



**Full Length Research Article**

**TYOLOGY OF CATTLE LIVESTOCK PRODUCTION SYSTEMS IN CÔTE D'IVOIRE**

**\*<sup>1</sup>DP Sokouri, <sup>2</sup>NE Loukou, <sup>3</sup>CV Yapi-Gnaoré, <sup>1</sup>B Soro and <sup>1</sup>AS-P N'guetta**

<sup>1</sup>Université Félix Houphouët Boigny, UFR Biosciences, Laboratoire de Génétique, 22 BP 582 Abidjan 22, Côte d'Ivoire

<sup>2</sup>Université Gbon Péléforo Coulibaly, UFR Sciences Biologiques, BP 1328 Korhogo, Côte d'Ivoire

<sup>3</sup>Centre International de Recherche-Développement sur l'Élevage en zone Subhumide (CIRDES), 01 B.P.4 54 Bobo-Dioulasso 01 – Burkina Faso

**ARTICLE INFO**

**Article History:**

Received 09<sup>th</sup> August, 2014

Received in revised form

04<sup>th</sup> September, 2014

Accepted 12<sup>th</sup> October, 2014

Published online 18<sup>th</sup> November, 2014

**Key words:**

Production system,  
Cattle, northern,  
Central,  
Region Côte d'Ivoire.

**ABSTRACT**

This study aimed to achieve typology of cattle production system related to social and structural characteristics. It was conducted in the two main breeding regions (central and northern) of Côte d'Ivoire; in 5 five departments of the central region and 7 departments in the northern region. A total of 1,041 farmers were interviewed; 599 farmers in the central region and 442 in the northern region. The results showed that cattle livestock production practices are closely linked to the social, lifestyle and skills of farmers. These practices are also related to the environment in which the animals are raised. Two major cattle livestock production systems were identified. The first is practiced by farmers from the northern region and those of two departments (Dabakala and Katiola) of the central region of Côte d'Ivoire. Farms from this system are real rural businesses generally refer satisfactory dividends to farmers. The second production system is practiced by farmers from the Central region (Bouake Béoumi and Sakassou). Farmers estimate that revenues of livestock products are not important and do not bring satisfaction.

Copyright © 2014 DP Sokouri et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**INTRODUCTION**

Like most developing countries, Côte d'Ivoire is a predominantly agricultural country. Agriculture employs two thirds of the workforce and contributes to 34% of total GDP and for 66% of export income. However, Côte d'Ivoire is deficient in animal protein. The country has long been wrongly or rightly considered as an unfavorable breeding territory. Therefore, farming remains a secondary economic activity with a contribution about 4.5% of agricultural GDP and 2% of total GDP. Nevertheless, it is an important activity that contributes to improving food security, diversification and increasing the income of farmers and ranchers. However, a national livestock was formed in a few decades when the country had no pastoral tradition before independence. It was during the period of the great drought of the Sahel countries (Mali, Burkina Faso, Niger, etc.) in the 1970s, which severely depleted the stock of these countries and compromise livestock exports to the coastal countries. Boundary, Côte d'Ivoire proclaimed in 1974, livestock as a priority sector.

For example, Cote d'Ivoire has in its genetic animal three local breeds of bull: N'Dama, Baoulé and Lagune. These breeds, well adapted to local tropical climate, are also resistant to many parasites and they are trypanotolerant (Sokouri *et al.*, 2007). Unfortunately their utility and contributions to sustainable agriculture are still poorly recognized. This results in even the threat of extinction of the animal genetic resources (Sokouri *et al.*, 2007). Indeed, the small size purebreds Baule and N'Dama is the pretext used by farmers to cross them (Baoulé and N'Dama) with zebu cattle which have a large format (Sokouri *et al.*, 2009).

Farmers believe that such a practice can increase the yield of their farm and animals. Unfortunately, these intense crossbreeding practices are fear falling trypanotolerance. While the loss of such a biological specificity in a farming area heavily infested by tsetse flies causes a significant decline in livestock productivity, especially at the farmers with small units (Hoste, 1992). So, producers have to be educated. However, it begins with the deepening of the knowledge of the characteristics of the production systems and management of animal genetic resources in general and animal breeds in particular. In Côte d'Ivoire, except the forest area (4.3% of

\*Corresponding author: DP Sokouri, Université Félix Houphouët Boigny, UFR Biosciences, Laboratoire de Génétique, 22 BP 582 Abidjan 22, Côte d'Ivoire.

national herd) where environmental conditions are limiting factor for livestock development, pre-forest area (Central region) with 17.4% of national herd and the Sudanese region (Northern region) with 78.3% of national herd appear as breeding regions. Previous studies about social characteristics of 1,041 farmers (599 in the central region and 442 in the northern region) and their farming practices have been conducted in both breeding regions of Côte d'Ivoire (Sokouri et al., 2014a; 2014b). Social expressions and very diverse modes of production have been identified, but some characteristics seem to be common. Therefore this study aims to achieve typology of production system related to these social and structural characteristics. In effect, typologies of farms allow compare farm groups, to assess their operation and find solutions to problems or constraints they faced (Faye et al., 1994).

