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### RESEARCH ARTICLE

#### CHARACTERIZATION AND TYPOLOGY OF GUINEA FOWL (*NUMIDA MELEAGRIS*) FARMING SYSTEMS IN BURKINA FASO.

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#### Abstract

Guinea fowl (*Numida Meleagris*) production systems characterization was carried out in Burkina Faso through a baseline survey describing diversity in Guinea fowl farming practices in a context of limited references on this specie, in order to plan further development efforts and to enhance productivity. Five sites belonging to the three agro-ecological areas of Burkina Faso were covered as followed: one, three and one sites respectively in Sahel, Sudan-Sahel and Sudan areas. A total of 100 farmers were interviewed: 25 in Sahel area, 55 in Sudan-Sahel area and 20 in Sudan area. Descriptive statistics, multiple correspondence analysis and hierarchical classification have been performed using R software to establish the diversity of local Guinea fowl production system and typology.

Guinea fowl breeding is mainly practiced by men (93%) in a free-range production system (93%), predominant in Sahel area (80%) while semi intensive breeding system was mainly encountered in Sudan (75%) and Sudan-Sahel (82%) zones. According to interviewers, the main reasons for keeping guinea fowl compared to hen were egg quantity (76%), high price value (66%), meat quality (60%) and better productivity (36%). The main constraints rely on diseases and pests (77%), high mortality rate (65%), lack of knowledge in breeding practices (57%) and predation (54%). Moreover, to carry out their activity, guinea fowl keepers need support from extension services for capacity building. An institutional support with appropriate research in the production sector is needed to improve the living conditions of rural breeders' association mixtures, which may contribute to alleviate poverty.

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**Introduction:-**

Burkina Faso is a land-locked country and a rural-based low income economy with livestock contributing 19.2% to country Growth Domestic Product (GDP). Roughly 90% of active population of Burkina Faso is involved in Agriculture and livestock breeding. This latter is one of the main economic activities on which the poorest populations depend for their foods and incomes. It is also essential to ensure against vulnerability and risk related to climatic conditions for populations which are highly dependent on rainfed agriculture for their livelihoods (Sanfo, 2009).

Family poultry is an important component in the economy of developing countries, representing a source of cash incomes for rural and economically disadvantaged households. There are several species of poultry out of which guinea fowl, which production fit very well with the climatic conditions of Burkina Faso regarding rainfall; the relatively lower rainfall which characterize roughly 90% of the three ecological areas, are ideal for guinea fowl production (Mahaka, 1990; Ikani and Dafwang, 2004). Compared to chicken and turkey, and according to several authors (Microlivestock, 1991; Ikani and Dafwang, 2004; Bonkoungou, 2005; Sayila, 2009), guinea fowls populations are generally resistant to most of the common viral diseases affecting poultry such as Newcastle disease, Fowl pox and Gumboro which decimate affected poultry populations, and are well adapted to traditional breeding production systems. However, mortality rate is dramatically higher in guinea fowl, mainly in rainy season and affecting young individuals with an average rate of 90%.

In Burkina Faso, the Guinea fowl population numbered 8 463 000 heads (MRA, 2014). It is reared throughout the country land (Sawadogo, 1995).

Apart from cash incomes generation, Guinea fowl plays a nutritional, cultural and social roles in African societies (Sanfo, 2009; Dahouda, 2003).

Although, guinea fowl production constitutes one of the key incomes sources for rural communities, there are very few detailed studies given comprehensive description of the flocks and smallholders characteristics and typology of their production system in Burkina Faso.

Therefore, this study aim to describe diversity in guinea fowl farming practices in a context of limited references on this specie, in order to plan further development efforts, to enhance Guinea fowl productivity in Burkina Faso.

**Materials and methods:-****Sites, Sampling and data collection:-**

Sampling was carried out in a total of 25 villages belonging to 5 provinces in the three ecological areas of Burkina Faso:

The Sahel area (Seno province) which is an arid area covering the northern part of Burkina Faso (from latitude 13° 5' N to 15° 3' N, approximately) with annual rainfall <600 mm, temperatures varying from 15°C to 47°C, and grassy, bushy, shrubby and thicket steppe vegetation, usually quite sparse, with ligneous species that may locally form penetrable bushes.

The Sudan-Sahel area (Sanguié, Gourma and Boulgou provinces) is a transitional zone with regards to rainfall and temperature. It covers the central part of the country (roughly from latitude 11° 3' N to 13° 5' N), with a short rainy season from June to September and very variable rainfall with average of 750 mm. Per year, temperatures varying between 20°C and 42°C, and vegetation varying from North to South with better hydric conditions, from the Sahel to the Sudan savannah and can eventually tend toward a clear forest in the Southwestern extreme of the zone.

The Sudan area (Poni province) covers Southern of Burkina Faso (latitude from 9° 3' N to 11° 3' N), shares with the Sudan-Sahel area a similar rainy season with annual rainfall >900 mm and a predominance of woodlands and both Sudanese and Guinean savannahs type. Temperatures are relatively low varying from 17 °C to 35 °C.

The sampling sites are described in figure 1.

A transversal survey was conducted in the three agro-ecologic zones of Burkina Faso from April to May 2016. A total of 100 guinea fowl keepers were selected with the approval of extension services in charge of animal resources

into their respective areas, and the only condition considered was to own a minimum of 5 heads of guinea fowl in their flock.

