERIALS AND METHODS

Study site

The village of Yambassé in the Central Region of Burkina Faso was the site of the research. According to the 1996 census, the village had 1540 inhabitants. The mixed crop/livestock farming system (CLFS) and the livestock farming system (LFS) are both used in the village.

The main activity in the crop/livestock farming system is crop production, cereals such as sorghum, millet and maize being the most important products. However, the households in this system also keep cattle (mainly draught cattle), small ruminants and poultry. In the livestock farming system, the main activity is livestock production (cattle, small ruminants and poultry) and cattle breeding plays the key role. However, the households in this system also practise crop production, growing sorghum, millet or maize as a secondary activity.

Data collection procedure

A rapid rural appraisal on village chicken production was carried out in the village of Yambassé by a multidisciplinary team over three successive days. Two zootechnicians, an agroeconomist, a veterinarian, a sociologist and two technicians constituted the team. All aspects of the chicken production system within each farming system were investigated qualitatively. The tools used in this rapid rural appraisal were a literature review, semistructured interviews and activity calendars. The questions asked in the questionnaire dealt with the economic activities in the village, the sociocultural organization in the village, the technologies used for livestock production (husbandry, feeding, health care, housing, fate of end products), the breeds of chicken, the production objectives, the relationships between chicken production and production of other livestock species, the relationships between poultry and other activities of the households, the preferential classification of livestock species, the methods of chicken production, the role of each family member in chicken production, the important periods in village chicken production, and the constraints on village chicken production. The groups targeted by the rapid rural appraisal included adult men and women and teenagers.

After analysis of the qualitative data from the rapid rural appraisal, a conceptual model (Figure 1) of the production system in the rural area was defined. This model