## MATERIAL AND METHODS

### a. Study area

The study was conducted in the two main breeding regions (central and northern) of Côte d'Ivoire; in 5 five department of the central region and 7 department in the northern region. The central region is a transitional area between forest and savannah regions. It is characterized by tree or shrub savanna and forest galleries along rivers. Moderate rainfall ranging from 1 000 to 2 500 mm, are divided into two rainy seasons from April to June and from August to October. Temperatures range from 14-39 ° C (Yapi-Gnaoré et al., 1996). The main agro-ecological characteristic of this region (Sudan region) is its climate Sudanese tropical, with a rainy season that lasts from April to October and an average rainfall of 859 mm per year. The dry season from November to March is under the influence of the Harmattan (Yapi-Gnaoré et al., 1996).

### b. Sampling methods

Farmers and their livestock were identified and located in collaboration with the National Chamber of Agriculture and the Regional Directorate of National Agency for Rural Development. Sampling criteria were essentially based on the availability of farmers to provide the information requested of them in a survey questionnaire. A total of 1,041 farmers were interviewed; 599 farmers in the central region and 442 in the northern region. Data were collected from a survey questionnaire with a single pass. These data were organized into two groups, each relating to a particular aspect of production systems. Structural and socioeconomic characteristics on the one hand, and farming practices, on the other hand, were the two groups. Variables relating to social and structural characteristics of farms were: age, ethnic group, level of education, installation year, exploitation size, ownership, animal habitat, source of income and destination of livestock products. Variables relating to farming practices were: breeding management, health monitoring and feed.

### c. Data analysis

Typologies were conducted using a factorial correspondence analysis and Principal Component Analysis (PCA) using the software XLSTAT-Pro 7.5 software. These analyses helped to identify and define the different types of Production systems

that are formed from combinations of farmers from different department and conditions that characterize them. The choice these analyses of is justified by the fact that they are methods for studying the links between two or more variables according to (Lebart et al., 1995). The main advantage of these methods is to represent the observations and simultaneously variables. These points can be projected on different axes and factorial designs, benefiting from all the tools to help interpret (percentage inertia contributions to the construction of the axis, projection quality on the axes, etc.) provided by this type of analysis (Moazami-Goudarzi et al., 2001).

## RESULTS

### Socioeconomic and structural characteristics

#### Social characteristics of farmers

The correspondence analysis applied to data relating to social characteristics of farmers does not separate clearly farmers from departments of central region from those of the northern region. The first and second axes explain 61.70 % of the total variance. On the first axis which explains 40.02 % of the total variance, farmers from the departments of Katiola and Dabakala differ from those of Bouaké, Béoumi and Sakassou, regarding the central region. The modalities that most contribute to the construction of the first axis are: "Age  $\geq$  45 years" (35.98 % of the inertia of this axis), "Baoulé breed " (12.70 %) and " Sénoufo / Tagbanan " ethnic group (9.63 %). The second axis explains 21.68% of the total variance. On this axis, farmers from Boundiali differ clearly from those of other department of the northern region. The participation of modalities "Donation of exploitation land" and "Other ethnic groups" in the second axis was 55.2 %, 37.57 % and 17.64 %, respectively. The projection in the factorial design formed by the two axes revealed a typology with three groups (Figure 1):

- A group consisting of farmers from three departments of the Central region; Bouaké, Béoumi, and Sakassou. Farmers are 45 years old, and they are mainly from Baoulé ethnic group. Furthermore, these farmers acquired their animals from donation.

- Farmers from six departments out of the seven of the northern region (Korhogo, Gbon , Kasséré , Karakoro Ferké and Tioro) and those of the department of Katiola located in the central region, were grouped. The main characteristics of this group are: most herds belonged to several owners, the main activity of these owners is agriculture and they are from three main ethnic groups; Sénoufo, Tagbanan and Malinké.
- Another group consists of famers from Boundiali, a department of the northern region and farmer from Dabakala, a department of the central region. This group is characterized by the fact that exploitation sites have been acquired by farmers from donation. Moreover, famers are from different ethnic groups.