Data collected included socio-economic characteristics of smallholders (age, ethnic group, sex, education level) and their household (location, type of vegetation around, type of livestock owned, breed owned). The survey covered also guinea fowl production system including breeding objective, feeding practices, health management, reproduction and breeding management.

The detailed description of sampling is given in table 1.

#### **Data analysis:-**

The typology of guinea fowl farming carried out in this study, took into account different elements of a farming system, the farmer, the herd and the management system including health, reproduction and breeding as stated by Gibson *et al.* (1990). All statistical analyses were performed using R Version 3.1.0 (R Core Team, 2015).

Descriptive statistics were first performed to determine the sampled herd characteristics. Multiple correspondence analysis (MCA) and hierarchical classification analysis (HCA, Ward's algorithm) allowed establishing the typology using the FactoMineR package of R (Lê *et al.*, 2008).

Sixteen significant variables were used for this typology and the details are given in table 2.

#### **Results:-**

##### **Socio-economic characteristics:-**

Table 3 summarizes socio-economic characteristics of the 100 breeders involved in this study. Guinea fowl farms are mainly headed by men (93%). However, 20% of farm headers are women in Sahelian area.

Breeders belong mostly to Fulani ethnic group (31%) followed by Mossi (30%), Gourounsi (19%) and Lobi (13%) depending on the survey location. Lobi (70%) and Fulani (20%) were the most represented ethnic groups in Sudan area while roughly 92% are Fulani in Sahel area. Sudan-Sahel area is a mixed one composed by several ethnic groups, such as Mossi (55%), Gourounsi (35%) and Fulani (7%).

About 61% of the respondents were Muslim (100% in Sahelian area) whereas the remaining 23% and 16% are Catholic and Animists respectively.

Regarding age, the survey respondents ranged from 30 to 80 years old with an average of 47.7. The largest proportion (55%) of the respondents was more than 50 years old.

The Guinea fowl flocks size are mainly between 0-50 individuals (90, 85 and 65% respectively in Sudan, Sudan-sahel and Sahel area). Only 8% (Sahel) and 10% (Sudan) of flock in Sudan area have more than 100 heads of Guinea fowl.

It was mainly the responsibility of women and children (80% of women and 74% of children) to feed and offer water to local guinea fowls. Their role is also focused to herd management while men are responsible for marketing of Guinea fowl and Guinea fowl products.

About 81% of the respondents received no training in poultry and guinea fowl breeding and 59% of the interviewed were illiterate while 16% read and write in Arabic.

Twelve (12%) percent and 11% went through primary or secondary cycles respectively. Only 2% of interviewees have university level.

Most respondents (68%) were fully involved in Agriculture as main means of livelihood and 23% are involved mainly in livestock keeping (guinea fowl and others species). The remaining 9% of the respondents were merchants.

##### **Guinea fowl production system:-**

The characteristics of the guinea fowl production systems are summarized in table 4. Three main productions

systems have been described in this study: the free-range, semi-free range and intensive production systems. The most predominant production system described is the free-range system (65%). However the predominant system in Sahel area is the free-range system (80%). In general, there is no separate housing system for guinea fowl in the study area (Table 4). About 63% of the respondents reported that guinea fowl share house with poultry in henhouse during night time while during day time, they scavenge around the house along with other domestic animals. This housing system is encountered in Sahel area (32%), Sudan (70%) and Sudan-Sahel areas (82%). In Sahel area, 84% of respondents declared that guinea fowl mainly perch on trees during nighttime.

Housing facilities in the areas are made with local and traditional materials, usually in banco mixed with straw.

The initial breeding stock were constitutes through three main different ways: inherited, purchased and gift. A considerable number of the farmers (82%) acquired their initial breeding stock through purchase from markets.

The main motives for keeping guinea fowl were profit; with 76%, 60% and 66% of interviewees keeping them for their high amount of egg, meat quality (organoleptic) and high price value respectively. However, differences are noted between sampling sites. The most reasons reported by Sudan and Sudan-Sahel smallholders were, the amount of egg (100% in Sudan area, 82% in Sudan-Sahel area), the meat quality (90% in Sudan area and 69% Sudan-Sahel are), high price (65% in Sudan area and 58% Sudan-Sahel area) and productivity (55% in Sudan area and 25% Sudan-Sahel area while in Sahel area guinea fowl are primarily kept for their high sales price (92%) followed by the amount of egg (44%) and productivity (36%). Moreover, breeders in Sudan area, the cultural and ritual reasons prevailed for keeping this specie (40%).

#### **Home consumption and marketing of the guinea fowl products:-**

According to interviewees, Guinea fowl and eggs were used for breeding (88% and 98% of citation respectively), self-consumption (99% and 97% of citation respectively), sale (93% and 83% of citation respectively) and donations (91% and 94% of citation respectively). Self consumption improves the supply of breeders in animal protein improving their income. Donation allow the maintenance of relationships and social cohesion (90%). The products were sold mainly in the breeder's home (in 80% of cases) and others market in the village (in 60% of cases) in the Sudan and Sahel areas. However, in Sudan-Sahel zone, the poultry products were mainly sold at home (63%) and at the village market (46%).

