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## Wassachiè chicken rearing system in the agro-ecological zones of southern and western Mali

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### ABSTRACT

Characterizing the production system is the first step towards carrying out studies to identify threats and opportunities for improving local poultry. A characterization of Wassachiè chicken production systems was carried out in the southern and western agro-ecological zones of Mali. A survey of 84 poultry farmers was carried out in 30 villages, using a structured questionnaire. Information was collected on the description of the farmers, the origin and management of the flock. The data collected were analyzed using SPSS 21.0 and R 3.4.3 software. The results showed that Wassachiè chicken breeding (mixed breed 3/4Rhods Island Red\*1/4 Kokochiè) is essentially a male activity (94.04%), with a high proportion of young breeders (50%) who have no level of education (53.57%). Despite having received no training in poultry farming (73.80%), artificial incubation (89.28%) is a common breeding practice on the farms. Most flocks have fewer than 50 chicks, which are fed with feed produced by the farmers themselves. A Multiple Correspondence Analysis (MCA) was used to divide the farmers into 3 groups. Group 1 is made up of farmers (37.04%) and breeders (24.07%). They have no level of education and started their breeding with a small number of chicks ( $\leq 50$  chicks) which they acquired by purchase. Group 2 is made up of artisans (56.25%) who take care of the health of the animals themselves (93.75%) and produce only for sale (100%). Group 3 is made up of civil servants (66.67%). The animals in this group are under the care of a veterinarian (75%), and their production objective is mainly for sale. The study showed that the Wassachiè chicken production systems generally applied in the two zones are such that there is a need for genuine support for producers to improve egg, chick and Wassachiè chicken production.

**Keywords:** Breeding system; agro-ecological zone; Wassachiè chicken, Mali; typology.

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## Introduction

*Faced with the demographic explosion in the world*, the breeding of short-cycle animal species constitutes an interesting approach to fill the deficit in protein of animal origin in order to respond to changing food preferences (Nantoumé, 2011, Orounladji et al., 2021). In Mali, poultry farming plays a key role in socio-cultural development. It is increasingly becoming part of people's dietary habits for its protein content (meat and eggs). Hence the development of a breed that outperforms the local breed through research, in line with



government policy. The poultry herd is estimated at 60,000,000 million head (DNPIA 2022), 90% of which is semi-traditional and a source of income and employment in peri-urban areas. Livestock farming contributes to income generation through the sale of eggs and poultry, improves food security conditions and consequently plays a part in reducing poverty in rural households (Orounladji *et al.*, 2022). Contributing 13% of the world's population, Africa supplies only 4% of the world's poultry products (Huart, 2004). In many sub-Saharan African countries, consumption of poultry products is still a luxury, even though animal protein requirements are high (Issa, 2012). This can be partly explained by the domination of the poultry sector by traditional poultry farming, which is practised by small rural farms because it presents fewer input constraints (Christy, 1989).

In Mali, traditional poultry farming accounts for almost 54703373, or 86.35% of the poultry sector (DNPIA, 2021). The local hen lays an average of 40 to 50 eggs a year, with 3 clutches and a hatching rate of 50 - 60%. At hatching, the weight of chicks varies between 15g and 26g with a mortality rate of around 80% (CRRA, 2012). Considered an important activity in Mali's livestock sub-sector, the development of traditional poultry farming has become an element of the socio-economic development strategy and an effective means of combating poverty in rural areas (DNPIA, 2021). Its rapid expansion is making a major contribution to ensuring food security and promoting rural women (Traoré, 1999).

In a bid to improve zootechnical performance, a local (indigenous) breed of hen known as the Kokochiè (KKC) was crossed with an exotic breed, the Rhodes Island Reed (RIR). These chickens (Wassachiè) were expected to produce mixed meat and egg products with relatively homogeneous phenotypes. The Wassachiè is a stabilized, homogeneous chicken. The plumage is russet in color, and the crest is simple in the hen and well-developed in the rooster. It is well adapted to the different agroclimatic zones of Mali, with a good level of productivity and hardiness. The mortality rate is around 3% during the rearing period (chick - growth) and 2% during the production period (laying) (CRRA, 2012). The Wassachiè hen is earlier than the local hen, entering laying at 18 weeks with a production of 173 - 210 eggs/year with an average weight of 45g. The weight of the female at 6 months varies between 1400g and 1600g while the cock weighs between 2000g - 2500g (CRRA, 2012).