#### Structural characteristics

The principal component analysis (PCA) was performed with 12 quantitative variables.

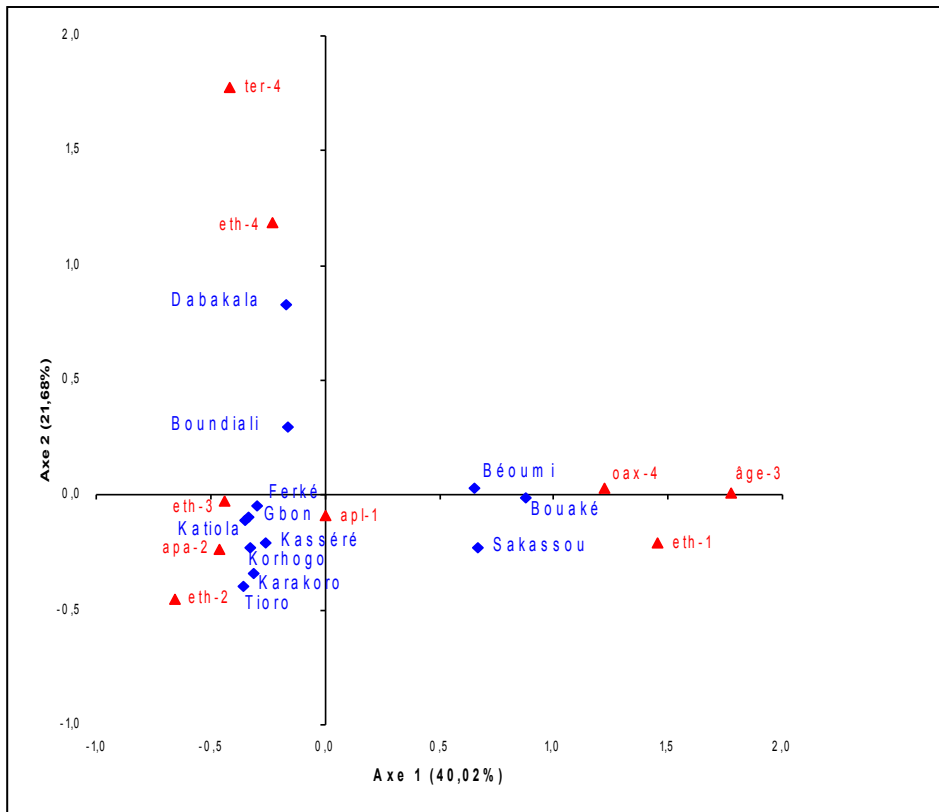


Figure 1. Typology according to social characteristics of farmers

*apa-2: Collective property; apl-1: Agriculture as main activity; age-3: Age ≥ 45 years; eth-1: Baoulé ethnic group; eth-2: Senoufo/Tagbanan ethnic group; eth-3: Malinké; eth-4: Diverse ethnic groups; OAX-4: First animals acquisition from donation; ter-4: Acquisition of farm site from donation*