Eggs price was the highest in the Sahel (50.22<sup>FCF</sup>), while that of the guinea fowl was highest in Sudanese zone (2631<sup>FCFA</sup> for females and 2675<sup>FCFA</sup> for males).

#### **Feed resources and feeding practices**

The results of this study show that there is no formal specific feeding practice of guinea fowl in Burkina Faso. Scavenging feeding is practiced by 100% of respondents in the three agro-environmental zones. However, depending on the sampling area, scavenging feeding system is coupled with cereals distribution.

The distributed feed resources include mainly sorghum (68% and 64% respectively for young and adult guinea fowl), millet (60% and 52% respectively for young and adult guinea fowl) and maize (43% and 50% respectively for young and adult). The others feed resources (6%) consist in insect, termites and kitchen wastes.

Foods are distributed two to three times a day especially in the morning upon opening the henhouse, afternoon and/or evening. In Sudan area, foods were mainly distributed in the morning and lunchtime. In Sudan-Sahel and Sahel zones, distribution is made two times a day, in the morning and evening (Table 5).

#### **Diseases and predation:-**

Diseases and predation were recorded as the major factor limiting rural household guinea fowl production system in the sampling areas. The most common predators are cats, snakes and eagles. Overall, mortality is mainly related to those two constraints, 94% and 61% respectively for diseases and predation. The associated symptoms reported are mainly drooping wings (73%), somnolence (58%) and tremor (55%) (Table 6).

#### **Health management:-**

High percentage of farmers does not offer health interventions to sick Guinea Fowl. But some breeders often use ethno-veterinary medicine based on herbal plants in form of decoctions and infusions merged with drinking water. Mainly breeders in Sahel area, for prophylactic purpose use ethno-veterinary medicine, while breeders in Sudan-

Sahel and the Sudan areas use modern (conventional) medicine, respectively at 73% and 65% prevent diseases (Table 6).

#### **Constraints in guinea fowl production:-**

The main constraints reported in this study were: health care problem (77%), mortality (65%), problem related to breeding techniques (57%) and predators (54%) (Table 7).

#### **Typology:-**

##### **Multiple correspondence analysis (MCA):-**

Multiple correspondence analysis (MCA) was applied on 16 variables with 55 modalities (Table 2). Two main factors representing 21.8% of total variation (Figure 2) allowed clear discrimination of breeders following those modalities. Axis 1 (Figure 2) opposes modalities related to intensification (health care, supplementation and semi-intensive system) on positive coefficient to those for extensive practices on the negative coefficient. Modalities describing extensive breeding system are associated mainly with breeders in Sahel area, with few experiences in guinea fowl breeding (less than 10 years), animals straying system and absence of shelters for birds (Guinea fowl perch on tree branches). Guinea fowl of these breeders do not benefit from supplements and special health care. These breeders are using ethno-veterinary medicine to treat guinea fowl. Most women of the sample were shown a link with this axis. The last group of modality describing intensive herding is associated with Sudan and Sudan-Sahel breeders with high experience in breeding of guinea fowl (above 10 years). These breeders practice a semi-straying system for the most and confined system for only a few parts of these smallholders. They have a shelter for guinea fowl, distribute a feed supplementation and have access to health services. Axis 2 shown a link with variables related to occupation and level of education of breeders. Indeed, in the positive coefficients of this axis, breeders with professional activities other than agriculture and livestock were found with high level of education (secondary and higher). Young breeders (30-50 years) were also found in this group, they have a large flock size of guinea fowl (superior to 100). At the negative coefficient, the professional activities of breeders is mainly agriculture or livestock, they have a low level of education, are elderly and have a small number of guinea fowl.

##### **Hierarchical classification and clusters' description:-**

Hierarchical clustering was performed on the 16 variables (Table 6) and allows retaining four clusters (Figure 3).

The proportions of the modalities that are most represented in different clusters are given in Table 8.

Group 1 (31 breeders) represents the breeders practicing traditional breed system. All Sahel breeders and 71% of women are in this group. The modalities related to extensive system, describe above on axis 1 positive coefficient, best describe this group.

Group 2 (47 breeders) consists of individuals with high level of education (82% of group individuals have a secondary level). Young breeders practicing intensive farming system characterize this group.

Group 3 includes only two individuals with high education level and where the breeding system is intensive in confinement mode.

Group 4 (20 breeders) consists on individuals with high experience in guinea fowl breeding. Those breeders practice feed supplementation and take care to their animals. 88% of farmers in this group have acquired their herd by buying and heritage.

#### **Discussion:-**

##### **Description of breeders:-**

The largest proportion of breeders (55%) in this study was in advanced ages, more than 50 years old and only 45% were between the ages of 30 and 50 years. It appeared that Guinea fowl breeding is mainly dedicated to residents with advanced ages. This observation coincide with that reported by Teye and Adam (2000), thinking that residents under 20 years of age were barred from rearing guinea fowl. The economic condition of young residents in rural area might not allow this category to have their own flocks. However, young breeders are more susceptible to adopt new technologies than advanced age breeders and this could constitute an inconvenient for the production improvement.