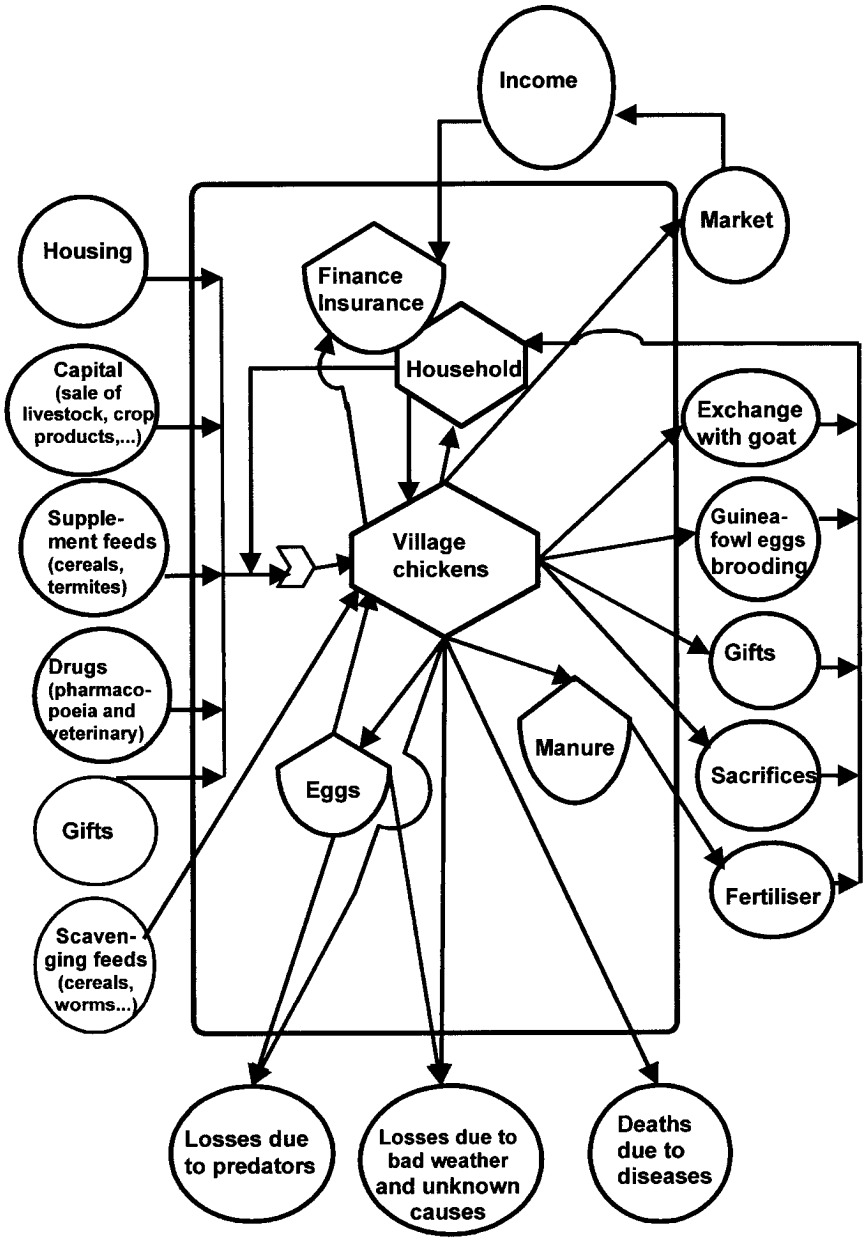

Figure 1. Conceptual model of village chicken production system in Yambassé

was then used as the basis for a monitoring system that lasted for 2 months (July 20 to September 15, 1999). The monitoring reached 10% of the households (random choice) in each system and was directed towards the main components of the chicken production system in the village, including flock size, flock mortality, sales, purchases, gifts, egg production, hatchability, loss due to predators, loss due to bad weather, and miscellaneous parameters.

Statistical parameters and analyses

Flock size was calculated as the mean flock size observed during the five visits in the two months (days 1, 15, 30, 45 and 60).

Percentage mortality (MR) was calculated according to the model of Faye and Perechon as cited by Mourah and colleagues (1997), where MR = ND/AF $\times$ 100; ND = the total number of dead or missing chickens during the observation period, being the sum of deaths due to disease and losses due to predators, bad weather or unknown causes; AF = average flock size = 1/2 $\times$ (flock size on day 1 + flock size on day 60).

The difference between the components of the two farming systems was studied by ANOVA. The statistical model was $y_{ij} = u + a_i \times e_{ij}$, where y_{ij} is the production parameter involved (mean number in flock, eggs per clutch, hatched eggs per clutch, hatching rate, percentage mortality, or losses); u is the mean of the parameter analysed; a_i is the effect of the respective farming system; and e_{ij} is the error term with $E(e_{ij}) = 0$.

RESULTS

Results of the rapid rural appraisal

Production objectives

Village chickens are raised for several purposes. Any sacrificial ceremony begins with village chickens, even when the main objective of the sacrifice is another animal, such as a sheep, goat or ox. Chickens are also used to honour hosts and friends or as a gift to the family of a spouse. Chickens are also used as objects of exchange for traditional medicine and are indispensable in a funeral ceremony. Farmers also consider chickens to be a source of funds for small expenses, such as for clothes or medicines, so they are frequently sold. Hence, chickens were found in the compounds of all the households.

It appeared that the sociological and cultural role of village chickens was more important in the crop/livestock farming system than in the livestock farming system. They were regarded by the farmers in the former system as the foundation for wealth. According to these farmers, engaging in livestock husbandry starts with owning chickens. After keeping chickens, one can move on to the husbandry of small ruminants before expecting to undertake cattle husbandry, the ultimate sign of wealth and prestige.

Role of household members

Labour input is exclusively familial in the husbandry of village chickens. Any household member can own village chickens, but the following differences were observed according to the farming system.

In the crop/livestock system, there was no distribution of tasks in chicken production by sex or age. Each member of the household (children, women, men and adolescents) may do any task, such as providing supplementary feed, or water and surveillance. The most active in these tasks were the young children and women. Women supply the chickens with household waste and water. Teenagers or children look for termites to supplement the chicks' diet and ensure that the chickens are enclosed in the evening. The farmers referred to the actions of women, adolescents and young by citing the following proverb: 'If the left hand holds a spear, it helps the right hand'. The men tended to sell most chickens in this system. The women, children or adolescents may sell their chickens for their own needs, but should inform their household chief. The household chief can sell or use for any other purpose (e.g. as a gift or for sacrifice) chickens belonging to any member of his household, merely needing to inform the owner.