Thanks to its performance, the Wassachiè chicken has been introduced to farmers to improve local production. Several studies have been carried out on the zoo-technical and reproductive performance of these Wassachiè chickens. A breed is characterized by a combination of phenotypic, morphological and genotypic characteristics (Savary *et al.*, 1997).

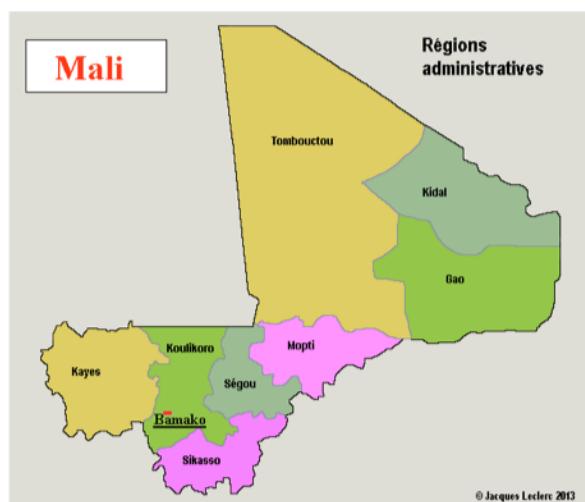
Mtileni *et al.*, (2009) and Danda *et al.*, (2010) expressed the view that characterizing production systems should be the first step towards carrying out a study that could identify threats and opportunities for improving local poultry. Okeno *et al.*, (2011) supported these steps as they help to understand the production and management practices of poultry farmers and the associated factors crucial to the development of improved strategies. Pedersen, (2002) suggested in his study that characterization should be carried out in farm situations through the collection of baseline data rather than on-station experimental studies.

Characterization of livestock systems explores the "how" and "why" in monitoring all stages, from housing, feeding and health care, in establishing production data. Consequently, this document aims to characterize Wassachiè chicken production systems in Mali's southern and western agro-ecological zones.

## **Materials and Methods**

### **Study area**

The study was carried out in two agro-ecological zones of Mali: the Southern zone (Sudanian) and the Western zone (Sudano-Guinean) (Figure 1). The Southern zone is characterized by average rainfall ranging from 600 to 1000 mm/year. It covers the regions of Kayes, Koulikoro and the district of Bamako. The West zone covers only the Sikasso region, and is characterized by rainfall in excess of 1,200 mm/year.



**Figure 1:** Map of the study area

### **Animal and survey material**

The study material consisted of: chickens of local and improved breeds, and data collection sheets.



**Figure 2:** Raising wassachiè chickens (3/4 RIR and 1/4 local breed)

### **Methodology**

#### **Data collection**

Surveys were carried out in 14 villages in the circles of Sikasso, Bougouni, Koutiala, Koulikoro, Kolokani and the district of Bamako for the southern zone, and 16 villages in the circles of Kita, Keniéba, Mahina and Kayes for the western zone, i.e. a total of 30 villages in 08 circles and the district of Bamako. A total of 84 breeders were selected, including 36 in the South zone and 48 in the West zone. The choice of villages and breeders to be surveyed was based on their socio-professional qualifications. During data collection, a questionnaire was administered to gather information on the herder's description, herd origin and herd management.

## Data analysis

IBM SPSS 21.0 and R 3.4.3 statistical software were used to analyze qualitative and quantitative data. Frequencies were calculated for qualitative variables relating to identification of the breeder, the farm, herd management (breeding practices) and use of livestock products.

Descriptive statistics were applied to quantitative variables (farm age), followed by t-testing. Multiple Correspondence Analysis (MCA) was used to highlight existing relationships between qualitative variables and to draw out a typology of production systems.