Results showed that majority of farmers in this study were male (93%). Guinea fowl breeding appeared to be a predominantly male occupation in all three agro-ecological areas of Burkina Faso, linked to socio-economic considerations telling that animal rearing is traditionally male dominated (Bounkougou, 2005; Saina, 2005; Avornyo *et al.*, 2016). Relative higher proportion of female farmers was found in Sahelian area due to the establishment of an innovative platform on guinea fowl breeding in this area, which takes into account gender issue. These results are in line with those shown before by Dankwa *et al.* (2000) in West Mamprusi district of Ghana. This is congruous also to the submission of Gueye (1998) who reported that approximately 70% of guinea fowl were under the control of women in rural Sub-Saharan Africa.

However, those results are in contrast with the case of Zimbabwe, where about 89% of surveyed farmers were female (Ndiweni, 2013).

Most of the farmers interviewed (59%) had no formal education. The estimate given by Teye and Adam (2000) was very similar, about 60%. Also, about 81% of respondents received no training in poultry and guinea fowl breeding. The results suggested that guinea fowl production was still largely the occupation of illiterates' farmers and training in breeding is highly needed to improve breeding practices as noted by Kwesisi *et al.* (2015).

Crop production is the main occupation of the interviewed breeders. This covers food needs and constitutes the main source of income for rural families. However, this activity is precarious and dependent to the rainy season and cannot meet farmer's food needs throughout the year. So, guinea fowl rearing could be a good opportunity for rural households to access a source of animal protein (meat and eggs) as well as the potential to generate income through the sale of guinea fowl and/or eggs (Magothe *et al.*, 2012; Yakubu *et al.*, 2013). The intense production periods and sale of Guinea fowl products coincide with the financial needs of farmers for the purchase of food (Idi, 1996).

The main motives for rearing guinea fowl in our study areas, compared to hen was the high amount of egg, the relative best price, meat quality, and productivity. These perceptions of guinea fowl are consistent with scientific literature. Indeed, Bonkougou (2005) and Sanfo *et al.* (2007) showed a productivity of 80 to 100 eggs per year with an average of 97 eggs for guinea fowl in Burkina Faso, considering this specie as good layer, compared to local hen, which produce only 50 eggs per year (Hien, 2002). Ikani and Dafwang (2004) in Nigeria and Saina (2005) in Zimbabwe reported that eggs and meat qualities of guinea fowl were higher than those of hen. Baeza *et al.* (2001) reported higher protein content in guinea fowl meat compared to chicken. A rate of 23% and 21% were reported respectively for guinea fowl and chicken (IEMVT, 1983).

Breeders in this study mentioned a variety of reasons for keeping guinea fowl. The majority of households offers them for sale to solve families' specific needs and consumed during special social events (Somda, 1987). Home consumption was another good reason why village guinea fowls are kept (Nagalo, 1984; Somda, 1987; Yakubu, 2013). The marketing of guinea fowls at the adult stage could be attributed to consumers' preference, and the higher price they attract.

#### **Production systems:-**

The semi free range production system practised by the majority of the farmers in this study was similar to the system adopted on village poultry by smallholder farmers in most sub-Saharan African countries (Idi, 1996; Dahouda, 2003; Saina, 2005). This system is widely used in Bangladesh for rearing of chickens (Swan, 1999). However, it is noted that the production system is highly related to the geographic area and this is confirmed by the typology; the free range production system is predominant in Sahelian area (80%). This system is well-known in West Africa is integrated in the poultry rearing system where birds of different age and species scavenge together (Sanfo *et al.*, 2008). Its constitutes an important resource for resource-poor farmers in some countries, especially in developing countries. Improvements in this type of farming are of economic importance, because they involve the entire rural population. These improvements include placing drinking water at the disposal of the birds, and protecting their health.

In semi free range system, there was virtually no appropriate habitat for the protection of guinea fowl. The few shelters encountered in this study, are made with traditional materials (bacon or straw). The major constraint of this housing system is their confinement, poor ventilation with difficulties for cleaning. They are inappropriate and do not provide good protection to guinea fowl against bad weather and predators, that are the main causes of mortality. These observations are consistent with those made by Pousga (2009); Moula *et al.* (2012). Dahouda *et al.* (2007)

where 80% of henhouses are built in bacon and 73% with straw in rural areas. In Sahelian zone (graphical representation of modalities on axe1, positive coefficient and cluster 1), individuals were in total freedom in the majority of cases. In this area, the birds do not benefit any shelter and they spend the whole night roosting in trees (Boko, 2004; Dahouda *et al.*, 2007) exposing them to predators and bad weather.

#### **Production management:-**

It is shown in this survey that hatching commence during the rainy season. Similar results were obtained by Dahouda *et al.* (2007).

The incubation of guinea fowl eggs is commonly done naturally. Most smallholder farmers use chicken and duck to hatch guinea fowl eggs, as the guinea hen will often leave the nest after only a few guinea keets hatch (US Department of Agriculture, 1976). This behavior has been observed in Benin (Dahouda *et al.*, 2007) and Burkina Faso (Bonkougou, 2005). This allowed to improving guinea fowl egg hatchability, by inhibiting their brooding instinct and limit losses of keets as hens take more care of them.