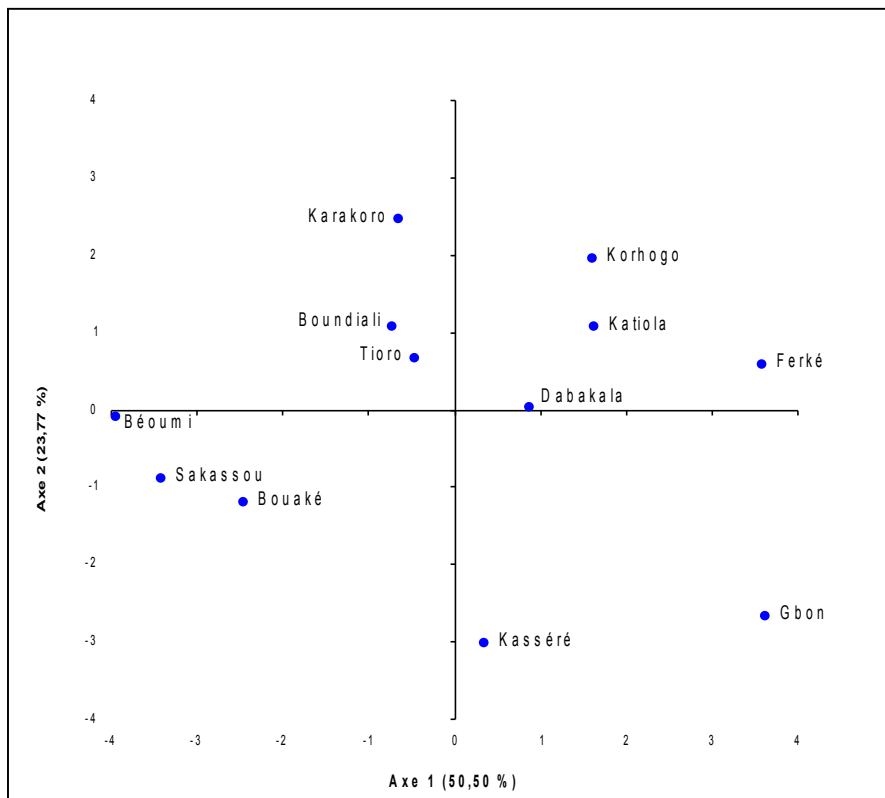


Figure 2. Structure of livestock according to data on the size of farms and the number of personnel systems

The correlation matrix showed a strong correlation between the variables related to farm size (number of livestock) on the one hand and between the variables related to the number of staff working on farms, on the other hand. The analysis of the histogram of the eigenvalues of data matrix indicates that the two first principal axes explained 74.27 % of the total variance. The first axis alone explained 50.50 % of the initial information. The factorial design formed by the two axes is therefore sufficient to describe most of the structure of the data table.

The study of the relative contribution of the variables in the construction of the first and second axis showed that the variables that contribute most to the construction of the first axis were those relating to the number of persons working in farms; number of children working on the farm (18.56 %), number of employees working on animals (21.78 %) and number of employees who work on other activities (14.86 %). Therefore, the first axis has been defined as the axis of operations staff. The variables that contribute most to the construction of the second axis were those relating to farm size; Number of breeding females (25.35%); Number of breeding males (15.52 %); Total number of livestock animals (22.73 %). Therefore, the second axis has been defined as the axis of the farm size. Projection in the factorial plane formed by the two first axes revealed a structure that has four types of farms (Figure 2):

- Type 1 occurred in four departments, two from the northern region (Korhogo and Ferké) and two from the central region (Katiola and Dabakala). This type was characterized by the use of a large workforce ranging in size from 7 to 15 people. The number of people working specifically on animals was on average six. There is a greater involvement of children owners in the farming activities. The number of children of taking part in activities varied from three to seven. In this type of farms, the average number of animals was 82 and the number of breeding females was on average 68.
- Type 2 occurred in two departments of the northern region; Kasséré and Gbon. The number of employees working on farms totaled seven people on average. The number of children working in the farm is an average of four. Herd size was 57 animals on average, with 39 breeding females.
- Type 3 occurred in three department of the central region; Bouaké, Béoumi and Sakassou. These are small farms that use more than two employees. Generally, this is an only child of the owner who takes part in the farm activities, in which he acts as manager. In most cases, he does not know much about farming practices. There are cases where the owner occupies himself with this task. Thus, none of his children was involved in either the management or the conduct of farm activities. The number of animals varies from 8 to 35 heads. The number of breeding females ranged from 5 to 22 heads with an average of 15 animals.
- Type 4 consisted of three departments of the northern region; Karakoro, Boundiali and Tioro. In this type of farm, large herds are encountered, with an average of 94 animals (from 44 to 225). The number of breeding females was an average of 77 animals. However, this type of farm employed very few people; more than two employees. The number of children who participated in farm activities was also smaller; from 1 to 3 children.

### Types of livestock products and marketing strategies

Correspondence analysis applied to data related to marketing strategies included farmers from the 12 departments in four groups. There were two groups that were composed of farmers from departments of northern and central regions and two other groups which were each composed of farmers from departments of the same region. The analysis of the histogram of the eigenvalues indicated that the two first factorial axes explained 49.75 % of the total variation. The two axes were therefore sufficient to describe most of the structure of the data table. The first axis separated farmers from a Katiol and Dabakala from those of Bouaké, Béoumi and Sakassou. For the northern region, farmers from departments of Tioro , Gbon and Boundiali detached from others. On the second axis, farmers from Sakassou stands out clearly from those of Katiola and Dabakala, on one hand and those of Bouaké and Béoumi, on the other hand (Figure 3).