In the livestock farming system, women were the main partakers in village chicken husbandry, the men being concerned with cattle keeping. The women provided the supplementation and surveillance, and even sold the birds in the market. They were generally the main owners of village chickens in the household.

Types of village chickens

Four varieties of village chickens could be distinguished, all of which have multi-coloured feathers: (1) The Noa-kuiguiga: this medium bird was the main type of chicken in the village. Every farmer kept some of them. (2) The Noa-kondé: according to the farmers, this kind of chicken has resulted from the crossing of local and imported chickens a long time ago. It is relatively large and was kept mainly in the livestock farming system. (3) The Noa-rigré: this dwarf chicken is characterized by short legs. According to the farmers, it does not lay within the household compound and can therefore be a source of conflict among neighbouring farmers. (4) The Noa-ibrongo: this chicken is featherless on the neck. It grows quickly but is owned by only a few farmers because it was introduced into the village only a few years ago.

Farmers prefer the Noa-kuiguiga variety for its high productivity and adaptation to the environmental conditions, while the Noa-kondé is valued for its higher market value and the Noa-ibrongo for its rapid growth. The Noa-rigré is not widely kept because farmers believe that it is a source of misfortune.

Relationship between village chickens and other production systems

An exchange system exists between village chickens and goats at the rate of seven chickens for one goat. Cattle owners sell village chickens to pay for health care or to purchase industrial by-products as cattle feed. In general, farmers prefer to sell chickens rather than ruminants when they need small amounts of money. Conversely, the sale of ruminants (cattle, sheep or goats) may allow the purchase of village chickens to increase flock size or to reconstitute a flock that has been decimated by disease.

The village chicken and guinea fowl production systems were considered to be complementary as chickens are used to hatch guinea fowl eggs. Ducks, however, had both a negative and positive relationship with village chickens: negative because ducks may decimate chicks, acting as a predator in a flock, and positive because they can be used for hatching hens' eggs and so to allow hens to return to lay early.

In the crop/livestock production system, chickens were slaughtered to feed hired labour or were used as payment for labour instead of money. Village chickens may also be sold to raise money to buy tools for crop production or to repair ploughs. Conversely, crop products may be sold to enable the purchase of chickens.

Nutrition

Village chickens found most of their food by scavenging. The households supplemented this according to the availability of feedstuffs. Supplementation was mainly provided for chicks. The most readily available feedstuffs for supplementation throughout the year were usually, in decreasing order, household waste, millet, termites, red sorghum and maize.

The village chickens were not provided with feed troughs, supplementation being provided on clean ground. In the dry season, water was provided in various kinds of containers, such as dishes, tin cans, or specially made clay containers. In the rainy season, the chickens drank anywhere from puddles.

In both systems, the inputs were negligible as they were small and very irregular, the chickens finding the main input, scavenged feed, for themselves.

Health care

Preventive care was rare although, in exceptional cases, some farmers vaccinated against Newcastle disease. In general, farmers treated their birds with substances from local trees, such as the bark of *Kaya senegalensis* (*caicédrat*) or *Butirospermum parkii* (shea butter tree) in cases of diarrhoea. For Newcastle disease, they used pepper in drinking water. The farmers were aware that these substances are not efficient, as a high mortality occurred despite these practices.

Predators (cats, snakes, sparrow hawks) are another source of high mortality in village chickens, owing to the poor housing and the location of the households in the bush.

Housing

In the crop/livestock farming system, the chickens were housed in a hut of clay covered by a roof of straw. In this system, young chicks were generally raised in a large hut that had been abandoned by people. Some of the huts had a perch and laying boxes were sometimes observed. Cleaning the houses usually occurred once each year in this system.