Scavenging, consisting of wide range of flora and fauna (insects, leaves, grains) is the main feeding system under free-range and semi free range guinea fowl production systems in Burkina Faso. The same founding was reported in Zimbabwe (Saina, 2005). Guinea fowl has competitive advantages over chicken as a free ranging bird consuming non-conventional feed that is not used in chicken feeding (Nwagu and Alawa, 1995; Bonkougou, 2005; Goromela *et al.*, 2006; Dahouda *et al.*, 2007; Pousga, 2009). However, in some cases they received feed supplementation. The main foods distributed in the three areas were sorghum, millet and maize. Similar observations have been reported in Burkina Faso (Bonkougou, 2005) and Zimbabwe (Saina, 2005). This is different in India (Gawandé, 2007) where the food distributed to guinea fowl is mainly composed of rice. Regarding these observations, it seems that the type of supplementation distributed to guinea fowl depends on the cereal crops of each country. The food is distributed two to three times a day especially in the morning upon opening the henhouse before straying, afternoon and / or evening. Breeders, mainly, those of Sudan and Sudano-Sahelian areas, take more care of the keets by providing supplements termites which are a significant source of protein for guinea fowl. These farmers were filed essentially cluster 3 of typology groups. Practice of supplementation is not a particularity of this study, indeed, Dahouda *et al.* (2007) showed that a considerable number of breeders in Benin distributed supplements twice daily (37%) or three times a day (33%) and the rest did it occasionally. Principal purpose of food distribution was the domestication of the fowl by creating a habit of behavior.

In traditional poultry farming, diseases have been identified as one of the major constraints affecting productivity. They are caused by inadequate housing system, bad weather conditions and the absence of vaccination (Jagne *et al.*, 1991). Ignorance, poverty and neglectation were the reasons given by farmers for the poor vaccine coverage as already reported in Cameroon by Fotsa (2008). The way of treatment vary from one region to another. These observations are supported by the typology. The breeders of the cluster 1 represented by mostly breeders of the Sahel area are opposed to those from other clusters with breeders of Sudan and Sudan-Sahel regarding Health management.

This difference relies in the way of prevention against diseases and treatments of guinea fowl. Farmers in Sudan-Sahel and Sudan area used extensively vaccination as a means of prevention while the Sahel farmers do not vaccinate their animals. Despite this difference, the mortality rates are almost equal in the 3 surveys areas. This latter observation can be explained by the failure to respect vaccination programs (Gawande *et al.*, 2007), the inadequate way to conserve vaccines (Fosta, 2008). In addition, referring to methods of treatment, the Sudan and Sudan-Sahel areas use modern and traditional methods. However, use of modern medication techniques is less in practice Sahel area (cluster1). Gawandé *et al.* (2007) attribute this difference to non-access to veterinary services due to the distance of the breeders.

#### **Constraints related to raising the guinea fowl:-**

In this study, the main constraints were in health problem, high mortality, problem related to breeding techniques and predation. In traditional breeding system, the guinea fowl are in rudimentary shelters during nighttime where there is no care. In this system, poultry should be robust and fairly productive and not requiring special care (Sharma, 2007). Thus, significant progress remains to be made in the three areas to improve health status in order to minimize losses.

The high mortality rate of guinea fowl particularly keets, is a major problem and is a source of discouragement for farmers. Dahouda *et al.* (2007) found during their study that the large losses are recorded during the first month of breeding. These losses would be caused by cold and rain and probably by parasites. According to Le Coz-Douin (1992), the system of thermoregulation of the guinea fowl is ineffective during the first weeks of their life.

Technical constraints may be minimized by focusing on breeders' training, strengthening their capacity to flock management.

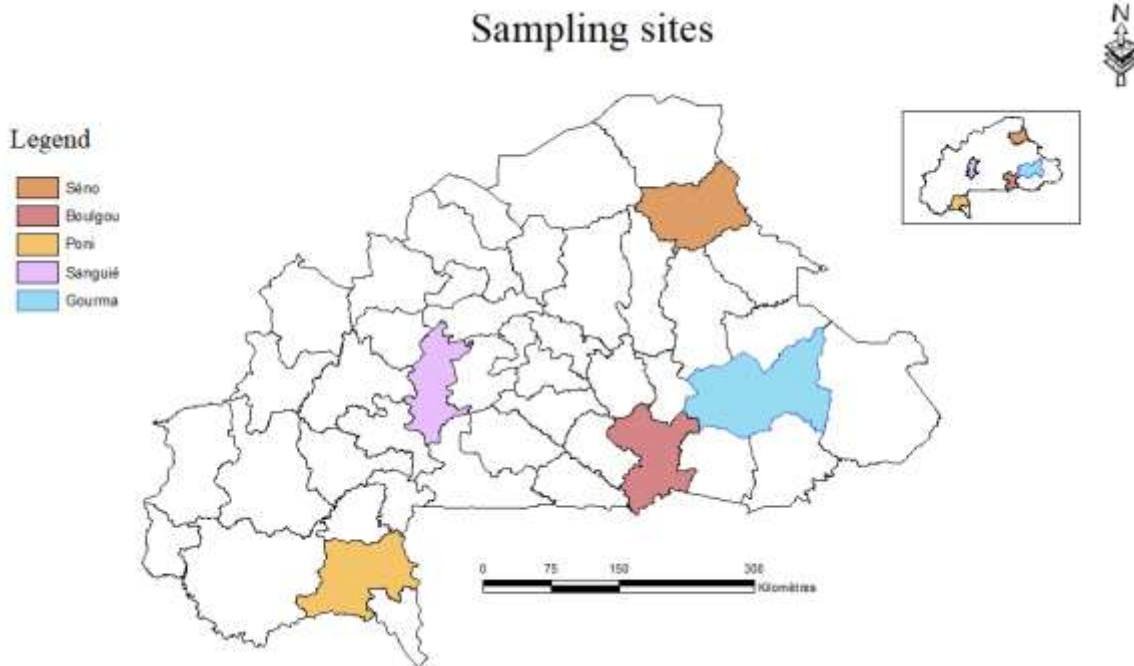


Fig 1:- Map describing the sampling areas.