The analysis of the relative contribution of variables in terms of the inertia of the first and second axis, showed that the modalities that contribute most to the construction of the first axis are; "sale of fresh milk" (10.13 % of the initial information). The modalities that contribute most to the construction the second axis are; "Animals for slaughter as the main type of production" (28.71 %), "Animal production for own consumption" (10.56 %). Projection in the factorial plane formed by the first two axes helped highlight the following typology:

- A group consisting of farmers from two departments of the central region (Katiola and Dabakala) and those of Kasséré, a department of the northern region. Meat production is the main characteristic of this group. However, milk production is usually performed in support of meat production of. The milk produced is intended for sale, and also for own consumption. Milk is usually sold fresh on the production site. Farmers of this group estimated that their income from the sale of their livestock products, are low.
- A group consisting of farmers from three departments of the northern region; Ferké, Korhogo and Karakoro. Meat production is the main objective of farmers from this group. However, this type is particularly characterized by the fact that the milk produced is entirely and solely intended for sale. Farmers believe they derive significant substantial income. In addition, farmers from this group are clearly satisfied with the income they get from selling the animals they produce.
- As farmers from the previous group, those of the departments of Tioro, Gbon, Boundiali (Northern region) and Sakassou (Central region) practices essentially meat production. In this group, milk production is almost nonexistent. However, small quantities of milk extracted from cows circumstantially are offered for sale in the farm site or in markets nearby farm sites.
- Another group consists of farmers from two departments of the Central region, Bouaké and Béoumi. This group is mainly characterized by livestock meat production. However, farmers did not want to say if the revenues derived from the sale of animal products are high, medium or low. They also refused to say if the milk produced in their farms is intended for home consumption or for sale.

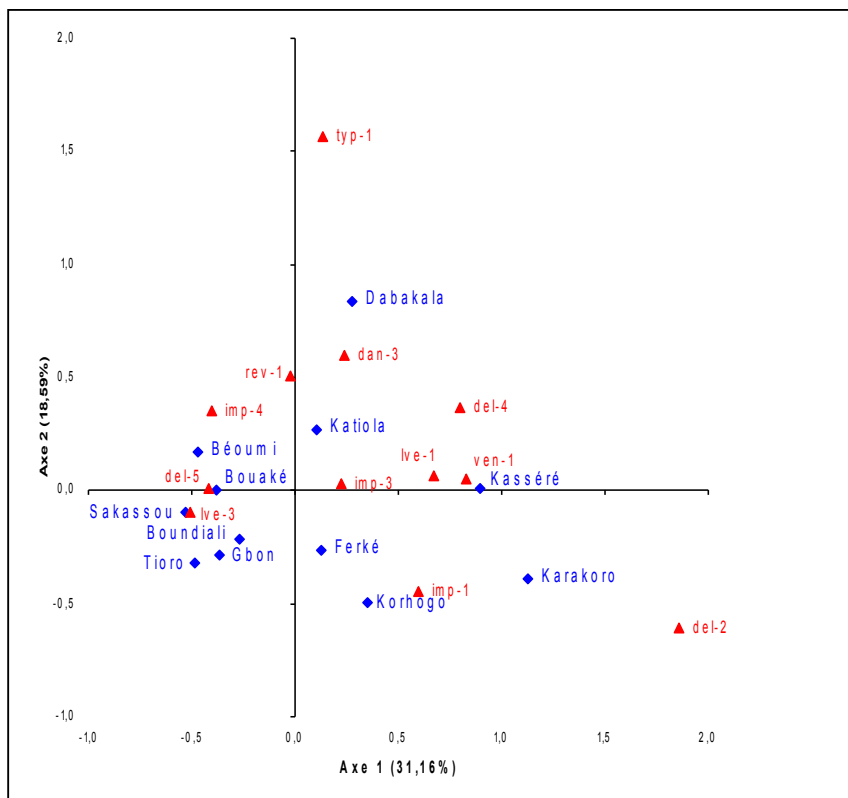


Figure 3. Typology according to economic characteristics

dan-3: Animals intended for consumption; del-2: Milk for sale only; del-4: Milk for the sale and consumption; del-5: No Answer; imp-1: Revenues from the sale of animals are important; imp-3: low income; imp-4: no answer; lve-1: Milk is sold on the place of production; lve-3: Information on the place of production and outside (village and / or town); Fri-1: the milk is sold fresh; typ-1 - = animal products such animals for slaughter; rev-1: importance revenues are: animals