## Results

### Socio-professional characteristics of respondents

In the West and South zones of Mali, Wassachiè chickens were reared mainly by men, i.e. 97.22% of respondents (Table.1). Breeders with no education dominated, with an average of 53.57% in both zones. Those with secondary education represented (29.76%) and those with primary education (16.67%) of those surveyed. In addition to the low level of education, 73.80% of respondents had not received any training in poultry farming. Wassachiè chicken farming is dominated by craftsmen in the South zone (36.11%) and by farmers in the West zone (31.25%). Overall, the majority of respondents in both zones were young (50%), but the proportions varied from zone to zone. Farmers in the southern zone were predominantly adults (55.56%), while in the western zone they were predominantly young (56.25%) (Table. 1).

**Table. 1:** Socio-professional characteristics of respondents

Parameters	Agro-ecological zones		Total (X=84)
	South zone (X= 36)	West zone (X=48)	
<b>Sex (%)</b>			
Male	97.22	91.66	94.04
Female	2.78	8.34	5.96
<b>Level of education (%)</b>			
No education	55.55	52.08	53.57
Primary	13.88	18.75	16.66
Secondary	30.55	29.16	29.76
<b>Occupation (%)</b>			
Farmer	16.66	20.83	19.04
Farmer	19.44	31.25	26.19

Civil servant	19.44	22.91	21.42
Tradesman	8.33	8.33	8.33
craftsman	36.11	16.66	25.00
<b>Poultry farming training (%)</b>			
Trained	16.66	33.33	26.19
Untrained	83.33	66.66	73.80
<b>Age of respondent (%)</b>			
Young ( $\leq 39$ years)	41.67	56.25	50
Adult (40 et 59 years)	55.56	43.75	48.81
old ( $\geq 60$ years)	2.78	-	1.19

### Setting up the farms

The average age of the farms was  $6.74 \pm 0.37$  years (Table .2). The history of farm creation varied, ranging from a simple donation to the purchase of chicks to build up a flock. With a proportion of 80.95% of total respondents in both zones, chicken acquisition by purchase was the main mode of acquisition, followed by acquisition by donation (19.04%). The initial flock size consisted mainly of small flocks ( $\leq 50$  chicks) of chicks in 77.78% of cases in the South and 91.67% of cases in the West, as shown in (Table 2).

**Table 2:** Farm constitution

Parameters	Agro-ecological zones		Total (X=84)
	South zone (X= 36)	West zone (X=48)	
<b>Departinf workforce (%)</b>			
Small ( $\leq 50$ chicks)	77.78	91.67	84.52
Medium (51 - 100 chicks)	5.56	4.17	5.95
Large ( $\geq 101$ chicks)	16.67	4.17	9.52
<b>Method of acquisition (%)</b>			
Purchase	83.33	79.17	80.95
Donation	16.67	20.83	19.04
<b>Farm age (mean <math>\pm</math> SEM)</b>	$6.94 \pm 0.73$	$6.58 \pm 0.36$	$6.74 \pm 0.37$

SEM: standard error of the mean

### Flock management

The percentage of Wassachiè chickens reared in confinement and free-range conditions were 78.57% and 21.42% respectively. Artificial incubation was the most common method of reproduction, with 89.28% of the chickens bred using this method, compared with 10.71% using natural brooding.

The source of food varied from zone to zone. In the southern zone, breeders mostly purchased their feed, whereas in the western zone they preferred to make their own. Irrespective of the zone, the rates of farmers whose production objective was sale in addition to self-consumption (69.05%) and who practiced health monitoring themselves (71.42%) were higher than for the other modalities. The sex ratio was 1/6 in the South zone and 1/5 in

the West zone ( Table. 3 summarizes herd management).

**Table. 3:** Herd management (Type of farming, Breeding method, production targets and health monitoring) in agro-ecological zones

Characteristics	Agro-ecological zones		Total (%) (X=84)
	South zone (W=38)	west zone (X=46)	
<b>Type of farming (%)</b>			
Claustration	80.55	77.08	78.57
Roaming	19.44	22.91	21.42
<b>Breeding method (%)</b>			
Incubation	86.11	91.66	89.28
Natural	13.88	8.33	10.71
Sex ratio	1/6	1/5	1/6
<b>Feed source (%)</b>			
Purchased feed	52.77	41.66	46.42
Manufacture	47.22	58.33	53.57
Number of chickens	41.37 ± 7.62	27.69 ± 7.22	33.34 ± 3.23
<b>Production targets (%)</b>			
Repayment	16.67	10.42	13.10
Sale	25	12,50	17,86
Sale + own consumption	58.33	77.08	69.05
<b>Health monitoring (%)</b>			
Producer 72.22 70.83 71.42	72.22	70.83	71.42
None 2.78 - 1.19	2.78	-	1.19
Veterinary	25	29.17	27.38