In the livestock farming system, the housing was always built of straw and was too small. Laying hens and chicks were housed, whereas other birds had to spend the night in trees in an attempt to avoid predators. No cleaning was done in these huts, but the farmers changed the place of the huts after about two years or when an excessive number of external parasites was observed in the housing. Trees or branches were sometimes used as shelters for village chickens in this farming system.

Products

In the crop/livestock farming system, when the quantity of chicken manure became sufficient, it was collected and spread on the maize fields or placed in manure pits for the production of compost. In the livestock farming system, the chickens were mainly destined for sale by women; manure was not exploited in this system. In both farming systems, the eggs from the chickens were mainly used for hatching, only eggs that had not hatched being given to children for consumption. Eggs were never sold in the markets.

Important dates

A high mortality was reported to occur in the dry season between December and May. Mortality was said to be from June to November in the rainy season. Higher prices were obtained for village chickens from December to May, months that include Christian, Islamic and traditional feasts.

Results of the monitoring study

Flock composition

The results of the survey of the size and composition of the village chicken flocks are presented in Table I. The flock size did not differ significantly ($p > 0.05$) between the two farming systems. Chicks represented 60% of the flocks. The sex ratio (cocks/hens) was 0.29.

TABLE I
Mean numbers in flocks of village chickens

Category of chicken	Farming system		
	Crop/livestock No.	Livestock No.	Overall No.
Hens (>5 months)	5.1±0.4	6.6±1.6	5.5±0.5
Cocks (>5 months)	1.7±0.2	1.5±0.7	1.6±0.3
Cockerels (2–5 months)	3.0±0.5	2.7±1.2	2.9±0.5
Pullets (2–5 months)	3.4±0.4	3.8±1.0	3.5±0.4
Chicks (0–8 weeks)	21.1±2.3	16.7±5.3	20.0±2.2
All ages	34.3±2.9	31.3±8.3	33.5±3.0

TABLE II
Number of laying hens per household during two months, hatching rate (%), number of eggs per clutch and number of hatched eggs per clutch of village chickens

Component	Farming system		
	Crop/livestock	Livestock	Overall
Laying hens (no.)	1.9±0.2	2.0±0.9	1.9±0.8
Eggs/clutch (no.)	11.7±0.4	12.2±0.8	11.8±0.2
Hatched eggs/clutch (no.)	8.2±0.6	5.6±1.3	7.6±0.6
Hatching rate (%)	70.0±4.0[a]	46.0±9.0[b]	64.0±4.0

[a,b]Mean values in the same row with different superscripts are significantly different at $p<0.05$

Egg production and hatching rate

The mean number of eggs per clutch was 11.8±0.2, no significant difference being observed between the two farming systems. However, there was a significant difference ($p<0.05$) in the hatching rate between the two farming systems (Table II).

Mortality during the rainy season

Mortality rates in both farming systems during the two months are summarized in Table III. Mortality was due to disease, predators, bad weather and miscellaneous causes. There was no significant difference ($p > 0.05$) in mortality between the two farming systems.

A high mortality rate was observed for the chicks in both farming systems, particularly in some units in the livestock farming system. Overall, 83% of the mortality was due to disease, 10% to predators and 7% to bad weather or unknown causes.

TABLE III
Percentage mortality during two months in village chickens

	Farming system		
Category of chicken	Crop/livestock	Livestock	Overall
Hens	5.1 ± 2.0^{a}	1.9 ± 1.7^{a}	4.2 ± 1.6^{a}
Cocks	6.5 ± 2.5^{a}	13.3 ± 9.7^{a}	7.8 ± 2.7^{a}
Cockerels	10.6 ± 3.0^{a}	6.6 ± 2.6^{a}	9.5 ± 2.3^{a}
Pullets	7.3 ± 2.7^{a}	6.3 ± 3.0^{a}	7.0 ± 2.2^{a}
Chicks	24.2 ± 5.0^{b}	52.3 ± 29.3^{b}	31.7 ± 8.6^{b}
Overall	8.7 ± 1.8	8.9 ± 1.5	8.8 ± 1.5

[a,b]Mean values in the same column with different superscripts are significantly different at $p < 0.05$

Flock movements

Purchases of village chickens were negligible during the 2-month period of the study in the village, only one or two chickens being purchased per household. Table IV shows the number of birds that left the village flock for various reasons during these three months. No significant difference was observed between the two farming systems for these exits. Mortality due to disease was the most common cause of loss in both farming systems, while losses caused by predators were common only under the livestock farming system.