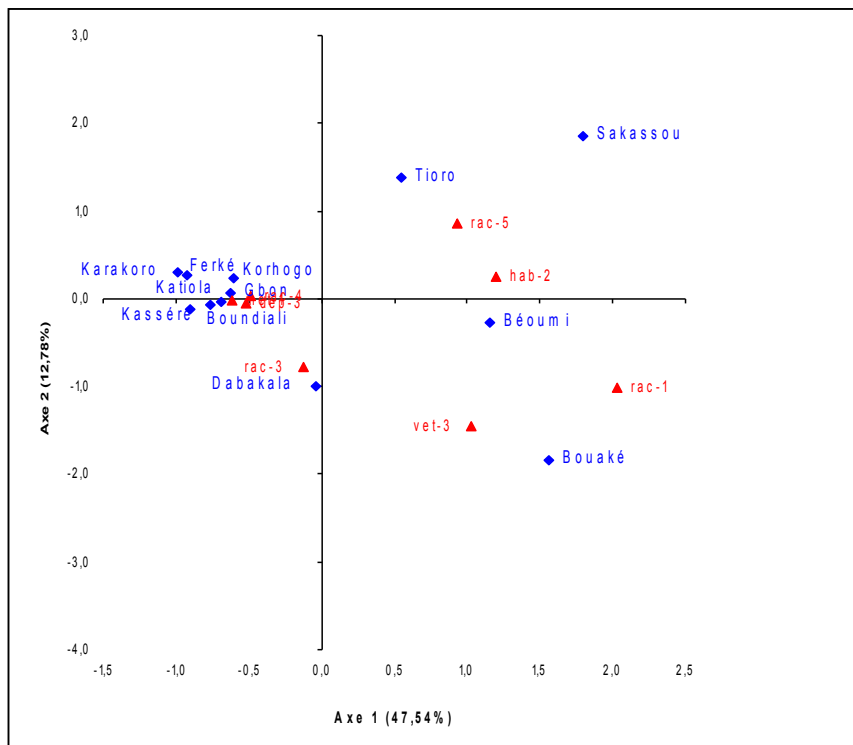


Figure 4. Typology according to herd management

Dep-3: External and Internal Parasite; hab-2: Free Accommodation without protection; met-1: Existence of mixing operations; rac-1: Race Baule; rac-3: Zebu; rac-4: Mere; rac-5: Other cattle; vet-3: Absence of veterinary assistance

## Herd management

The analysis of the histogram of the eigenvalues of data matrix indicates that the first two principal axes explain 60.32 % of the total variance. So, the factorial plane formed by these two axes is sufficient to describe most of the structure of the data table. The first axis alone explained 47.54 % of the initial information. This axis showed a heterogeneous farming systems in the Central region. It separated farmers from the departments of Katiola Dabakala and those of the departments of Bouaké, and Béoumi Sakassou. In the Northern Region, except farmers from the department of Tioro which is a bit out, all farmers from the other departments are clustered around the axis. On the second axis that accounts for 12.78 % of the initial information, the departments of Tioro and Sakassou completely detached from others. The study of the relative contribution of modalities of the variables of the inertia of the first and second axes, has shown that modalities that contribute most to the construction of the first axis are "free housing without protection" (26.28 % of the inertia of this axis), "Méré cattle" (11.04 %), "Crossbreeding practice" (10.83 %) and "external and internal deworming" (8.66 %). Those that contribute to the construction of the second axis are "other cattle" (20.15 %), "Baoulé cattle" (13.15 %), "no veterinary assistance" (10.18 %) and "Zebu cattle" (9.15 %). The projection in the plane formed by the first and second two axes revealed a typology of farming systems into three groups (Figure 4):

- Group 1 consisted of farmers from six departments of the northern region (Boundiali Ferké, Gbon, Karakoro Kasséré and Korhogo) and those of two departments of the central Region (Katiola and Dabakala). Cattle livestock production is based on the use of crossbred animals; Méré cattle. In the department of Dabakala, farms are particularly characterized by the strong presence of Zebu animals. In this farming system, crossing operations are regularly practiced by farmers. Selected within herds by farmers themselves, breeding males are used to produce crossbred animals. Medical prophylaxis is properly insured. Animals are dewormed (internal and external parasites) regularly. Veterinary services are also solicited on a regular basis to control and medical care of animals. Animals are usually conducted on pasture or in the evening to return the following morning, early morning to return later in the evening. Given the state of degradation of pastures, farmers practice what they call themselves "small transhumance". Farms have no fence and do not receive any other type of infrastructure protection. Farmers recognized that the state of natural pastures they use pose a real problem in their mode of conduct of their animals. However, they do not want to grow grass to feed the animals, because they believe that cultivating a pasture, and maintain it is restrictive and expensive. Dams built by farmers are the main source of water the animals.
- Group 2 consists of farmers from the departments of Bouaké and Béoumi (central region). The cattle livestock system in this group is based primarily on raising Baoulé cattle. Health monitoring of animals is approximate or nonexistent. Only the external deworming is practiced, but rarely. Farms in this group receive no veterinary assistance. Most farmers in this group are aware of the need to grow grass in order to solve the problem of degradation of natural pastures that is

increasingly enhanced. But they are reluctant to grow grass to feed the animals, because they believe that the establishment of a cultivated pasture is expensive.