### Farm typology

A Multiple Correspondence Analysis (MCA) was carried out on 13 variables, including 12 active variables characterizing farms, herd origin and management. An additional variable was associated with the active variables: the farm age variable. All these variables contributed to the representation of individuals in two-dimensional space. The first two dimensions (axes) enabled discrimination between farmers and explained 53.85% of the total variation.

The MCA enabled us to group the respondents into 3 groups or clusters (group 1 in black, group 2 in red and group 3 in green). Based on the production objectives and sanitary management methods of the three groups, a nomenclature was drawn up to designate the producers in each group.

#### ▪ Group 1: Classic mixed-purpose producer

Group 1 is made up entirely of men, most of whom are farmers (37.04%) or breeders (24.07%). They have no level of education and started their breeding with a small number of chicks ( $\leq 50$  chicks) which they acquired by purchase. Artificial incubation is practiced in 98.15% of cases, and farmers in this group make their own feed (59.26%). They are

motivated by sales + consumption:

▪ **Group 2:** Classic market-oriented producer

Group 2 is found in both the south (62.50%) and the west (37.50%). It is made up of artisans (56.25%) who acquired their initial workforce through Don (68.75%). They look after the health of their animals themselves (93.75%) and produce exclusively for sale (100%).

▪ **Group 3:** Modern market-oriented producers

This group is made up of civil servants (66.67%), most of whom have secondary education (58.33%). 75% of these farmers are adults, 66.67% men and 33.33% women. Although they keep a small number of chickens ( $\leq 50$ ) in the flock, they practice artificial incubation (66.67%) and the animals are monitored by a veterinarian (75%). The production objective of the breeders in this group is mainly sales, the percentage distribution of parameters is shown in Figure 3.