No household consumption was recorded during the observation period. Use of village chickens in sacrificial ceremonies for religious reasons occurred exclusively in the crop/livestock farming system.

TABLE IV
Loss of village chickens, number per household

Cause of loss	Farming system		
	Crop/livestock	Livestock	Overall
Sale	1.4±0.6	1.6±1.2	1.4±0.6
Gifts	0.7±0.5	0.6±0.3	0.7±0.4
Sacrifice	0.2±0.2	0	0.2±0.1
Predators	0.7±0.3	2.6±1.4	1.1±0.5
Bad weather and miscellaneous causes	1.3±0.6	0.3±0.3	0.8±0.5
Disease	10.2±3	7.5±2.3	9.5±2.3
Overall	14.5±3.4	12.6±3.4	13.7±2.6

DISCUSSION

This study indicates how village chickens play an important role in a rural household's life because of their use as a source of income, as gifts, and as elements in various ceremonies. There was a difference in the sociocultural use of village chickens between the crop/livestock and the livestock farming systems, in that the role of women was more important in the latter system. Village chickens appeared to be a starting point for livestock production in the crop/livestock farming system; men were actively involved in village chicken production in this farming system. In the livestock farming system, the men were mainly interested in ruminant production. These sociocultural roles of village chickens are similar to those indicated by previous authors (Gunaratne *et al.*, 1993; Panda and Mohapatra, 1993; Guèye, 1998; Sonaiya *et al.*, 1999) in other developing countries.

Only low inputs were provided for village chickens, as they got most of their daily diet from scavenging and had poor housing. This kind of production is similar to the free-range system described by Sonaiya (1995), IEMVT (1987) and Guèye (1998). Sonaiya (1995) described the free-range or traditional system as one in which the birds are free to roam around the homestead. Such a free-range production system was the common situation in the village but some differences in the management and in the exploitation of the flocks could be observed between the two farming systems.

The four types of village chickens found in the flocks (Noa-kondé, Noa-kuiguiga, Noa-rigré, Noa-ibrongo) were not specific breeds, as farmers had done no selection. This is in agreement with the assertions of IEMVT (1987) and Guèye (1998), who indicated that the local stock in Africa is the result of disorderly crossings of local and exotic strains. There is no systematic breeding system, so the concept of breeds is not strictly applicable.

The average flock size and components shown in Table I are consistent with those of Gunaratne and colleagues (1993), who indicated an average flock size of 2.3 cockerels, 1.4 cocks and 4 hens for village chickens in Sri Lanka. The mean flock size (33.5 ± 3) was higher than that indicated by Sonaiya (1995), who reported flock sizes in a free range system of only 5–10 birds in Nigeria, but it is within the range (10–50) indicated by Aini (1999) in South East Asia. There were no significant differences ($p > 0.05$) in numbers of birds between the two farming systems and, excluding chicks, the flock size was very small at about 13.5 birds per household.

The sex ratio found in this study (29%) was lower than that of 38% indicated by Mourad and colleagues (1997), but higher than the value of 10% indicated by IEMVT-CIRAD, as cited by the same author. It appears that there is great variability in this ratio in village chicken production systems.

The difference in the hatching rate between the two systems observed in our study (70% and 46%) was probably related to the housing conditions. In the crop/livestock farming system, the chicken houses provide more protection against the infiltration of rainwater than those used in the livestock farming system. The mean hatching rate (64%) found in this study is within the ranges indicated for tropical regions by Guèye (1998) (60–90%) and by Mourad and colleagues (1997) (42–100%). The number of eggs per clutch observed in our study (11.8 ± 0.2) is comparable to the lower end of the range (12–18) indicated by Guèye (1998), but somewhat higher than that of 10 eggs per clutch indicated by Mourad and colleagues (1997) in Guinea.