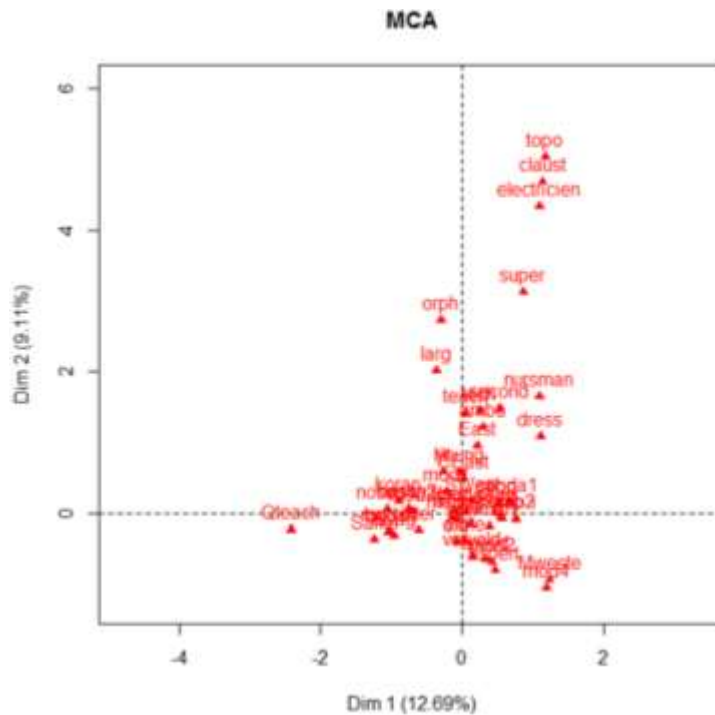
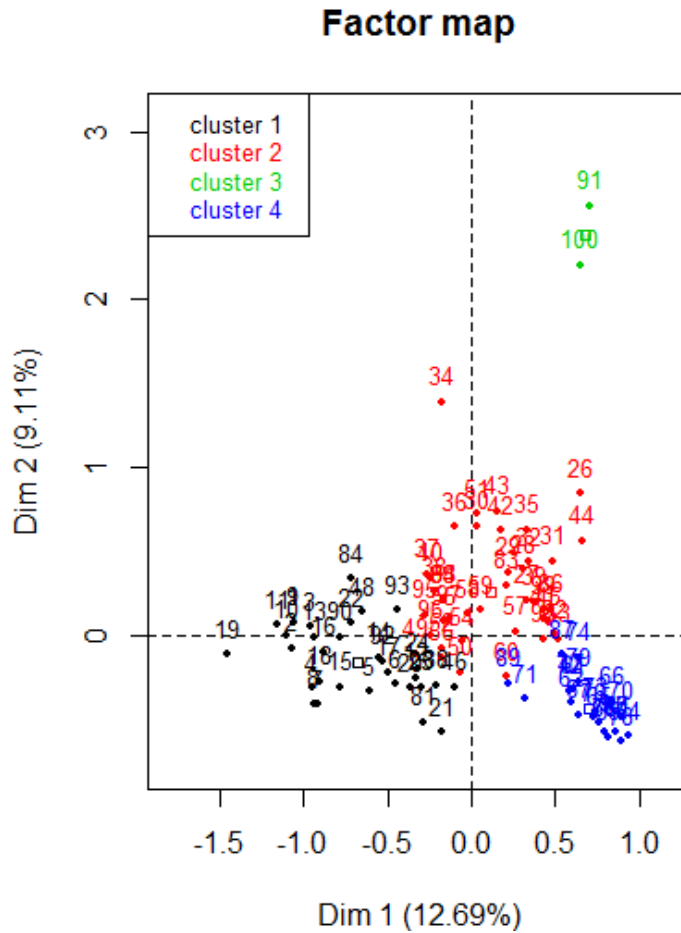


Fig 2:- Graphic representation of modalities on axis 1 and 2





**Fig 3:-** Graphic representation of clusters on axis 1 and 2 (the numbers correspond to breeders' identifiers).

**Table 1:-** Description of sampling

Provinces	Villages	Number of interviewed farmers per area		
		Sahel	Sudan-Sahel	Sudan
Sanguié	Tio		7	
	Baleledo		8	
	Tenado		2	
	Tiogo		3	
Gourma	Namougou		4	
	Fada		11	
Boulgou	Malenge		2	
	Soungdin Peulh		2	
	Kampoaga		8	
	Sougri		2	
	Lagwenda		3	
	Tenkodogo		2	
	Zougnobghim		1	
Seno	Debere talata	5		
	Towgel	9		
	Yakouta	6		
	Bangue	2		
	Katchari	1		
	Djomga	1		
	Dori	1		

Poni	Gaoua			6
	Gonfera			9
	Hella l			3
	sibera			1
	Bouroum-bouroum			1
<b>Total</b>	<b>25</b>	<b>25</b>	<b>55</b>	<b>20</b>