- Group 3 consists of farmers from the department of Tioro (northern region) and those of the department of Sakassou (centre region), mainly characterized by the use of animals categorized as "Other cattle" whose farmers are generally unaware name. In this production system, animals are generally from various phenotypic types and they coexist within the same herd. They are usually housed outside without shelter and without any other form of protection. Farmers are not bound to a specific watering source. Furthermore, farmers refused to use any woody forage regardless the state of degradation of natural pastures.

## DISCUSSION

The typology of livestock production systems according to herd and pastures management methods showed that farmers from the departments of Katiola and Dabakala (central region) have the same breeding practices as those of the northern region. Moreover, the typology of social characteristics of farmers showed that farmers from these two departments of central region have the same social characteristics as those of the northern Region. This could be the main reason that farmers of these two areas of the central region have the same husbandry practices than those of the northern region. These farmers have a permanent effort to improve the productivity of their animals and their farms. They provide their animals a good health monitoring and they invest in improving their animal genetic potentialities by crossing local breed (Baoulé, N'Dama) with zebu cattle. However, for these farmers, the question of animal feed becomes very crucial, because it is difficult for them to find good quality grass in sufficient quantity for their animals. In addition, they face stiff competition that imposes by transhumant zebu from neighboring sahelian countries, also searching better pastures. In effect, the severe pasture degradation is caused by overgrazing of animals (Holtland, 1994). Furthermore, Beuret and Mouchet (2000) showed that the external effects of cattle farms (mainly on grassland) depend on the one hand, on the nature of the production system and on the other hand on elementary choices made by farmers.

However, despite the advanced degradation of natural pastures, farmers from group mentioned above, do not care pasture improvement to overcome this constraint. For these farmers the greater use of Zebu cattle would be the appropriate response to the problem of severe environmental degradation, due to their ability to withstand high temperatures and their suitability for long walk. Thus, zebu cattle are not sought after by farmers, only for their big size, but also for their ability to support transhumance. Therefore, the alternative would be, for them, to engage in the cultivation of grass to feed their animals properly while avoiding spending a lot of energy in search of good quality pasture. Another group consists of farmers from the department of Bouaké and Béoumi in which farmers are neither culture nor pastoral tradition, according to the management methods of bovine resources that is practiced. Animals receive no health monitoring. Baoulé cattle ideally fit this production system, because they are very hardy. Studies conducted with farmers in the south (De Jode *et al.*, 1992) and south-western Nigeria (Jabbar *et al.*, 1997) indicated that the

main reasons for farmers to keep bullfighting was their resistance to disease and their ability to feed themselves with a variety of fillings. D'Ieteren *et al.* (1994) also recognized that these animals have the ability to live in conditions of limited water and poor diet. Naturally, farmers using such animals do not want to grow grass to feed their animals insofar as these skills make Baoulé breed an asset in areas of extremely harsh environmental conditions. Moreover, farmers from these two departments are generally far from daily activities of their farms. Production and marketing activities are entirely the responsibility of the employee (usually a Fulani herdsman) who reports to the owner. Thus, such owners who have no visibility, either upstream or downstream of production, cannot determine the amount of revenue generated by their livestock. In addition, Baoulé cattle are not popular on the cattle market because of their small size. That is the reason that Balagtas *et al.* (2007) asserted that the challenges of production are low yield per animal, the challenges of marketing include long distances to markets, lack of transport infrastructure, etc.

### Conclusion

Two major cattle livestock production systems were identified in this study. The first is practiced by farmers from the northern region and those of two departments (Dabakala and Katiola) of the central region of Côte d'Ivoire. It is mainly characterized by the use of Zebu cattle and Mere. Farmers have good knowledge of farming practices. They provide their animals a health care through correct and consistent assistance and supervision of veterinary services (public or private). Farms are real rural businesses generally refer satisfactory dividends to farmers. The second production system is practiced by farmers from the central region (Bouake Béoumi and Sakassou) where owners do not have pastoral tradition. The employee (usually a Fulani herdsman) manages all activities upstream and downstream of the farm. This production system is practiced primarily using Baoulé breed. These animals do not receive any control program and vaccination. Farmers not seek or technical supervision or veterinary assistance. The animals are generally used for the payment of dowries or slaughtered during animist ritual ceremonies, especially funerals. Obviously, farmers estimate that revenues livestock products are not important and do not bring satisfaction.