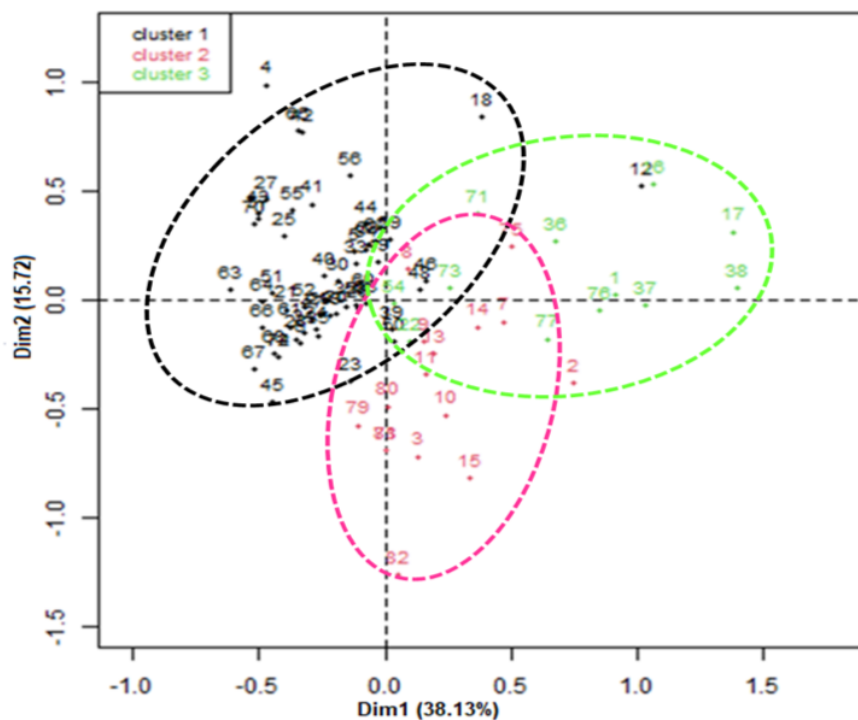


Figure 3: The percentage distribution of parameters is shown

## Discussion

The present study has shown that Wassachiè hen rearing is a male-dominated activity in the southern and western zones of Mali. This trend is in line with the results obtained by Pinde *et al.*, (2020), Dao, (2015) and Loukou, (2013) in Burkina Faso, Togo and Côte d'Ivoire respectively. However, an opposite finding was made by Fotsa *et al.*, (2007) according to whom poultry farming is a traditionally female activity and practiced by 80% of women and disadvantaged youth in most developing countries. In rural areas, the patriarchal management of the family in Mali could be at the root of this high percentage of men in the poultry sector. Nevertheless, men's involvement in the decision to sell hens is already well-known in Africa. It is due to socio-cultural considerations that give men the right to manage the family to the detriment of women (Gueye, 1998).

The study showed a high proportion of herders working in the primary sector (agriculture, livestock breeding, handicrafts, etc.). This result would be linked to the low level of education of respondents in both zones and perfectly reflects the low literacy rate of the

Malian population, which is 38% (INSTAT MALI, 2016). What's more, the proportions of 16.66% in the south and 20.83% in the west show that Wassachiè chicken farming is practiced as a secondary activity alongside activities such as agriculture, trade and handicrafts.

Although the level of training in poultry farming is low, poultry farmers in the South and West zones produce for sale + self-consumption. These results are in line with those of Loukou, (2013), according to whom poultry farming constitutes a means of subsistence during the lean season, whereas during the winter season, products are consumed directly. The study revealed that the majority of farmers have built up their flocks by purchasing chicks. This observation corroborates those of Loukou, (2013) and Fosta *et al.*, (2007), who respectively showed in Côte d'Ivoire and Cameroon that poultry flocks in rural areas are constituted mainly by Purchase, followed by other modes such as Gift, Trust, Inheritance and Barter.

It has been observed that breeders with the smallest number of chicks at start-up are the most successful in sustaining their flocks over the years. This observation is the fruit of ancestral knowledge based on animal husbandry techniques and cultural practices handed down from generation to generation (Lobry, 2003). This also justifies veterinary care practices by the farmers themselves, as well as self-medication practices, sometimes with non-conventional pharmaceutical products (ampicillin commonly known as "toupaille", paracetamol or nivaquine) or traditional treatments based on the bark, leaves and fruits of medicinal plants used by people in rural areas (Loukou, 2013). However, these practices have their limitations with medium and large numbers of people. These constraints are factors in the loss of genetic diversity, as they lead to genetic erosion through the elimination of genes carried specifically by the individuals that disappear.

The MCA enabled us to classify the breeders into three groups. Groups 1 (Classical mixed-purpose producer) and 2 (Classical market-oriented producer) correspond to the commercial production system described by Dang, (2009). In this type of system, the herd is made up of animals obtained by Purchase. For farmers in this system, raising Wassachiè chickens is a source of income. Although artificial incubation is common practice on these farms, the level of biosecurity practice is low, due to a lack of knowledge and skills in chicken health monitoring. Group 3 (Modern market-oriented producer) corresponds to the category described by Yusuf *et al.*, (2014). Breeders in this type of farm have a secondary level of education, which justifies the high proportion of civil servants. These authors found that a person's level of education contributes to their rate of adoption of new technologies. Ochieng *et al.*, (2012) confirmed in their findings on the adoption of management interventions in local chicken production in Kenya, that farmers' level of education had a positive marginal effect on the adoption of feed supplementation and vaccination.

## **Conclusion**

The characterization of Wassachiè chicken production systems in the southern and western zones of Mali has enabled us to divide the breeders into three groups, all of which share the common feature of carrying out this activity as a secondary activity. As a result, efforts must be made to

## **Authors contribution**

Amene dit Moussa DOLO: Project manager. Responsible for coordinating the writing of the article; Ibrahima Karim DIALLO. Data collection team leader and member of the drafting



and synthesis team; Amadou KONE Responsible for statistical analysis of field data; Mohamed DEMBELE. Field team coordinator and data analysis team member

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### **Ethical approval**

All experimental procedures involving animal care have been approved by the ethics committee of the Institut d'Economie Rurale and the Comité National d'Ethique du Mali at its 17th session (2023).

### **Conflicts of interest statement**

Conflicts of interest statement All authors have declared no conflict of interest  
This study presents no conflicts of interest.

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