Our study showed a mean mortality of $8.8\% \pm 1.5\%$ over the period of 2 months in the rainy season and no significant difference ($p > 0.05$) between the two farming systems. Annualized, this is at the lower end of the annual mortality rates indicated by other authors, which range from 50% to 80% (Guèye, 1998; Mourad *et al.*, 1997). The period of observation, which was in the rainy season, could be a period of low mortality in village chickens in the region. This assertion is in agreement with Sonaiya and colleagues (1999), who indicated that the heaviest losses from Newcastle disease occur in the cooler dry season in West Africa. The high mean mortality in chicks ($31.7\% \pm 8.6\%$) observed in this study is probably due to bad weather and the inadequate housing. This was borne out by the mortality of $52.3\% \pm 29.3\%$ in the chicks in the livestock farming system, in which housing is both too small and of poor quality, being constructed of straw, so that the chickens are exposed to predators and bad weather.

The 83% mortality due to disease, which was the main cause of losses in the village chicken flocks, emphasizes the inefficiency of the current production systems and indicates that priority should be to considerably reducing these losses.

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Analyse comparative de la production de poulets de ferme dans deux systèmes d'élevage à Burkina Faso

Résumé – L'objectif de l'étude a été de décrire et de comparer la production de poulets de ferme dans deux systèmes d'élevage à Burkina Faso. Les systèmes ont été ceux pour lesquels les récoltes et la production de bétail ont été respectivement les plus importantes. Une évaluation rurale rapide a précédé une étude de monitorage lors de laquelle des données ont été recueillies tous les quinze jours pendant 2 mois. L'étude a révélé que les poulets de ferme étaient utilisés pour des sacrifices, des dons et des objets d'échange pour une médecine traditionnelle ou qu'ils étaient vendus pour un peu d'argent sous les deux systèmes. La production de poulets est une production fermière, mais il existe des différences de gestion. En moyenne, la taille des volées a été de $33,5 \pm 3$ oiseaux , dont 5% étaient des poussins. Durant la période de 2 mois de la saison des pluies, la mortalité globale a été relativement basse ($8,8\% \pm 1,5$) mais la mortalité des poussins a été élevée (31,7%). La principale cause de perte financière chez les poulets de ferme a été la mortalité qui a représenté jusqu'à 84% des morts totales. Le taux de couvée et la mortalité chez les jeunes poussins ont différé considérablement ($p < 0,05$) entre les deux systèmes d'élevage.

Análisis comparativo de la producción de pollos camperos en dos sistemas agrícolas en Burkina Faso

Resumen – El propósito de este estudio fue describir y comparar la producción de pollos camperos en dos sistemas agrícolas distintos. Los sistemas fueron aquellos en los que predominan, por un lado, los cultivos y, por otro, la ganadería. El estudio, en el que los datos se recogieron quincenalmente durante dos meses, fue precedido por una valoración rápida. El estudio reveló que en ambos sistemas los pollos camperos se utilizan en sacrificios, regalos, objetos de cambio por medicina tradicional, o bien son vendidos por poco dinero. En ambos sistemas, la producción de pollos se hace en condiciones extensivas, pero existen diferencias en el manejo. El tamaño medio del grupo fue de $33,5 \pm 3$ pollos, de los cuales el 57% eran polluelos. Durante la estación lluviosa, la mortalidad total a lo largo de dos meses fue relativamente baja ($8,8\% \pm 1,5$), pero la mortalidad de los polluelos fue elevada (31,7%). La principal causa de las pérdidas económicas fue la mortalidad, que representó casi el 84% del total. La tasa de eclosión y la mortalidad en polluelos jóvenes difirieron significativamente ($p < 0.05$) entre los dos sistemas agrícolas.