### REFERENCES

- Balagtas J.V., Coulibaly J., Eales J.S., Diarra I. 2007. Import Demand for Dairy Products in Cote d'Ivoire. *Journal of International Agriculture Trade and Development*, 3(2):217-233.
- Beuret J.E. and Mouchet C. 2000. Pratiques agricoles, systèmes de production et espace rural : quelles causes pour quels effets ? *Cahiers Agricultures*, 9 : 29-37.
- D'Ieteren G.D.M. 1994. Trypanotolerant livestock, a sustainable option for increasing livestock production in tsetse-affected areas. In *Towards Increased Use of Trypanotolerance: Current Research and Future Options*. Eds. G.J. Rowlands and A.J. Teale. Proceedings of a Workshop organized by ILRAD and ILCA. Nairobi, Kenya. pp. 3-14.
- De Jode A., Reynolds L., Mathewman R.W. 1992. Cattle production systems in the derived savannah and southern Guinea savannah. *Animal Health and Production*, 24: 90-96.
- Faye B., Lefèvre P.C., Lancelot R., Quirin R. 1994. *Ecopathologie animale. La méthodologie. Applications en milieu tropical*. Maisons-alfort, France, Cirad-emvt, 119 p
- Holtland, G. 1994. Farming systems analysis of Mvumi Division: A Case Study on Intensifying Agriculture in semi-arid Tanzania, DCT Print, Dar es Salaam. Production strategies and pastoral man in *Pastoral Systems Research in Su-Saharan Africa*. Proceedings of the workshop held at ILCA, 21-24 March 1983. Addis Ababa, Ethiopie, pp. 213-231.
- Hoste, C.H. 1992. Contribution du bétail trypanotolérant au développement des zones affectées par la trypanosomiase animale africaine. *FAO World Anim. Rev.*, 70: 34-46.
- Jabbar M.A., Swallow B.M., D'Ieteren G.D.M., Busari, A.A. 1997. Farmer preferences and market values of cattle breeds of West and Central Africa. Livestock Policy Analysis Programme. International Livestock Research Institute. Addis Ababa, Ethiopia. *Socioeconomic and Policy Research Working Paper*, 21: 15-23.
- Lebart L., Morineau A., Piron M., Shriver M.D. et Loftus R.T. 1995. *Statistique exploratoire multidimensionnelle*. Paris, France, Dunod, 439p.
- Moazimi-Goudarzi K., Belemsaga D.M.A., Ceriotti G. 2001. Caractérisation de la race bovine Somba à l'aide de marqueurs moléculaires. *Revue Elev. Méd. vét. Pays trop.* (54) 2 : 129-138.
- Sokouri D.P., Loukou N.E., Yapi-Gnaoré C.V., Soro B., N'Guetta A.S-P. 2014a. Analysis of livestock production practices in the northern region of Côte d'Ivoire. *International Journal of Current Research*, (6), 10 : 9108-9115.
- Sokouri D.P., Loukou N.E., Yapi-Gnaoré C.V., Soro B., N'Guetta A.S-P. 2014b. Smallholders and their livestock production conditions in the Central region of Côte d'Ivoire. *Basic Research Journal of Agricultural Science and Review*, (3) 8 : 65-74.
- Sokouri, D.P., Yapi-Gnaoré, C.V., N'Guetta, A.S.P., Loukou, N.E., Kouao, B.J., Touré, G., Sangaré, A., Kouassi, A. 2009. Utilisation et gestion des races taurines locales sous la pression des croisements avec les zébus dans les régions Centre et Nord de la Côte d'Ivoire. *Journal of Animal and Plant Sciences*, 5 (2): 456-465.
- Sokouri, D.P., Loukou, N.E., Yapi-Gnaoré, C.V., Mondeil, F., Gngangbé, F. 2007. Caractérisation phénotypique des bovins à viande (Bos taurus et Bos indicus) au centre (Bouaké) et au nord (Korhogo) de la Côte d'Ivoire. *Animal Genetic Resources Information*, 40 : 43-53.
- Yapi-Gnaoré, C.V., Oya, B.A., Ouattara, Z. 1996. Revue de la situation des races d'animaux domestiques de Côte d'Ivoire. *Animal Genetic Resources Information*, (19) : 99-118.