**Table 2:-** Variables used in MCA and HCA for the typology of guinea fowl production system in Burkina Faso

Variables	Codes	Modalities
Sampling area	region	Sahel : sahel
		East : East
		SWest : South West
		Mweste : Midwest
		CEast : East center
Sex	sex	Men
		Women
Age	age	young : between 30 and 50 years
		old : between 50 and 60 years
		Veryold : more than 60 years
Instruction's level	level	anyle : no education level
		koran : koranic school
		Primary : primary level
		Second : secondary level
Literacy in local language	alhab	noalhab : no literacy in the national language
		alpha : literacy
Training in breeding	formati	noformat : received no training in breeding
		formation : received training in breeding
Main occupation	agri	agri : farmer
		breed : breeder
		Qteach : koranic teacher
		nursman : nurserman
		orph : manager of an orphanage
		ambu : ambulance driver
		teach: teacher
		dress: dressmaker
		topo: topographer
		electricien: electrician
Number of guinea fowl	effect	low : less than 50
		inter : between 50 and 100
		larg : more than 100
Experience in breeding	experien	peu : less than 10 years experiences
		mieux : between 10 and 20 years experience
		expert : more than 20 years experiences
Breeding system	mode	Divag : Free-range system
		Semi: guinea fowl left in semi-straying
		claut: guinea fowl breed in cloistering

**Table 2 (continued):-** Variables used in MCA and HCA for the typology of guinea fowl production system in Burkina Faso.

Variables	Codes	Modalities
Acquisition mode	acquis	Mode 1: purchased and/or donation
		Mode 2: inherited and/or donation
		Mode 3: donation
		Mode 4: purchased and/or inherited

Health	health	Mod0: use of self medication medicines alone or no care
		Mod1: access to health services and used of medicines
		Mod2: access to health services and used of veterinary and self medication.
Supplement for very young	Suppintd	nosup1 : no supplementation
		sup1 : supplementation
Supplementat for young	Supjeu	nosup2 : no supplementation for young
		sup2 : supplementation for young
Supplementat for adults	supadlt	nosup3 : no supplementation for adults
		sup3 : supplementation for adults
Housing system	habitat	branch : trees branches
		coop : henhouse
		comb : roofing + henhouse or henhouse + branch

**Table 3:-** Socio-economic characteristics of guinea fowl breeder's in Burkina Faso

Variables	Modalities	Smallholders' percentages			
		Overall	Sudan	Sudan-Sahel	Sahel
Ethnicity of breeder	Fulani	31	20	7	92
	Gourounsi	19	0	35	0
	Mossi	30	0	55	0
	Lobi	13	70	0	0
	Others	07	10	03	08
Sex	Men	93	95	98	80
	Women	07	05	02	20
Age	Age	51	48	52	52
Religion	Muslims	61	25	56	100
	Catholic	23	25	33	0
	Animist	16	50	11	0
	Neither	59	65	58	56
Education	Koranic school	16	05	11	36
	Primary	12	10	14	08
	Secondary	11	20	13	0
	Superior	02	0	04	0
Literacy in local language	Yes	10	0	13	12
	No	90	100	87	88
Livestock training	Yes	19	15	02	24
	No	81	85	20	76
Role of women in breeding	No role	08	21	08	24
	Feeding/watering	80	79	87	76
	Herd management	33	58	43	0
	Marketing of birds	03	15	0	0
	Marketing of eggs	03	11	02	0
Role of Kids in breeding	No role	09	15	11	44
	Feeding/watering	74	85	79	52
	Herd management	35	60	36	04
	Marketing of birds	03	05	04	0
	Marketing of eggs	02	05	02	0
Main activity	Crop production	68	65	65	76
	Livestock keeping	23	15	27	20
	Others	09	20	08	04
Guinea fowl flock size	Low (0-50)	82	90	85	68
	Average (50-100)	11	10	05	24
	High (more than 100)	7	0	10	08

**Table 4:-** Local Guinea fowl farming system characteristics per agro-ecological zone of Burkina Faso

Variables	Modalities	Breeder's percentages			
		Overall	Sudan	Sudan-Sahel	Sahel
Farming systems	Free range	33	25	14	80
	Semi free range	65	75	82	36
	Intensive	02	0	04	0
Guinea fowl housing system	Henhouse	63	70	82	32
	Branch	32	15	14	84
	Mix	05	15	04	0
Foundation stock	Inherited	24	10	31	20
	Purchase from market	82	85	84	76
	Gift	07	10	07	04
Reasons for breeding guinea fowl	Quantity of egg	76	100	82	44
	Quantity of meat	60	90	69	16
	High price	66	65	58	92
	Productivity	36	55	25	36
	Ease of breeding	21	40	13	24
	Rusticity	16	35	13	08
	Cultural	16	40	15	0
Use of guinea fowl	Adaptation	09	20	09	0
	Reproduction	88	100	98	56
	Consumption	99	100	98	100
	Marketing	93	90	91	100
	Gift	91	85	93	92
Use of eggs	exchange	05	0	09	0
	reproduction	98	100	100	92
	consumption	97	95	100	92
	Marketing	85	75	87	88
	Gift	94	90	96	92
	exchange	0	0	0	0
Reason for disposal	family feeding	96	100	96	92
	cash need	90	85	91	92
	social cohesion	90	90	98	72
Price of animals (FCFA)	Egg	45.24	40.38	44.18	50.22
	Female	2405	2631	2368	2324
	Male	2419	2675	2378	2324
Incubation	guinea fowl	14	0	16	20
	hen	98	100	96	96
	duck	09	15	07	08
	turkey	10	6	18	0
	artificial	03	05	04	0

**Table 5:-** Types of feed and their distribution period in the three agro-ecological zones of Burkina Faso

Variables	Modalities	Percentages of citation by farmers			
		Overall	Sudan	Sudan-Sahel	Sahel
Food type for keets	Sorghum	62	50	54	88
	Mil	59	20	60	88
	Maize	25	15	38	04
	Others	06	15	22	24
Food type for young guinea fowl	Sorghum	68	35	71	88
	Maize	60	20	60	88
	Mil	43	50	56	05
	Others	06	15	22	20
Food type for adults guinea fowl	Sorghum	64	25	65	88

	Mil	52	10	51	88
	Maize	50	60	67	04
	Others	06	15	05	20
Distribution periods for keets	Morning	96	100	100	88
	Noon	44	90	42	12
	Evening	57	35	71	48
Distribution periods for young guinea fowl	Morning	93	90	98	88
	Noon	28	50	31	12
	Evening	52	35	60	48
Distribution periods for adults guinea fowl	Morning	92	90	96	88
	Noon	27	45	31	12
	Evening	51	35	58	48
Supplementation	Keets	65	95	75	08
	Young	49	35	67	04
	Adults	47	35	65	04

**Table 6:-** Causes of mortality, symptoms, prevention and treatment of diseases in the three agro-ecological zones of Burkina Faso

variables	Modalities	Percentages of citation by farmers			
		Overall	Sudan	Sudan-Sahel	Sahel
Causes of keets mortality	Predators	61	60	60	64
	Accident	14	25	15	04
	Diseases	94	80	98	96
	Others	15	35	11	08
Causes of adults mortality	Predators	19	55	07	16
	Accident	14	25	13	08
	Diseases	58	50	58	64
	Others	20	30	23	08
Symptoms of diseases encountered	Diarrhea	52	65	40	68
	Cough	09	25	04	08
	Drowsiness	58	80	60	36
	Smallpox	11	15	11	08
	Drooping wings	73	85	87	32
	Swelling of the head	15	15	18	08
	Trembling of paws	55	40	67	04
Diseases prevention	Housing hygiene	43	50	58	12
	Vaccination	47	75	53	0
	Others	29	05	25	04
Treatment diseases	Vitamin	40	50	53	04
	Deworming	27	30	36	0
	Antibiotics	54	65	73	04
	Traditional treatment	48	40	58	04

**Table 7:-** Constraints and recommendations

Variables	Modalities	Percentages of citation by farmers			
		Overall	Sudan	Sudan-Sahel	Sahel
Constraints in livestock	Lack of henhouse	46	35	50	48
	Lack of laying nest	20	65	11	04
	Health problem	77	75	81	68
	Lack of water	11	15	15	0
	Predators	54	90	41	52
	Mortality	65	80	80	20
	problem of breeding	57	85	56	36

	techniques				
	Lack of water	22	10	20	36
	Lack of food	44	20	47	56
	Low eggs production	01	0	02	0
	Theft	39	50	45	16
Recommendations to improve production	Technical framing	91	100	84	100
	Subsidies	95	95	94	96
	Granting of reproduction	29	95	18	0

**Table 8:-** Distribution of breeders in clusters for the most relevant modalities

Modalities	Cluster 1	Cluster2	Cluster3	Cluster4
Coop	-	57.1		-
Branc	90.6	-	-	-
East	-	100	-	-
SWest	-	85	-	-
Mweste	-	-	-	100
Sahel	100	-	-	-
moda0	84.4	-	-	-
moda1	-	-	-	40.8
moda2	-	64.7	-	-
Semi	-	60	-	32.3
Claust	-	-	100	-
Divag	84.2	-	-	-
nosup1	67.6	-	-	-
nosup3	52	-	-	-
nosup2	52	-	-	-
Super	-	-	50	-
Second	-	81.8	-	-
Koran	62.5	-	-	-
Anyle	-	-	-	30.5
Woman	71.4	-	-	-
Man	30.1	-	-	-
sup3	-	-	-	44
sup2	-	-	-	44
sup1	-	-	-	34.8
Larg	-	-	28.5	-
Topo	-	-	100	88.8
Electri	-	-	100	-
Breed	-	-	-	47.8
Expert	-	-	-	60
Bett	-	65.6	-	-
mod2	-	-	-	55.5
mod1	-	55.1	-	-
young	-	65.2	-	-

**Conclusion:-**

Guinea fowl is central to many circumstances of socio-cultural, economic and religious of the rural households in Burkina Faso. The breeding of this bird is a socio-economic activity that allows farmers to have animals' protein and incomes. It was clear from our study that this activity present insufficiencies in health level, housing and feeding. These constraints are an obstacle for production development. However, the increase of poultry productivity is an important mean to fight against rural poverty and to meet the needs of producers. For this, technical constraints

raised in this study have to be minimized by focusing on the formation of farmers. Genetic can also contribute to the improvement of productivity and for this, a characterization of different populations would be needed.

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